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[1] The Army Vision: A Status Report, *By: General Eric K. Shinseki, Chief of Staff, U.S. Army,* Copyright 2001 by United States Army

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The Army Vision: A Status Report

By Gen. Eric K. Shinseki
Chief of Staff, U.S. Army

Since 1775, Army forces have deterred, compelled, reassured, and supported in war, conflict and peace. The Army's history spans over 225 years of service to the Nation, domestically and overseas. Army forces have fought 10 wars, from the American Revolution to the Gulf War. They have engaged in expeditions and contingency operations in US territories and projected land power around the world. They have performed stability and support operations in Latin America and the Caribbean and defended friendly countries in Asia and Europe during the Cold War. . . . Throughout the nation's history, Army forces have demonstrated that the Army remains the nation's strategic land combat force, a service with the diverse capabilities needed to conduct full spectrum operations anytime, anywhere. FM 3 0, Operations

The Army is changing. Not since the end of the last century has our Army undertaken such a profound and comprehensive effort to transform itself. We can all be proud of the tremendous accomplishments achieved thus far, and while there is much more to be done, this magnificent Army of ours has proven something important: we are adaptive. And we have proven that we CAN change. Over one million strong, we are an agile and forward thinking Army capable of transforming to meet the challenges of a new century and the emerging needs of our Nation. From squad level to Department of the Army level, our strength comes from our agility in adapting to new situations an ability that is rooted in proven and sound fundamentals of our leadership training process: our Troop Leading Procedures and the After Action Reviews. We are a learning organization, and this Army will continue to adapt to change today and in the future, just as it has for the past 226 years.

The requirement to transform the Army is based upon the evolving security challenges of the 21st century and the compelling need to respond more rapidly and decisively across the full spectrum of operations. In support of the emerging National Security Strategy (NSS) and National Military Strategy (NMS), the strategic significance of land forces will lie in their ability not only to fight and win our nation's wars, but also to provide the National Command Authorities a range of options for influencing the global environment to the advantage of our country and its allies. An Objective Force that provides full spectrum dominance will be fundamental to our nation's future joint operational concepts and will meet the joint requirements for dominant land maneuver forces.

Where is The Army today?

The Army has accelerated the process of transforming itself into an Objective Force that will be more strategically responsive and dominant across the entire spectrum of military operations and decisive at every point on that spectrum. The Objective Force will be more responsive, more deployable, more agile, more versatile, more lethal, more survivable, and more sustainable than today's force. And we are committed to achieving the Objective Force this decade. But Transformation is much more than equipment. The Army Vision addresses three things: People, Readiness, and Transformation. It begins and ends with People because Soldiers are the centerpiece of Army formations. What follows is a brief status report on the three components of The Army Vision.

People:

"We must restore faith with our Soldiers; . . . they are burdened with too few personnel, aging equipment, and poorly maintained homes and facilities. . . . America today enjoys a vibrant standard of living that is the envy of the world. At significant personal sacrifice, the American Soldier guarantees that way of life, but he and his family do not share in it fully. Our Soldiers are proud and capable and honorable. They perform every mission that we ask of them professionally and at a high standard. . . . They are a tremendous bargain for the Nation – American Soldiers have provided far more in readiness than we have paid for. But we should not expect such selfless devotion to include the sacrifice of their families' well being." General Eric K. Shinseki, CSA, Congressional testimony, 27 Sep 00

The Army's readiness is inextricably linked to the well being of all its people Soldiers, civilians, retirees, veterans, and their families. The most significant investment in our Nation's security is the investment in our people. The Army must provide adequate housing, schools, and medical and dental care with the quality and access comparable to society at large. These essential benefits must provide Soldiers and families resources to be self reliant both when the force is deployed and when it is at home station. In order to address concerns that have surfaced and begin restoring faith with our Soldiers and their families, The Army stood up two task forces in 1999: the Well Being Task Force and the Turbulence Task Force.

During the 1999 2000 academic year, the U.S. Army War College Well Being Task Force identified issues of greatest concern to Soldiers and families affecting their overall personal well being. Among the issues raised were the quality and accessibility of health and dental care, adequate housing, pay and other compensation, quality of schools and the school experience, eroding retirement benefits, and time spent away from home and family.

Congress helped The Army progress in taking care of its people with the FY 01 pay raise, pay reform, and retirement reform. The Army continues to push for improvements in military health care and dental care and for even greater pay increases to make our Soldier and family housing compensation commensurate with the actual cost of living.

Initiated by General Dennis J. and Mary Jo Reimer, the Secondary Education Transition Study (SETS) was conducted over the course of 18 months in 1999 and early 2000, in concert with local public and Department of Defense schools. The intent of this study was to examine and find solutions to the turbulence experienced by high school students of military families due to recurring moves from one school system to another. The SETS conference convened in May 2000, and again in March 2001, to brief The Army leadership on recommendations for implementing policies and procedures to improve the quality of our children's high school experience. Since that time, local initiatives in many communities are already in place, and a comprehensive memorandum of agreement, involving nine Army communities in CONUS, Germany, and Korea, was signed in May 2001 by participating school officials. These initiatives facilitate reciprocal agreements between these school systems, thereby ensuring that courses, tests, and other schoolwork, including graduation prerequisites, completed at one school, will be acceptable at another. The goal of this program is to help our high school students by making their transitions from one school district to another smoother in terms of credit transferal, socialization, graduation prerequisites, testing requirements, and participation in extracurricular activities. Work continues in other states to expand this Army initiative.

The Army senior leadership is committed to giving something back to the youth of America and to improving the quality of math, science and technical education in the Nation's schools. Driven by this commitment, The Army is planning to launch a nationwide, web based, group/team competition centered around math, science, and technology for 6th to 9th graders. The initiative envisions the use of Army resources, infrastructure and personnel for logistics and administrative support. It also envisions strategic partnerships with industry and academia as a critical component. Given that numerous other nationwide science and math competitions exist, The Army is approaching this initiative strategically to augment the current landscape with a broadly inclusive competition targeted at students with a wide range of math and science competencies. The Army has completed its Stakeholder analysis, the first phase of a four phased approach that also includes a Business case; Research, Design and Development of a Science Fair Beta Test, and a phased roll out of that Beta Test. Final implementation of the Science Fair is planned for Academic Year 2002 2003.

In September of 1999, The Army War College Turbulence Study Group explored the concept of turbulence in The Army to determine ways to reduce it. The Study Group defined turbulence as the effect on readiness and well being caused by job position turnover and the absence or lack of predictability. It handed off the study results to a Headquarters, Department of the Army Turbulence Task Force which had the mission of analyzing the recommendations of the Army War College Turbulence Study Group and designing Action Plans to implement those recommendations approved by Army senior leaders and the Major Commands. In April 2000 the DA Task Force finalized its master action plan. The Army is in the process of implementing recommendations from that master action plan, and the following actions are being pursued or have been implemented:

1. Establishing a Central Tasking Authority to reduce short notice taskings, ensure that taskings adhere to strict timelines, and minimize non operational taskings as much as possible.

2. Offering Soldiers the opportunity to request stabilization if they have children who are high school seniors.

3. Restricting the amount of time Soldiers spend working on weekends while in garrison.

4. Authorizing Soldiers 4 day weekends in conjunction with every federal holiday.

5. Stabilizing lieutenants in their platoon level jobs for a minimum of one year to ensure they build an adequate leadership foundation.

6. Moving all battalion and brigade changes of command to a summer cycle.

7. Exploring the possibility of routinely scheduling PCS moves in the summertime, especially for families with school age children.

8. Pursuing actions to give Soldiers PCS orders a year out from their assignments.

Another effort to reduce turbulence, especially AC personnel tempo (PERSTEMPO), is to increase mission requirements of the Reserve Component. In order to improve the predictability of unit schedules, The Army Staff developed a five year calendar that includes all training center rotations, deployments to Bosnia, and other rotational missions such as those in Kuwait, Saudi Arabia, and the Sinai. Our manning initiative should also reduce turbulence at unit level. Many units are reporting C1 in personnel for the first time in five years. The Deputy Chief of Staff for Personnel is also working to better manage PCS moves so Soldiers don't rotate out of places like Bosnia into a unit about to deploy elsewhere. The Army is working hard to improve predictability so that Soldiers can make plans and provide for their families in a more timely and comprehensive manner.

Readiness:

". . . Training at the battalion level and below. This is where I see the heart of warfighting readiness. . . . Unless squads and platoons and companies can do what they need to do, which is what I call short sword warfighting, unless you can get the short sword warfighting business done, you're not ready. . . . Crews, squads, platoons, companies, battalions this is where Army readiness resides. And inside short sword warfighting readiness, it's sergeant's time which provides the foundation for training excellence in The Army."

General Eric K. Shinseki, CSA, Sergeants Major Luncheon, 16 Oct 00

The Army has a nonnegotiable contract with the American people to fight and win the Nation's wars decisively. It evaluates its capability to fight and win those wars through the readiness reporting of its earliest deploying units: ten divisions, two cavalry regiments, and five special forces groups, all in the Active Component. Readiness reports assess the preparedness of Soldiers and their equipment and evaluate the realism of their training to prepare them for the rigors of combat. But given the greater complexity of today's strategic environment different from the Cold War environment and one in which the Reserve Component and Institutional Army share The Army's missions readiness has taken on broader implications. Cold War readiness standards no longer suffice as measures of our capability to meet today's operational requirements. In 1999, The Army faced readiness challenges on several different fronts, manning and recruiting initially being of foremost concern. Full spectrum dominance may, at times, challenge high levels of warfighting readiness. This challenge must be anticipated and the risk mitigated, where possible. To study the challenges to its readiness, The Army directed The U.S. Army War College to convene a Readiness Study Task Force. The outcome of their year long study is a report recommending changes to The Army's readiness reporting system from a design focused system to a mission focused system. To that end, the Office of the Deputy Chief of Staff for Operations and Plans designed a Strategic Readiness System (SRS) to better assess, track, and report The Army's overall readiness, taking into account mission requirements, the Reserve Component, and the Institutional Army. Full implementation of SRS is expected in 2002.

Manning:

In 1999, The Army faced two significant personnel challenges adversely affecting readiness: unit manning and recruiting. Personnel shortfalls across The Army were so deftly and evenly distributed that there was little discernible pain, no issue of inadequate end strength Soldiers still felt the effects. The vast majority of Active Component formations then were undermanned. Exacerbating this shortfall in the force in FY 99, The Army missed its active component recruiting mission of 74,500 by about 6,300 inductees and our Army Reserve recruiting mission by some 10,000.

To attack the manning challenge, The Army moved to fill its active component divisions and cavalry regiments to 100%. Implementation of that 100% manning effort is currently in its final stages. Reports from the field indicate that units benefit significantly from this new manning initiative. These units achieved higher readiness, some reaching a C1 rating in personnel for the first time in five years. The bill payers, however, have been in the Institutional Army, which experienced some pain due to concentrated personnel shortfalls. The Army had to take this measure to be able to assess accurately the nature and extent of its personnel shortages across the force. The Army had to get its house in order if it ever hoped to make the case to Congress that The Army was too small for its mission profile and under resourced for its current endstrength. In the next five year budget submission, The Army will, in fact, make the case that it cannot accept a force structure/endstrength decrease without a major change in the National Military Strategy.

The second piece of the personnel equation was reversing the serious slide in recruiting, which The Army accomplished in FY 2000 for the first time in at least five years thanks in large measure to the remarkable efforts of the NCOs of the U.S. Army Recruiting Command (USAREC) and the reinforcing efforts of CONUS unit commanders. The Army not only met the goals for Active, Guard, and Reserve accessions, it exceeded all expectations by achieving a 22,000 recruit turnaround in a 12 month period, making up for the shortfalls of 1999 and exceeding the increased accession goal for 2000. The Army's new recruiting campaign, *An Army of One*, continues to resonate with youngsters across the country, and The Army declared in late July that it would meet its 30 September recruiting targets. It's been a long time since we were able to make such early predictions with confidence.

Recruiting and Retention:

Several other initiatives are behind our recent successes in recruiting. Last year, The Army instituted several initiatives, including GED(+), College First, and the Hometown Recruiter Program, to enhance The Army's ability to bring youngsters into the force. These programs have helped the Army improve its overall recruiting posture.

Another incentive program, USAREC's Partnership for Youth Success (PaYS) project, offers a formal arrangement between private industry and The Army. This program ensures that young Americans who serve in The Army and gain life skills in education, training, discipline, teamwork, and leadership are able to transfer these skills to civilian jobs upon completion of their service commitment. Currently, ten corporations have formally signed on with The Army, and 1503 soldiers are signed up for the program. The PaYS program will once again be highlighted as an "Investment in America" during the Conference Board Annual Human Resource Conference held in New York City in October 2001 with executives from across Corporate America

Army University Access Online has proved to be an incentive to many potential recruits, and it has provided a revolutionary means of allowing Soldiers everywhere an opportunity to earn their college degrees. Twenty different accredited universities and colleges currently participate in the program, including such diverse campuses as Penn State, Central Texas College, and Fayetteville Technical College.

In the realm of retention, we are achieving great success. To sustain the force at acceptable manning levels, The Army must maintain an aggregate retention rate of 67 percent. For FY 00 and thus far this FY, The Army met or exceeded its reenlistment goals. This has been especially true in those units performing missions in the Balkans. Currently, the FY 01 aggregate retention rate is 105.7%

AC/RC Integration:

Today, nearly 2,000 Soldiers from the Guard and the Reserve are on point for the Nation around the globe, serving in places like Bosnia, Kosovo, Saudi Arabia, and Kuwait. There are also hundreds of individual augmentees with civil affairs, psyops, military intelligence, transportation, postal, and medical support skills deployed overseas serving alongside their active duty counterparts. In 2000, The Army set a precedent by placing a National Guard unit in command of active duty units in Bosnia for the first time since World War II. In February 2000, the headquarters of the 49th Armored Division, Texas Army National Guard assumed the Task Force Eagle mission from the 10th Mountain Division. The 49th Division did a superb job and set a standard for other National Guard units to follow. Along with the 3rd Armored Cavalry Regiment, they demonstrated beyond a doubt that AC/RC Soldiers and units can serve side by side under tough and demanding conditions. In October 2001, the 29th Infantry Division, Virginia Army National Guard, will assume command of Task Force Eagle in Bosnia. National Guard and Army Reserve Soldiers carry a heavy load for our Army and our Nation. They are valuable assets whose service makes them even more valuable in the workplace. They bring to the civilian sector a broader view of life, a keen understanding of teamwork, and leadership skills that cannot be gained in the civilian workplace. When these Soldiers return from their rotations, they infuse their communities with new energy and a greater respect for diversity. They assume leadership roles in the community and serve as role models whose service has made a difference in the world. The Army will continue to integrate Reserve and National Guard units and Soldiers into our contingency operations and rotational missions abroad.

Training and Leader Development:

As a logical extension to the training revolution of the 1980's crafted by General Carl E. Vuono, The Army conducted Phase I (Officer) of its in depth Army Training and Leader Development (ATLD) study of issues affecting The Army's culture and its Training and Leader Development doctrine. The ATLD Panel (ATLDP) surveyed and interviewed over 13,500 officers and spouses. Phase II, the NCO study which interviewed over 30,000 officers, warrant officers, noncommissioned officers and spouses will be completed in November 2001, and a Warrant Officer study will be conducted in 2002. The primary objectives of the panels are to identify skill sets required of Objective Force leaders and assess the ability of current training and leader development systems to cultivate those skills. Study participants addressed issues affecting Army Culture, the Officer Education System, Training, and Leader Development. This study represents a candid self assessment by The Army and seeks to keep faith with Soldiers and set a course for improving all aspects of The Army's culture by bringing institutional beliefs and practices in line. It is a testament to the strength of The Army that it is willing to take such an honest look at itself. For The Army, such self assessment has its roots in the After Action Review (AAR) process. This kind of healthy introspection characterizes a true profession and a learning organization. In the ATLDP surveys and interviews, Soldiers and their families echoed findings of the U.S. Army War College Well Being Task Force by expressing concerns about the Army's commitment to well being as it relates to their family and personal time, health care, housing, and retirement benefits. Many in the field believe micromanagement is pervasive and the officer assignment process is focused on personnel management rather than leader development. Junior officers are disappointed because they are often rushed through developmental leadership positions, thus limiting their opportunity to master tactical and leadership skills. Respondents also indicated that the value of tough, realistic training is often lost because of a high operational pace that adversely impacts training, predictable time for families, and opportunities for self development. The study recommendations were grouped into seven major categories considered as imperatives for the Army: Army Culture, Officer Education System, Training, Systems Approach to Training, Training and Leader Development Model, Training and Leader Development Management Process, and Lifelong Learning. Included in the recommendations under those imperatives are the following:

1. Reduce the Operational Pace by re establishing discipline in the training management process and by eliminating nonmission related compliance training in AR 350 41, *Training in Units*, and other DA and MACOM level documents.

2. Conduct a review of the OER this year. Involve the field in the review.

3. Revise DA PAM 600 3, Commissioned Officer Development and Career Management, to focus on growing leaders and providing quality educational and operational experiences.

4. Provide all majors with quality resident intermediate level education based on OPMS XXI.

5. Develop doctrine for mentoring in FM 6 22 (22 100), *Army Leadership*.

6. Rewrite FM 7 0 (25 100), *Training the Force*, and FM 7 10 (25 101), *Battle Focused Training*, to adapt to full spectrum operations.

7. Give more training time to company commanders and platoon leaders by providing more discretionary training opportunities.

8. Train on warfighting METL tasks unless ordered to change to stability operations tasks or support operations tasks by the Corps Commander.

9. Establish a single Army proponent for training and leader development to improve the linkage between training and leader development, policy, and resourcing.

10. Provide the doctrine, tools, and support to foster lifelong learning in the Army through balanced educational and operational experiences supported by self development.

The Army has already implemented many of the study's recommendations and is undertaking implementation of the others.

Transformation:

"The Cold War system was a system built around weight. . . . The globalization system is built around speed. In the Cold War, the big ate the small. In globalization, the fast eat the slow. . . . globalization is happening in a power structure . . . . that is maintained and preserved . . . by something called the U.S. Army . . . . without America on duty, there's no America Online." Thomas Friedman, author of *The Lexus and the Olive Tree*

Over the past two years, The Army implemented solutions and strategies for change some through long range planning, others through more expedient measures. Building fiscal support for Transformation required tremendous effort with Congress during the first year. Through the concerted efforts of many senior leaders, The Army pushed its plan for funding Transformation through the system, moving from an Operational Requirements Document to a Request for Proposals in a matter of seven months a process that normally takes years.

Legacy Force:

A trained and ready Legacy Force affords The Army the necessary time and flexibility to pursue investments needed to get the Objective Force right. The Legacy Force must maintain the readiness to fight and win decisively against any threat for the next 15 to 20 years. When the Nation calls, The Army will go to war with this force. Modernization and selective recapitalization continue to be the primary emphasis with the Legacy Force. In April 2001, as a logical conclusion to the digitalization initiatives begun by General Gordon R. Sullivan, the 4th Infantry Division (ID) (Mechanized) The Army's first digitized division completed its Division Capstone Exercise One (DCX I) at the National Training Center, Fort Irwin, CA. The DCX I provided The Army an opportunity to showcase the tremendous increase in combat capability of a maneuver brigade and the aviation brigade of the 4th ID. Digitized command and control systems like Force XXI Battle Command Brigade and Below (FBCB2) provided remarkably enhanced battlefield situation awareness, from crew to division level. With it, commanders were better able to *see first, understand first, and act first, and finish decisively*. In October 2001, the division will complete its experimentation with DCX II. The Army will continue to digitize and recapitalize selected Legacy formations until the transition to the Objective Force is complete.

Interim Force:

In the spring of 2000, Congress approved funding for two Interim Brigade Combat Teams (IBCT), and The Army programmed for 4 more. The first two IBCTs, the 3rd Brigade, 2ID and the 1st Brigade, 25th ID (Light), are currently standing up at Fort Lewis, WA. These two brigades are expected to complete transformation to IBCTs no later than FY 03 and FY 04, respectively, with the fielding of the recently selected Interim Armored

Vehicle (IAV). In July of this year, we announced the next four brigades to transform into IBCTs: The 172nd Infantry Brigade (Sep) at Forts Richardson and Wainwright, Alaska; the 2nd Armored Cavalry Regiment (Light) at Fort Polk, Louisiana; 2nd Brigade, 25th Infantry Division (Light) at Schofield Barracks, Hawaii; and the 56th Brigade of the 28th Infantry Division (Mech), Pennsylvania Army National Guard. The Interim Force will meet an operational shortfall that currently exists between the capabilities of our early arriving light forces and our later arriving heavy forces. The IBCTs are operational forces that will help meet warfighting and contingency needs for the next 25 to 30 years. The Interim Force will also serve as the vanguard of the Objective Force by validating operational and organizational concepts, training and leader development initiatives, and deployment scenarios.

Objective Force:

The Objective Force is a system of integrated capabilities space, air, ground, direct, and indirect, internetted with Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR). The Army has established a general officer led task force to integrate The Army's plan to achieve the Objective Force this decade and seeks to accelerate traditional timelines through an active, innovative partnership with Industry. Establishing a cooperative effort with the Defense Advanced Research Projects Agency (DARPA) the largest service effort in DARPA's history The Army intends to mine technologies in the key areas of lethality, survivability, and C4ISR. Two key milestones govern achievement of the Objective Force. The first occurs in 2003, when The Army selects the best technologies and concepts to go into the next phase of the program. Science and Technology (S&T) performance is reviewed monthly at the Chief of Staff level in order to assess The Army's return on its investments (currently over a billion dollars per year through 2005). When appropriate, The Army will shift resources to the most promising technological solutions. The Army will fund the second milestone, a System Development and Demonstration beginning in FY 06, by programming additional dollars starting in the '03 POM build. These dollars fund strategies for system development and demonstration focused on the Future Combat System. The intent is to accelerate the transition to Research and Development (R&D) by collapsing the traditional timelines. Mastering the transitions from S&T to R&D and then from R&D to first unit equipped will be critical to achieving the Objective Force this decade.

Conclusion:

Army Transformation to the Objective Force this decade. We must continue to pursue this goal with the same tenacity we have displayed over the past two years. It is a mind set that embraces change and eagerly looks forward to the future. By undertaking the comprehensive transformation of the Operational Army and the Institutional Army across doctrine, training, leader development, organizations, materiel, soldier systems, and facilities, our Army is making history. As leaders, we all have a responsibility to educate the force on the changes occurring in our future. Change is difficult, but communicating the message of change will help this Army master the transitions ahead of it, in this decade and beyond. There will most certainly be another war in our future. If history is any indicator, it will happen sometime in the early decades of this century. Our Army will be ready. We have never let the country down, and we stand ready today and every day, to fight and decisively win our Nation's wars.

[2] HASC Language; U.S. Government Printing Office Washington: 79-403 House Of Representatives 107th Congress 2nd Session, Report 2003 107-436, Bob Stump, National Defense Authorization Act for Fiscal Year 2003, Report Of The Committee On Armed Services, House Of Representatives On H.R. 4546 Together Additional And Dissenting Views [Including cost estimate of the Congressional Budget Office] May 3, 2002

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BOB STUMP

NATIONAL DEFENSE AUTHORIZATION ACT

FOR FISCAL YEAR 2003

R E P O R T

of the

COMMITTEE ON ARMED SERVICES

HOUSE OF REPRESENTATIVES

on

H.R. 4546

together with

ADDITIONAL AND DISSENTING VIEWS

[Including cost estimate of the Congressional Budget Office]

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107th Congress Report
HOUSE OF REPRESENTATIVES
2d Session 107-436

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NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2003

_____

May 3, 2002.--Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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Mr. Stump, from the Committee on Armed Services, submitted the following

R E P O R T

together with

ADDITIONAL AND DISSENTING VIEWS

[To accompany H.R. 4546]

[Including cost estimate of the Congressional Budget Office]

The Committee on Armed Services, to whom was referred the bill (H.R. 4546) to authorize appropriations for fiscal year 2003 for military activities of the Department of Defense, and for military construction, to prescribe military personnel strengths for fiscal year 2003, and for other purposes, having considered the same, report favorably thereon with amendments and recommend that the bill as amended do pass.

The amendments are as follows:

The amendment strikes all after the enacting clause off the bill and inserts a new text which appears in italic type in the reported bill.

The title of the bill is amended to reflect the amendment to the text of the bill.

EXPLANATION OF THE COMMITTEE AMENDMENTS

The committee adopted an amendment in the nature of a substitute during the consideration of H.R. 4546. The title of the bill is amended to reflect the amendment to the text of the bill. The remainder of the report discusses the bill, as amended.

PURPOSE

The bill would--(1) Authorize appropriations for fiscal year 2003 for procurement and for research, development, test and evaluation (RDT&E); (2) Authorize appropriations for fiscal year 2003 for operation and maintenance (O&M) and for working capital funds; (3) Authorize for fiscal year 2003: (a) the personnel strength for each active duty component of the military departments; (b) the personnel strength for the Selected Reserve for each reserve component of the armed forces; (c) the military training student loads for each of the active and reserve components of the military departments; (4) Modify various elements of compensation for military personnel and impose certain requirements and limitations on personnel actions in the defense establishment; (5) Authorize appropriations for fiscal year 2003 for military construction and family housing; (6) Authorize appropriations for fiscal year 2003 for the Department of Energy national security programs; (7) Modify provisions related to the National Defense Stockpile; and (8) Authorize appropriations for fiscal year 2003 for the Maritime Administration.

RELATIONSHIP OF AUTHORIZATION TO APPROPRIATIONS

The bill does not generally provide budget authority. The bill authorizes appropriations. Subsequent appropriation acts provide budget authority. The bill addresses the following categories in the Department of Defense budget: procurement; research, development, test and evaluation; operation and maintenance; working capital funds, military personnel; and military construction and family housing. The bill also addresses Department of Energy National Security Programs and the Maritime Administration.

Active duty and reserve personnel strengths authorized in this bill and legislation affecting compensation for military personnel determine the remaining appropriation requirements of the Department of Defense. However, this bill does not provide authorization of specific dollar amounts for personnel.

SUMMARY OF AUTHORIZATION IN THE BILL

The President requested budget authority of $396.8 billion for the national defense budget function for fiscal year 2003. Of this amount, the President requested $378.3 billion for the Department of Defense, including $9.0 billion for military construction and family housing. Of this amount requested for the Department of Defense, $10.0 billion has been designated as a reserve fund and will receive separate treatment pending submission of a detailed budget request. The defense budget request for fiscal year 2003 also included $16.4 billion for Department of Energy national security programs and the Defense Nuclear Facilities Safety Board.

The committee recommends an overall level of $382.8 billion in budget authority. This amount represents an increase of approximately $39.5 billion from the amount authorized forappropriation by the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107).

SUMMARY TABLE OF AUTHORIZATIONS

The following table provides a summary of the amounts requested and that would be authorized for appropriation in the bill (in the column labeled ``Budget Authority Implication of Committee Recommendation'') and the committee's estimate of how the committee's recommendations relate to the budget totals for the national defense function. For purposes of estimating the budget authority implications of committee action, the table reflects the numbers contained in the President's budget for proposals not in the committee's legislative jurisdiction.
<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

RATIONALE FOR THE COMMITTEE BILL

The National Defense Authorization Act for Fiscal Year 2003 (H.R. 4546) demonstrates the committee's continuing responsibility and commitment to the national security of the United States in the wake of September 11th--a date that now marks the most lethal single attack on the United States in our nation's history.

H.R. 4546 is the first defense authorization bill in decades that was drafted with our country at war. Accordingly, this bill sends an important signal of unwavering support for the American soldiers, sailors, airmen, and Marines who are fighting the global war against terrorism. This commitment is evident by the fact that H.R. 4546 would authorize--

<bullet> The largest relative increase in defense spending since 1966;

<bullet> The largest defense budget (in inflation-adjusted terms) since fiscal year 1990;

<bullet> The fifth straight year of real increases in defense spending, after 13 consecutive years of real cuts to defense budgets; and

<bullet> The largest increase in military manpower since 1986.

The committee is convinced that the U.S. military is finally on the road to recovery, as the coming fiscal year will set a modern day high-water mark for the U.S. defense program. This bill would ensure that the Armed Forces are fully capable and ready to execute their assigned missions while transforming themselves to meet future threats; enhance the nation's ability to deter and defend against strategic threats, and to counter the proliferation of weapons of mass destruction; advance efforts to protect our homeland from a variety of threats; and support the President's campaign to defeat international terrorism.

The unconventional nature of the military campaign against terrorism required that Congress accordingly adjust its traditional budget process to allow for greater flexibility in financing the significant costs of these operations. In keeping with this approach, the committee divided the annual defense authorization bill into two separate components.

H.R. 4546 would authorize $383.4 billion for defense activities during fiscal year 2003. This bill provides for the base defense budget for the upcoming fiscal year, and largely covers the costs associated with the normal rate of investment and operations of the Department of Defense. The second bill, H.R. 4547, the Cost of War on Terrorism Authorization Act for Fiscal Year 2003, will supplement H.R. 4546 by covering the known costs of continuing Operations NOBLE EAGLE and ENDURING

FREEDOM, as well as miscellaneous DOD incremental costs directly associated with the war on terrorism. In addition, H.R. 4547 would serve as the legislative vehicle for further authorization action once the Administration submits a detailed budget proposal for the $10 billion contingency fund identified in the budget request.

The committee believes this approach--dividing the annual defense bill into two discrete components--represents the most workable implementation of the flexible budgeting proposal contained in both the President's budget request and the House-passed Concurrent Resolution on the Budget. Equally important, this approach would facilitate appropriate Congressional oversight of this remaining portion of the proposed defense budget by ensuring regular-order consideration and action.

In keeping with this approach, the committee carefully scrutinized the base defense budget and identified a discrete category of items that, due to their direct relationship to the conduct of the war against terrorism, are more appropriately funded through this second bill, H.R. 4547. These items, which total $3.4 billion of the $10 billion expected to be authorized by H.R. 4547, would cover the following war-related costs: replacement weapons and equipment used or lost in the war; one-time upgrades or special operational costs; and personnel costs.

When combined, the core defense authorization bill, H.R. 4546, which is funded at $383.4 billion, and the second defense authorization bill, H.R. 4547, which is expected to be funded at $10 billion, would fully support the President's budget request of $393.4 billion for the national defense function. The committee is pleased with the Administration's overall request for defense, but believes that even greater spending will be required to ensure that the military is properly manned, trained, equipped, and organized to deal not only with today's threats, but with emerging, unforeseen, and asymmetric ones as well.

Strategic Defense, Deterrence, and Forces

H.R. 4546 would promote U.S. national security and strategic readiness by moving forward with research and development of multi-tiered missile defense systems, and implementing several of the findings and conclusions of the Nuclear Posture Review (NPR).

Recent reports by the Intelligence Community state that the ballistic missile threat to the United States continues to grow. A December, 2001, National Intelligence Estimate (NIE) concluded that ``The probability that a missile with a weapon of mass destruction will be used against U.S. forces or interests is higher today than most of the Cold War, and it will continue to grow as the capabilities of potential adversaries mature.'' The NIE added that short and medium range ballistic missiles already pose a significant threat overseas to U.S. interests, military forces, and allies.

North Korean missiles under development are capable of striking the United States, and Iran could attempt to launch an Intercontinental Ballistic Missile (ICBM) by 2005. Both countries also have active nuclear weapons programs designed to develop nuclear warheads for their missiles. And were it not for international sanctions and prohibitions, Iraq would have similar capabilities--which have only been delayed by a few

years because of Iraq's continuing, covert efforts.

Russia maintains the most robust ballistic missile force capable of reaching the United States, but resource problems, force structure decisions, and expected agreements with the United States will force a significant reduction in Russia's strategic forces over the next several years. Conversely, China continues its multi-year effort to modernize and expand its strategic forces, including the development of new road-mobile missiles and submarine-launched missiles.

As a result of these disturbing threat reports, and the urgent need to eliminate the United States vulnerability to ballistic missiles, the committee endorses the President's ballistic missile defense program, and supports the proposed layered defense system and realistic testing program. Therefore, the bill fully supports and marginally increases the President's $7.8 billion budget request for missile defenses.

Beyond the constitutional and moral obligation to defend the nation, the committee believes that missile defenses are critical to deterring enemies from attacking the United States or its interests. Missile defenses also prevent adversaries from attempting to intimidate or blackmail the United States from acting in its interests by removing the enemy's missile trump card and changing their strategic calculus. Finally, missile defenses promote stability by dissuading other nations from building ballistic missiles in the first place, given that such endeavors become too costly and too risky if their missiles can be defeated.

The other component to effective strategic defenses and deterrence is robust, flexible, and capable nuclear forces. The Bush Administration's Nuclear Posture Review (NPR) of January 2002 provided a comprehensive road map to achieving the capabilities necessary for today's strategic environment, and to deal with future, unforeseen threats. The NPR calls for a new triad of offensive forces, defensive capabilities, and a reinvigorated nuclear industry/infrastructure. The committee held hearings and received briefings from senior government officials, and other experts, on the need to revitalize the United States nuclear weapons industry, and to enhance our nuclear weapons infrastructure. As a result, the bill would, among other things, endorse the President's Nuclear Posture Review and task the Administration to develop a plan for enhanced nuclear test readiness.

Combating Terrorism

Recently, the Director of Central Intelligence (DCI) appeared before Congress and stated that the al Qaeda terrorist network is the most immediate and serious threat that the country faces, that it will continue to attack the United States and our interests abroad, and that its pursuit of weapons of mass destruction is particularly alarming. The DCI added that American military facilities around the world are at particular risk. This is not surprising given the attack on the USS Cole in Yemen two years ago, the 1996 attack on the Khobar Towers in Saudi Arabia, and the fact that the U.S. military is the most visible symbol of American strength and values.

Given these threats, both here in the United States and abroad, the committee bill endorses the President's efforts to combat terrorism by supporting the Department of Defense's request of $7.3 billion for combating terrorism activities.

This request includes $6.0 billion for antiterrorism, $676.0 million for counterterrorism, $360.0 million for terrorism consequence management, and $223.0 million for counterintelligence efforts.

The antiterrorism measures proposed by the Department include increased security and vigilance for key personnel, installations, and equipment. These activities will complement the actions of other federal agencies and friendly nations.

The committee supports the Department's plans for terrorism consequence management, which are focused on two major areas: the preparedness of installation emergency responders to mitigate the effects of an attack involving chemical, biological, radiological, nuclear, or high-yield explosives; and the support provided to a lead federal agency when foreign, state, and local governments request assistance.

The Department defines counterterrorism as ``offensive measures taken to prevent, deter, and respond to terrorism.'' The committee endorses this definition, recognizes the Department's exceptional history with regard to counterterrorism operations; applauds the military's current efforts in Afghanistan, the Philippines, and elsewhere; and supports the Department's efforts to ensure U.S. Special Operations Forces are the best manned, trained, armed, equipped, and supported in the world.

Good intelligence is the first line of defense against terrorism. As such, the committee supports the Department's efforts to improve intelligence collection, analysis, and dissemination to commanders in a timely manner.

Putting People First

The committee believes that the key to capable and flexible armed forces is the people--military and civilian alike, and the families that stand with them--who have dedicated themselves to the defense of the country. As such, the committee believes that the Department of Defense must take special care to ensure that their readiness, morale and quality of life are enhanced.

The National Defense Authorization Act for Fiscal Year 2003 would not only ensure that our military personnel are well trained and equipped, but also reflects the committee's concern about the impact that the war on terrorism is having on service members and their families. Despite years of overuse and budgetary neglect, the Armed Forces have performed magnificently in the wake of the September 11th attacks on the nation. Notwithstanding their exceptional successes in Afghanistan, and their deployments to the Philippines, Georgia, and Central Asia, the committee believes that wartime operations have exacerbated the same debilitating stresses of high operations and personnel tempos that existed before the global war on terrorism.

The Committee fully supports the Secretary's efforts to reduce operational and mission requirements, and to free up force structure to reduce the ``tooth to tail'' ratio. Accordingly, the committee bill would increase active duty end strength by 12,600 from the requested levels, and provide an additional $550.0 million to support this increase.

Because ``people'' are the key to a great military force, this bill gives the Department the resources it needs to recruit and retain quality people at all levels, improve the

quality of life for service members and their families, and to take better care of military retirees and veterans. As in the past, the committee bill would provide a pay raise that combines both across-the-board and targeted increases for mid-grade noncommissioned officers and officers. The bill would also reduce out-of-pocket housing expenses for military personnel, authorize concurrent receipt of military retired pay and disability payments for the most severely disabled military retirees, and implement several changes to improve health care for military personnel.

Finally, taking care of our military personnel also means providing them with the best equipment, weapons, resources, and technology available to do their jobs and accomplish their missions. But given the billions of dollars of unfunded requirements, coupled with the need to fight a war abroad and protect the homeland from terrorism, adequate military readiness will be difficult to sustain over the long term. Many of the military's weapons systems and platforms are long past their initial design lifespan, so maintenance problems and costs will continue to degrade mission capability. That said, the committee enhanced the President's budget request by providing the additional investments in the technology and weapons that will give our soldiers, sailors, airmen and Marines the advantages on the modern battlefield that will help guarantee success. The committee remains committed to making even larger investments in the future to ensure that our service members remain the best armed, equipped, and capable in the world.

Conclusion

In H.R. 4546, the committee has focused its efforts on improving military readiness, taking care of DOD personnel and their families, strengthening our strategic defenses and forces, combating terrorism, stemming the proliferation of weapons of mass destruction, and preparing for an extended war against terrorism. As a result, the committee believes its message is clear--that the House Armed Services Committee is completely committed to defending the United States, the American people, and our interests by restoring the strength and improving the capabilities of our nation's Armed Forces.

HEARINGS

Committee consideration of the National Defense Authorization Act for Fiscal Year 2003 results from hearings that began on February 6, 2002 and that were completed on April 11, 2002. The full committee conducted 8 sessions. In addition, a total of 22 sessions were conducted by five different subcommittees and two panels of the committee on various titles of the bill.

DIVISION A--DEPARTMENT OF DEFENSE AUTHORIZATION

TITLE I--PROCUREMENT

OVERVIEW

The fiscal year 2003 Department of Defense (DOD) procurement request subject to authorization was $68,637.2

million, $6,430.3 million higher than the fiscal year 2002 authorization.

The budget request also included $3,382.4 million in procurement-related equipment and items, as part of the Defense Emergency Response Fund request, resulting in a $9,812.7 million budget request increase over the fiscal year 2002 authorized level.

The committee increased the authorization for procurement by $2,933.3 million and transferred $1,793.2 million from procurement to H.R. 4547, for a net increase to the budget request of $4,522.5 million, and a total procurement authorization of $73,440.5 million.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Aircraft Procurement, Army

Overview

The budget request contained $2,061.0 million for Aircraft Procurement, Army in fiscal year 2003. The committee recommends authorization of $2,300.3 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

AH-64 modifications

The budget request contained $93.6 million for AH-64 modifications, but included no funds to procure the digital source collector (DSC) health usage monitoring system (HUMS); nor the oil debris detection system (ODDS); nor combination ammunition storage magazine and crashworthy ballistically, self-sealing, internal auxiliary fuel tanks; nor a tactical engagement simulation system (TESS) for the Army National Guard (ARNG).

The DSC-HUMS, a pre-planned product improvement for the vibration management enhancement program, is an on-board, crash-survivable memory unit that records voice, flight data, and electronic diagnostic data from the 1533 multiplex data bus. The system aids post mishap investigations and troubleshooting field maintenance failures.

The ODDS is an on-board detection system that alerts aircrews to the presence of metal chips in engines and propeller gear boxes, which allows flights to be terminated prior to catastrophic failure of critical components. The system also permits the clearing of smaller particles that routinely accumulate in engine oil and cause false impending engine failure alarms resulting in unnecessary termination of aircraft missions and costly engine diagnostics.

The committee notes that requirements for additional combination ammunition storage magazine and crashworthy ballistically, self-sealing, internal auxiliary fuel tanks exist for both AH-64A Apache and AH-64D Apache Longbow

aircraft. These tanks replace externally-mounted, non-crashworthy, non self-sealing fuel tanks and are currently installed in 101st Airborne Division (Air Assualt) Apaches operating in Operation Enduring Freedom and provide a 26 percent increase in additional fuel capacity while preserving the capability to carry 300 rounds of 30 millimeter ammunition.

The TESS is an advanced imbedded training system to enhance combat training and readiness for Apache aircrews and provides communications, decentralized engagement tracking and prosecution, and real time casualty assessment, which enables aircrews to conduct collective training at their home stations. The committee believes that the TESS would allow ARNG pilots to train more proficiently and help maintain similar proficiency levels of active component AH-64 aircrews.

The committee recommends $132.6 million for AH-64 modifications, an increase of $8.0 million to procure DSC-HUMS; an increase of $8.0 million in PE 64746A for continued development of DSC-HUMS for the Apache Longbow; an increase of $5.0 million to procure ODDS; an increase of $18.0 million to procure combination ammunition storage magazine and crashworthy ballistically, self-sealing, internal auxiliary fuel tanks; and $8.0 million for one TESS for the ARNG, for a total increase of $39.0 million for procurement upgrades for the AH-64 Apache fleet.

Airborne communications

The budget request contained $44.5 million for the procurement of 10 AN/ARC-220 aviation non-line-of-sight (NLOS) high frequency (HF) radios, 262 AN/VRC-100 NLOS HF ground radios and associated A-kits for installation of AN/ARC-220 radios into AH-64 Apache attack helicopters.

The AN/ARC-220 aviation NLOS HF radio provides secure voice and data communications between Army helicopters flying nap-of-the-earth missions and beyond-line-of-sight tactical operations centers. The committee notes that the Task Force Hawk after action report identified the lack of such capability in AH-64 Apache attack helicopters as a major deficiency for conducting long-range strike missions. Further, the committee understands that the Army has recently increased its basis of issue of the AN/ARC-220 radio to one per AH-64 Apache versus the earlier basis of issue of one per every two aircraft.

Based on the Task Force Hawk shortfalls, the increased requirement, and the committee's belief that this communications requirement is essential to effectively employ Apache aircraft for deep strike missions and ground offensives, the committee recommends $53.0 million, an increase of $8.5 million, to procure an additional 375 AN/ARC-220 aviation NLOS HF radios.

Aircraft survivability equipment (ASE)

The budget request contained no funds to procure ASE.

The AN/AVR-2A laser detecting set (LDS) is the only device in the Army capable of providing warning to helicopter crews when they have been illuminated by a laser-targeted weapon. It detects, identifies, and characterizes threats 360-degrees-around and plus-or-minus 45 degrees above-and-below an aircraft.

The committee continues to be concerned with the growing

laser threat to helicopter aircrews and notes the limited fielding of this system to force package one aircraft only. The committee understands that the Army plans to budget for LDS beginning in fiscal year 2004 to complete LDS kit installation on the AH-64D Apache Longbow and UH-60M Blackhawk helicopters. Based on a growing laser threat to Army helicopters and consistent with prior year actions, the committee recommends an increase of $5.0 million to accelerate procurement and fielding of AN/AVR-2A LDS kits.

Aircrew integrated systems

The budget request contained $15.2 million for the procurement of aircrew integrated systems, but included no funds to either procure cockpit airbag systems (CABS) or HGU-56P, AH-64 Apache helicopter integrated helmet and display sight subsystems (IHADSS) for the Army National Guard (ARNG).

The CABS is a crash-activated, inflatable protection system, which provides head and body supplemental restraint for helicopter aviators, reducing death and injury caused by the body and head impacting against cockpit structures in the event of a crash or hard landing. The committee is highly supportive of technological advances that contribute to improved aircraft crashworthiness and aircrew safety, and, also notes that the Army Chief of Staff has identified $26.1 million for the procurement of CABS as a top fiscal year 2003 unfunded priority. The IHADSS is comprised of an AH-64A Apache helicopter flight helmet, which provides crash protection and noise attenuation and a small monocular display which provides line-of-sight as well as flight critical video and symbology information to the pilot. The committee believes these helmets provide aviators with better situational awareness and safety of flight information and note that not all ARNG Apache units have these helmets.

The committee recommends $42.6 million for aircrew integrated systems, an increase of $26.1 million to procure CABS and $1.3 million for the procurement of 64 IHADSS for the ARNG.

Avionics support equipment

The budget request contained $7.5 million to procure AN/AVS-6(V)3 aviator's night vision imaging systems (ANVIS) and AN/AVS-7 heads-up displays.

The AN/AVS-6(V)3 ANVIS is a helmet-mounted, twin-tube, image-intensified (I2), generation IV, night vision system that significantly enhances night flight operations in conditions that vary from overcast starlight to strong urban lighting. Currently fielded systems comprise older generation II or generation III night vision technology. AN/AVS-6(V)3 ANVIS generation IV technology provides a 200 percent improvement in visual acuity and range performance in high light levels and a 65 percent improvement in visual acuity and range performance in low light levels over current technology, fielded from fiscal years 1985 through 1993.

The committee believes that improved safety of flight operations would result from this enhanced generation IV technology and recommends $15.5 million, an increase of $8.0 million, to accelerate the procurement of AN/AVS-6(V)3 ANVIS.

CH-47 cargo helicopter modifications

The budget request contained $382.1 million for MH-47/CH-47F special operations and cargo helicopter modifications, but included no funds for crashworthy crew seats.

While existing pilot and co-pilot seats offer some protection in the event of a hard impact landing or a crash, crew chiefs and load master personnel do not have crashworthy crew seats to provide increased protection from the acceleration forces created by such a landing or crash, thereby avoiding serious injuries or, in extreme cases, fatalities to soldiers. The committee notes that the Army Chief of Staff has identified a fiscal year 2003 unfunded requirement to accelerate procurement of crashworthy crew seats into the CH-47 Chinook helicopter.

The committee recommends $395.6 million, an increase of $13.5 million, to procure crashworthy crew seats for CH-47 cargo helicopters.

Helicopter new training

The budget request contained no funds to procure TH-67 Creek training helicopters.

The committee notes the continued shortfall in visual flight, instrument flight, and basic combat skills training helicopters which will occur with the anticipated retirementof Vietnam-era UH-1 and OH-58 A/C aircraft as outlined in the fiscal year 2000 Army Aviation Modernization Plan. The committee understands that the Army does not intend to replace these retiring aircraft due to affordability.

Based on the need to replace the aging Huey and OH-58 A/C training fleet as soon as possible and the need to provide quality training for Army aviators, the committee recommends an increase of $9.6 million for six TH-67 helicopters.

UH-60 Blackhawk

The budget request contained $153.4 million for the procurement of 12 UH-60L Blackhawk utility helicopters for the Army National Guard (ARNG), but included no funds for HH-60L enhanced medical evacuation (MEDEVAC) helicopters for the ARNG or for a UH-60L full motion simulator.

The Blackhawk is the Army's primary utility helicopter for air assault, general support and aero medical evacuation missions. The HH-60L MEDEVAC helicopter provides enhanced medical evacuation and treatment of six litter or seven ambulatory patients in a state-of-the-art medical treatment cabin interior.

The committee is aware that the national command authority's rapid reaction force 18th Airborne Corps has a requirement for one additional UH-60L Blackhawk full motion simulator and that this simulator is not planned to be budgeted for until fiscal year 2005. However, aviation units from this corps are currently deployed in combat operations in Operation Enduring Freedom and must maintain the highest levels of readiness and training as a rotational alert force.

The committee recommends $268.7 million, an increase of $52.6 million to procure five additional UH-60L Blackhawks for the ARNG and $47.7 million to procure three HH-60L MEDEVAC variants for the ARNG, and an increase of $15.0 million for one

UH-60L Blackhawk full motion simulator for the 18th Airborne Corps, for a total increase of $115.3 million.

UH-60 modifications

The budget request contained $41.9 million for UH-60 modifications, of which $10.3 million was for crashworthy external fuel systems, but no funds were included for this system for Army National Guard (ARNG) UH-60 combat search and rescue aircraft or for UH-60 deicing system upgrades.

UH-60 crashworthy external fuel systems are self-sealing, ballistically-tolerant tanks that replace existing 230 gallon non-crashworthy external fuel tanks originally intended only for ferry flights. However, expanding Army aviation missions have increasingly required these non-crashworthy tanks to be used to extend UH-60 tactical mission ranges, which create safety risks to flight crews, passengers, and aircraft that require individual mission waivers by individual commands.

The committee understands that the original UH-60 series aircraft were built with a marginally capable deicing system and that an upgrade is underway to improve its performance.

As a result of potential safety risks created by existing systems, the committee recommends $49.9 million for UH-60 modifications, an increase of $6.0 million, for crashworthy external fuel systems for both ARNG combat search and rescue aircraft and active Army UH-60s, and an increase of $2.0 million for UH-60 series aircraft deicing system upgrades, for a total increase of $8.0 million.

Missile Procurement, Army

Overview

The budget request contained $1,642.3 million for Missile Procurement, Army in fiscal year 2003. The committee recommends authorization of $1,693.9 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Army tactical missile system (ATACMS) summary/ATACMS block II system summary

The budget request contained $9.1 million for the fielding of prior year procured missiles, but included no funds to procure ATACMS quick reaction program (QRP) unitary warhead missiles. The budget request also included $49.7 million for engineering services, production engineering support and related activities for ATACMS block II missiles, however, no block II missiles are planned to be produced in fiscal year 2003.

The ATACMS is a surface-to-surface, global positioning system-guided missile for deep-strike attacks against tactical surface-to-surface and surface-to-air missile sites; logistics

elements; and command, control, communications complexes.

The committee is aware of the ATACMS QRP upgrade that will incorporate Standoff Land Attack Missile-Expanded Response warheads into ATACMS Block IA missiles. This warhead upgrade is designed to limit collateral damage when used against targets in urban environments and is a direct outgrowth of the Army's inability to conduct deep strike missions against such targets with its existing ATACMS missile inventory during Operation Allied Force. The committee also notes that the Army received $38.0 million in fiscal year 2002 Defense Emergency Response Fund supplemental funding to accelerate this conversion initiative.

The committee notes that $5.0 million and $6.1 million was appropriated for engineering services and production engineering support, respectively, in fiscal year 2002 for the production of 6 ATACMS block II missiles and 83 brilliant antitank submunitions (BAT). However, $25.3 million and $12.0 million is requested for engineering services and production engineering support, respectively, in fiscal year 2003, yet no missile or submunition production is planned. The committee is concerned about the fiscal year 2003 request including a five-fold increase for engineering services and just under twice the amount for production engineering support over the amounts appropriated for these fiscal year 2002 production requirements. The committee also notes that the Army is currently reviewing and restructuring the ATACMS block II and BAT program and considering arming unmanned aerial vehicles (UAV) with BAT pre-planned product improved (P3I) submunitions instead of expending BAT P3I submunitions from missiles.

The committee believes that the Army should have the capability to provide joint force commanders with a surface-to-surface deep strike option, which creates limited collateral damage in urban environments. Also, the committee is supportive of expanding UAV capability with weapons, which have been effectively demonstrated in Operation Enduring Freedom.

The committee recommends $47.1 for ATACMS missile system summary, an increase of $38.0 million, to upgrade ATACMS Block IA missiles to the QRP configuration. Also, the committee recommends $23.3 million for ATACMS block II system summary, a decrease of $20.3 million and $6.1 million from engineering services and production engineering support, respectively, for a total decrease of $26.4 million, since no production is planned in fiscal year 2003 for ATACMS block II missiles or BAT P3I submunitions.

Hellfire system summary

The budget request contained $184.4 million for the procurement of Longbow Hellfire missiles, but included no funds to procure laser Hellfire II missiles.

The committee notes that the Army Chief of Staff has identified a fiscal year 2003, $80.2 million unfunded requirement for laser Hellfire II missiles.

The committee recommends $224.4 million for Hellfire system summary, a $40.0 million increase, for laser Hellfire II missiles.

Weapons and Tracked Combat Vehicles, Army

Overview

The budget request contained $2,248.6 million for procurement of Weapons and Tracked Combat Vehicles, Army for fiscal year 2003. The committee recommends authorization of $2,373.0 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Bradley base sustainment

The budget request contained $397.1 million for the procurement of Bradley A3 fighting vehicle upgrades, including $3.5 million for fielding Army National Guard (ARNG) A2 Operation Desert Storm (ODS) variants.

The Bradley A2ODS is an upgraded first-generation Bradley A0, which enhances its lethality, survivability, and mobility, as well as the situational awareness of its crew. Modifications include installation of a laser range finder, Global Positioning System navigation capability, a combat identification system, a driver's thermal viewer and a missile countermeasure device.

When the Army completes all of its planned upgrades to the Bradley, the active fleet will include a mix of the most advanced A3 variant, along with A2 and A2ODS versions. The committee understands that beginning in fiscal year 2003, approximately 400 ARNG Bradley A0s will remain unmodified since this upgrade program was initiated. Because of major survivability deficiencies, Bradley A0s were not mobilized during the Persian Gulf War. However, as part of the new ARNG enhanced brigades, the committee notes that some of these A0 vehicles will be required to deploy with active Army forces.

Because ARNG enhanced brigades will comprise an increasing percentage of the Army's warfighting capability in the future, the committee recommends $457.1 million for Bradley base sustainment, an increase of $60.0 million, to upgrade an additional 45 Bradley A0 vehicles to the A2ODS variant for the ARNG.

Improved recovery vehicle (IRV)

The budget request contained $50.3 million for the procurement of 16 M88A2 IRVs, but included no funds for the procurement of these vehicles for the Army National Guard (ARNG).

The 56-ton M88A1 is capable of towing only vehicles weighing less than 60 tons. Consequently, two M88A1s are required to safely tow an Abrams tank if it becomes immobile due to combat damage or mechanical failure. The M88A2 IRV upgrade is a jointly procured system for both the Army and Marine Corps and includes increased engine horsepower, as well as braking, steering, winch, lift, and suspension capabilities required to safely recover Abrams tanks and other heavy combat systems. The committee understands that the Army will terminate

this program in fiscal year 2006 as one of its 18 programs it identified for termination through the future years defense program to reprioritize funds for transformation, however, these upgrades will be procured to fulfill heavy counter attack corps requirements. The committee also notes that the ARNG has a shortfall of IRVs in its enhanced separate brigade force structure.

The committee recommends $96.1 million, an increase of $45.8 million, for 15 additional M88A2 IRV upgrades for the ARNG.

M113 carrier modifications

The budget request contained $60.3 million for M113 carrier modifications, of which $14.9 million was for M113 ``A3'' upgrades, and $45.4 million was for new T-150 track for the United States-based Counter Attack Corps.

The M113A3 upgrade program, forecast to add an additional 20 years of service life to the vehicle, includes installation of a new engine, transmission, external armored fuel tanks, driver controls, and internal Kevlar spall liners. The committee notes, however, that the M113A3 upgrade program is one of 11 programs to be terminated by the Army in fiscal year 2003 in order to afford higher transformation priorities.

While the committee is supportive of transformation and understands the need to reallocate resources to accelerate improved transformational technologies, in this instance it believes that the Army's decision to not upgrade the remaining forward deployed 112, 2nd Infantry Division M113A2s in the Republic of Korea, and the 185, 1st Armored Division and 167, 1st Infantry Division M113A2s in Europe, will at a minimum, leave the soldiers in these front line units vulnerable and lacking increased maneuver capability in the potentially unstable and high threat environments they are required to operate in. Unless the Secretary of the Army can present the committee with a valid plan as to why the Army would not complete these particular unit vehicle upgrades prior to terminating the ``A3'' upgrade program after fiscal year 2003, the committee recommends that the entire $60.3 million requested for fiscal year 2003 be only for M113A3 upgrades for these units.

M249 squad automatic weapon (SAW)

The budget request contained no funds for the procurement of the M249 SAW. The M249 SAW is a lightweight machine gun capable of delivering a sustained volume of automatic, accurate, and highly lethal fire up to ranges of 800 meters. It is being widely fielded throughout the Army to airborne, artillery, light and mechanized infantry, and aviation units. The committee notes that this has been one of the infantry's critical weapon systems in the Army's deployment to Afghanistan for Operation Enduring Freedom. As a result of a review and increased requirements, the committee understands that the Army Chief of Staff has identified an $18.6 million fiscal year 2003 unfunded requirement for an additional 9,580 guns, which will fulfill the service's total procurement objective of 89,428 guns.

The committee recommends an increase of $18.6 million for this purpose to complete the procurement objective of M249

SAWs.

Ammunition Procurement, Army

Overview

The budget request contained $1,159.4 million for Ammunition Procurement, Army in fiscal year 2003. The committee recommends authorization of $1,320.0 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Army ammunition procurement

The budget request contained $1,159.4 million for procurement of ammunition and production base support. The committee recommends an additional $133.6 million, for the following types of ammunition programs, of which ammunition production is among the top unfunded requirements identified by the Army Chief of Staff in fiscal year 2003:

Small/Medium Caliber Ammunition:ions of dollars]	
CTG 5.56mm, all types (production line upgrade)	5.0
CTG 25mm, APFSDS-T M919	23.0
Mortar Ammunition:	
81mm M816	2.8
CTG 120mm M934A1	7.8
CTG 120mm IR Illum M983	3.0
Pine Bluff Arsenal production line upgrade	3.0
Artillery Ammunition:	
Projectile, Artillery 155mm Illum M110	10.0
Projectile, Artillery 155mm HE M795	24.0
Modular Artillery Charge System	20.0
Rockets: Bunker Defeating Munition	10.0
Demolition Munitions, All Types: Modernization Demolition Initiators	5.0
Production Base Support: ARMS Initiative	20.0

Army ammunition production and load, assemble, and pack (LAP) capacity

The committee understands that the Department of the Army has issued a request for information with regard to consolidation of its four government owned, contractor operated, ammunition LAP facilities beginning in fiscal year 2003. However, it also understands that the necessary funds to execute a contract related to consolidation are not included in the future years defense program. The committee notes that the Army has identified a $544.0 million fiscal year 2003 unfunded requirement for conventional ammunition, its largest annual unfunded requirement over the past five fiscal years, as a result of growing shortfalls in war reserve ammunition and increased marksmanship training requirements identified by the

Army Chief of Staff to fight the war on terrorism. While the committee is a proponent of streamlining and eliminating excess capacity within the ammunition industrial base, it is aware that unique job skills exist in these production facilities and that the correct industrial production and LAP capacity and related skills must be maintained to meet surge production requirements.

The committee directs the Secretary of the Army to provide a report to the congressional defense committees by January 15, 2003, which outlines the conventional ammunition industrial base requirements, including LAP capacity, to fulfill the ammunition requirements for the Department's new capabilities-based strategy and Army Chief of Staff unfunded requirements.

Other Procurement, Army

Overview

The budget request contained $5,168.5 million for Other Procurement, Army in fiscal year 2003. The committee recommends authorization of $6,119.4 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Automated data processing equipment (ADPE)

The budget request contained $156.5 million for procurement of ADPE, of which $13.5 million was included for automatic identification technology (AIT)/radio frequency-identification (RFID) devices.

AIT/RFID devices, which consist of various radio frequency, bar code scanning, and data carrier devices, are components of automated logistics systems that expedite receiving, storage, distribution, and inventory management of new and repairable items as well as afloat and ashore pre-positioned stockpile items and equipment. These devices are also used to automate manufacturing process controls for repair parts and to track other types of ground support equipment at various military depots. The committee believes that substantial savings and efficiencies can continue to be achieved from further implementation of these devices in automated inventory and repair processes. The committee urges the Secretary of the Army to review the opportunities to reduce manpower requirements in Army industrial facilities as a result of increased efficiencies that may be achieved from the continued installation of this technology.

The committee recommends $174.0 million, an increase of $12.3 million for maintenance AIT/RFID implementation in Army industrial facilities, and an increase of $5.2 million for AIT/RFID implementation in pre-positioned stocks, for a total increase of $17.5 million.

Combat support medical

The budget request contained $21.0 million to procure deployable medical systems and field medical equipment, but included no funds for rapid intravenous (IV) infusion pumps, or Life Support for Trauma and Transport (LSTAT) units, or the Army Medical Support Group Telemedicine Instrumentation Pack (TIP). The budget request also contained $12.6 million in PE 64807A, but included no funds for LSTAT spiral development.

The Rapid IV infusion pump is a Food and Drug Administration approved miniature, portable, lightweight pump specifically designed for life-saving intravenous fluid resuscitation by a medic in the field to restore blood pressure and prevent shock and death of victims with severe blood loss or dehydration. The committee understands that it is estimated that up to 15 percent of the soldiers that died in Vietnam who were not immediate battlefield casualties would have survived their wounds if rapid infusion of fluids had been a possibility during that conflict.

The LSTAT integrates a set of commercially available, FDA-approved medical devices in a self-contained mini-intensive care, medical evacuation platform, which provides advanced life-support, on-board ventilation, suction, environmental control, oxygen generation, and patient monitoring to stabilize wounded soldiers near the battlefront as they are evacuated. LSTAT is configured on a NATO-standard litter, is broadly interoperable with other medical systems and compatible with most evacuation platforms including UH-60s, UH-1s, C-130s, and High Mobility Multi-purpose Wheeled Vehicles.

The TIP is a portable electronic patient record and diagnostic device, which allows medical personnel to acquire and update a patient's health information and treatment history from statistics gathered by numerous patient health monitoring and diagnostic instruments. A patient's medical treatment history and statistics are automatically recorded into the electronic patient chart for later review during a patient's treatment or can be transmitted online for other medical expert's assistance.

The committee is supportive of the potential life saving capability that these devices offer, and, therefore, recommends $38.0 million, an increase of $5.0 million to procure rapid IV infusion pumps; an increase of $10.0 million to continue procurement of LSTAT units, and an increase of $2.0 million to procure TIPs. The committee also recommends $17.6 million in PE 64807A, and increase of $5.0 million, for spiral development of expanded LSTAT capabilities.

Family of heavy tactical vehicles

The budget request contained $242.8 million to procure palletized load systems, heavy equipment transporter systems, heavy expanded mobility tactical trucks and other related equipment of which $34.3 million was included to procure 2,324 movement tracking systems (MTS). However, no MTS were requested for the Army Reserve.

The MTS is a satellite-based tracking, communication system providing both active and reserve component combat service support units with global positioning system vehicle location and tracking and two-way text messaging between stationary base locations and vehicles.

The committee understands the MTS significantly enhances

the Army's ability to strategically position, monitor, and track re-supply items, while providing near real-time command and control of in-theater logistical requirements. As Army Reserve unit deployments increase, the committee believes there is an increasing need for better communications interoperability between active and mobilized reserve combat service support units.

The committee also notes the Chief of the Army Reserve has identified a fiscal year 2003 unfunded requirement for MTS and, recommends an increase of $9.0 million to accelerate procurement of MTS for the Army Reserve.

High mobility multi-purpose wheeled vehicles (HMMWVs)

The budget request contained $196.8 million for 2,064 HMMWVs, of which $54.0 million was included to procure 360 of the M1114 Up-Armor variant.

The Up-Armor HMMWV is a multi-service, four wheel drive utility vehicle that provides proven ballistic protection for soldiers from anti-personnel and anti-tank mines and armored piercing munitions. The committee notes the Army Chief of Staff has identified a $31.1 million fiscal year 2003 unfunded requirement for an additional 180 Up-Armored HMMWVs. The committee understands these additional vehicles will be fielded to deployed active and reserve units to enhance combat support missions.

Recognizing the ongoing importance of force protection and in light of lessons learned from previous urban and combat operations, the committee recommends $227.9 million, an increase of $31.1 million, to fulfill the unfunded requirement for an additional 180 M1114 Up-Armor HMMWVs.

Information system security program (ISSP)

The budget request contained $39.1 million and $13.4 million to procure secure voice and data equipment for the Army and Air Force respectively.

The committee strongly supports upgrading critical secure telecommunications by replacing older secure voice and data systems with modern secure digital communications equipment. These upgrades will help reduce the exploitation of classified and sensitive information due to growing information security threats. The committee also notes that this is a top fiscal year 2003 unfunded priority of the Air Force Chief of Staff.

To accelerate the replacement of older secure voice and data terminals, the committee recommends an increase of $14.0 million for Army ISSP and $10.0 million for Air Force Command, Control, and Communications Countermeasures to procure additional secure terminal equipment.

Items less than $5.0 million (construction equipment)

The budget request contained $12.9 million to procure construction equipment support items, of which $784 thousand was for two water distributors for airborne units, but no funds were requested for the Army Reserve.

These water distributors provide water distribution for rapid construction requirements in the deployed locations. The committee notes that the Chief of the Army Reserve has identified a $4.0 million fiscal year 2003 unfunded requirement

for 12 water distributors.

The committee recommends an increase of $16.9 million for construction equipment items less than $5.0 million, an increase of $4.0 million, to accelerate procurement and fielding of 12 water distributors to the Army Reserve.

Joint tactical area command systems

The budget request contained $900 thousand for management of joint tactical area command systems, but included no funds to upgrade AN/ARS-6 (V) personnel locator communications systems.

The AN/ARS-6 (V) personnel locator communications system is an airborne electronic locator, which can precisely locate survivors on the ground equipped with AN/PRC-112 survival radios. The committee understands that this commercial-off-the-shelf (COTS) upgrade will include a global positioning system waveform for currently fielded systems and believes that this capability may aid in the rescue and recovery of personnel and survivors in extremis situations.

The committee recommends $6.9 million for joint tactical area command systems, an increase of $6.0 million, for AN/ARS-6 (V) COTS insertion upgrades.

Lightweight maintenance enclosure (LME)

The budget request contained $7.7 million to procure LMEs, of which $1.9 million was for the Army National Guard (ARNG).

The LME is a lightweight, frame-supported tent designed to provide forward deployed maintenance units a quick setup-and-takedown enclosed shelter in which to perform field maintenance operations across the battlefield in all climatic conditions.

The committee notes that mobility will be the hallmark of the Army's future medium brigades as well as ARNG units and that they must therefore be capable of rapidly repairing and maintaining equipment while deployed.

The committee recommends $17.7 million, an increase of $10.0 million, for the procurement of additional LMEs: $5.0 million for the Army and $5.0 million for the ARNG.

Single channel ground and airborne radio systems (SINCGARS) family

The budget request contained $30.1 million to procure SINCGARS for high priority Army National Guard (ARNG) units and interim brigade combat teams. The budget request also included $22.1 million to procure improved high frequency radios (IHFR) for ARNG weapons of mass destruction civil support teams, but included no funds for IHFRs for the Army Reserve.

The IHFR is the primary means of communications for maneuver battalions, combat support and combat service support units, the latter of which are comprised primarily of Army Reserve forces. The IHFR provides a versatile capability for short- and long-range communications, particularly important for highly mobile and geographically dispersed units not supported by active component communications units. The IHFR is also the only tactical radio that possesses a long-range communications capability independent of terrestrial or satellite relays and exceeds the range of the line-of-sight SINCGARS. To date, limited fielding has occurred to the Army Reserve due to budget constraints; however, as a result of

newly expanded missions in support of the war on terrorism, the Chief of the Army Reserve has identified a $61.1 million fiscal year 2003 unfunded requirement for 1,750 IHFRs.

The committee recommends an increase of $61.1 million to procure IHFRs for the Army Reserve.

Small tug

The budget request contained no funds to procure small tugs.

The small tug is a 60-foot, steel hull, twin propeller vessel designed to tow general cargo barges in harbors, inland waterways, and along coastlines. It is also capable of assisting larger tugs in mooring ships of all sizes at piers and in restricted navigation waterways, moving floating cranes and machine shops, and performing line-handling duties.

The committee is aware that the Army has procured 12 of these tugs, has two under contract, and has recently increased its requirement to 16 vessels. The small tug replaces the Army's obsolete 40-year-old small tugs that were used in Operations Desert Shield and Desert Storm.

Consistent with prior years, and to complete the requirement for two additional tugs, the committee recommends an increase of $7.0 million to accelerate procurement of 2 additional vessels towards completion of the requirement for 16 small tugs.

Stamis tactical computers (STACOMP)

The budget request contained $61.3 million for STACOMP, of which $47.2 million was for global combat support system (GCSS)-Army hardware and fielding.

The GCSS-Army will be the business and tactical information system for Army combat service support to manage supply property, maintenance, ammunition, and supply support. In fiscal year 1997, the Army began development of GCSS-A to transform the Army's information technology support systems, which included replacing 16 legacy systems with 5 modules. However, the Army is still attempting to implement the first, and admittedly easiest, module to more than support supply property requirements. Despite spending $320 million on GCSS-Army over 5 years, nothing has been fielded to date and no legacy information systems have been replaced. The Army intends to initially field the first module in fiscal year 2002. The committee is concerned about the amount of funds that have been expended, the lack of success, and amount of time required for initial fielding of the first and easiest module.

The committee has learned that the Army has now changed its acquisition strategy for the second module, which will cover maintenance logistics requirements and intends to use a commercial based enterprise resourcing plan versus continuing development of the second module. This is a significant change in strategy, which will affect the acquisition approach, funding requirements, and testing and implementation schedule.

Because of the Army's adoption of a commercial system acquisition strategy, the committee believes the system will require less funds to field the additional modules and recommends $51.3 million for STACOMP, a decrease of $10.0 million for GCSS-A.

Striker family

The budget request contained $28.5 million for the procurement of 54 Striker command and control vehicles, but included no funds for Strikers for the Army National Guard (ARNG).

The Striker vehicle is a high mobility multi-purpose wheeled vehicle mounted system, which incorporates a Bradley fire support vehicle mission equipment package of a laser rangefinder/designator, thermal sight, handheld computer, and both inertial navigation and global positioning systems. The Striker is operated by combat observation lasing teams (COLTs) as an integral part of heavy and light division and ARNG enhanced separate brigade reconnaissance teams to locate and designate targets for laser-guided ordnance.

The committee understands that funds appropriated in fiscal year 2001 for the ARNG Strikers enabled the fielding of only 50 percent of the required systems for an ARNG separate enhanced brigade and the full requirement is not expected to be budgeted for until fiscal year 2006.

The committee recommends $33.0 million, an increase of $4.5 million for six Striker systems to accelerate and complete fielding to an ARNG separate enhanced brigade.

Chemical Agents and Munitions Destruction, Army

Overview

The budget request contained $1,490.2 million for Chemical Agents and Munitions Destruction, Army, for fiscal year 2003. The committee recommends no funds for fiscal year 2003.
<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Chemical agents and munitions destruction

The budget requests contained $1,490.2 million for Chemical Agents and Munitions Destruction, Army.

The committee notes that section 1412 of the National Defense Authorization Act for fiscal year 1986 (Public Law 99-145), as amended, requires that funds for the destruction of the U.S. stockpile of lethal chemical agents and munitions, including funds for military construction projects necessary to carry out the demilitarization program, shall only be authorized and appropriated in the budget of the Department of Defense (DOD) as a separate program and shall not be included in the budget accounts for any of the military departments. The committee notes that for the fourth year in a row, the Department's budget request contains authorization and appropriation of funds for the chemical demilitarization program in a budget account of the Department of the Army in contravention of direction provided by the law.

The committee believes that the original 1986 legislation, which mandated that funds for the chemical demilitarization program be authorized and appropriated in a defense-wide budget account in order to emphasize that destruction of the chemical weapons stockpile was a national issue affecting all of the

Department and not just a single military service, was appropriate. In 1986, the estimated cost of the chemical stockpile demilitarization program was approximately $1,500.0 million. Today, the potential estimated cost of the program has grown to $24,000.0 million and reinforces the committee's earlier position.

The committee recommends no funds for Chemical Agents and Munitions Destruction, Army, a decrease of $1,490.2 million. The committee recommends an increase of $1,490.2 million for Chemical Agents and Munitions Destruction, Defense, as described elsewhere in this report. The committee also recommends a provision, section 143, that would require the Under Secretary of Defense (Comptroller) to certify in subsequent annual budget requests that the request is in accordance with the law.

Aircraft Procurement, Navy

Overview

The budget request contained $8,203.9 million for Aircraft Procurement, Navy in fiscal year 2003. The committee recommends authorization of $8,971.6 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

AV-8B series modifications

The budget request contained $32.2 million for AV-8B series modifications, but included no funds for the AV-8B engine life management program (ELMP) or for Litening advanced airborne targeting and navigation (AT) pods.

The ELMP was developed by the Marine Corps to address the safety and reliability of the AV-8B's engine. The committee understands that increased ELMP funds for fiscal year 2003 would provide more efficient foreign object damage repair capability, improved oil analysis systems, and fuel metering unit revitalization, and recommends an increase of $5.8 million for the AV-8B ELMP.

The Litening AT pod is the next generation Litening pod system that will incorporate an advanced forward-looking infra-red radar and other enhancements to the existing multi-sensor and precision strike capability. The committee understands that the Marine Corps has a requirement for 98 Litening targeting pods but has thus far only procured 66, for a shortfall of 32, and, recommends an increase of $55.0 million for 32 Litening AT pods.

The committee recommends $93.0 million for AV-8B series modifications, an increase of $60.8 million, and notes that both of the recommended AV-8B series modification increases are included among the Commandant of the Marine Corps' unfunded priorities for fiscal year 2003.

E-2 modifications

The budget request contained $17.2 million for E-2 modifications, but included no funds to upgrade E-2C aircraft to the Hawkeye 2000 configuration.

The Hawkeye 2000 configuration is an upgrade to older-model E-2C aircraft that integrates satellite communications, a commercial-off-the-shelf, high-capacity mission computer and associated workstations, and cooperative engagement capability equipment. The committee understands that the Navy's E-2C aircraft inventory includes at least two older-model E-2C aircraft, which are not configured to meet current operational fleet requirements, and can be economically upgraded to the Hawkeye 2000 configuration.

The committee recommends $81.2 million for E-2 modifications, an increase of $64.0 million, to the upgrade two older-model E-2C aircraft to the Hawkeye 2000 configuration.

EA-6B modifications

The budget request contained $223.5 million for EA-6B modifications, of which $45.8 million was included for 15 EA-6B wing center sections (WCSs), but included no funds for the outer wing panel (OWP), the USQ-113 communications jammer, or for band 9/10 transmitters. The Department of the Navy's fleet of 122 EA-6B aircraft are the Department of Defense's only aircraft configured to provide the electronic-jamming capability to deny and degrade the acquisition of friendly forces by enemy air defense systems.

The committee understands that recent EA-6B fatigue life inspections have revealed that both existing WCSs and OWPs are aging more rapidly than expected due to fatigue cracking, and that this situation has prompted the Navy to ground eight of its EA-6Bs and restrict EA-6B flight operations in 51 aircraft to less than three times the force of gravity, or ``g's,'' rather than its full operating envelope of 5.5 g's. To restore these aircraft to their full operating envelope, WCSs and OWPs must be replaced and the committee recommends an increase of $40.0 million to procure and install an additional four WCSs and five OWPs.

The USQ-113 communications jammer provides upgraded very-high and ultra-high frequency jamming capability. The committee understands that procurement of this system not only improves equipment maintainability and operational capability, but also improves the availability of this system for deployed aircraft. The committee recommends an increase of $35.0 million for the USQ-113 communications jammer.

The band 9/10 transmitter provides the EA-6B with expanded jamming capability against target tracking and fire control radars of modern integrated air defense systems. Since the committee understands that 214 of the Department of the Navy's 263-inventory objective for band 9/10 transmitters have been procured thus far, it recommends an increase of $29.0 million to procure 43 additional band 9/10 transmitters.

The committee recommends $327.5 million for EA-6B modifications, an increase of $104.0 million, and notes that each of the EA-6B modification increases recommended are included among both the Chief of Naval Operation's and Commandant of the Marine Corps' top unfunded priorities for fiscal year 2003.

H-1 series modifications

The budget request contained $1.8 million for H-1 series modifications, of which $1.0 million was included for three AN/AAQ-22 night thermal imaging system (NTIS) product improvement program (PIP) upgrades.

The AN/AAQ-22 NTIS provides the Marine Corps' UH-1N helicopter fleet with a capability to operate in both day and night conditions, as well as in a smoke, dust or haze environment, and the PIP upgrade improves the AN/AAQ-22 NTIS by increasing resolution by greater than 20 percent, improving system stability and control, upgrading target detection and obstacle avoidance capability, and adding a laser designator to guide precision munitions. The committee understands that the UH-1Ns equipped with the AN/AAQ-22 NTIS PIP upgrade have performed superbly in Operation Enduring Freedom in their mission to identify targets of opportunity and to provide rapid alerting of threats to Allied forces.

To enhance the UH-1N's mission effectiveness and to improve its flight safety, the committee recommends $16.8 million, an increase of $15.0 million to accelerate procurement of the AN/AAQ-22 NTIS PIP upgrade.

H-60 series modifications

The budget request contained $15.4 million for H-60 series modifications, but included no funds for the H-60 link 16 upgrade.

The committee understands that the link 16 upgrade is required in the Navy's H-60 series helicopters to provide situational awareness to the aircraft and the warfare commander of crucial and time critical information for strike operations and defense within an area of responsibility, and notes that the Chief of Naval Operations has included the H-60 link 16 upgrade among his unfunded priorities for fiscal year 2003.

Consequently, the committee recommends $70.4 million for H-60 series modifications, an increase of $55.0 million, for the H-60 link 16 upgrade.

Joint primary air training system (JPATS)

The budget request contained no funds for the Navy JPATS.

The JPATS, consisting of both the T-6A aircraft and a ground-based training system, will be used by the Navy and Air Force for primary pilot training. The T-6A will replace both the Navy's T-34 and Air Force's T-37B fleets, providing safer, more economical and more effective training for future student pilots.

Despite the fact that the Department of the Navy does not plan to continue JPATS procurement until fiscal year 2007, the committee continues to believe that its procurement for the Navy would not only reduce procurement costs for both the Navy and the Air Force but would also reduce operations and maintenance costs, and notes that the Chief of Naval Operations has included JPATS procurement among his top unfunded priorities for fiscal year 2003.

The committee recommends an increase of $60.0 million and expects that this amount will procure ten T-6A aircraft and associated ground-based training systems.

MH-60S

The budget request contained $284.2 million for 15 MH-60S helicopters and $88.0 million for advance procurement of 13 MH-60S helicopters in fiscal year 2004. The MH-60S helicopter's primary mission will be organic airborne mine countermeasures; however, it will also replace the H-46D for the Navy's helicopter combat support missions including vertical replenishment, cargo and personnel transfer, and search and rescue.

The committee understands that the aging H-46D helicopter is increasingly expensive to operate, and that, because of its diminished availability, the Navy's inventory of combat support helicopters is 24 less than required to sustain its battle group combat support needs. The committee also notes that the Chief of Naval Operations has identified additional MH-60S helicopters among his top four unfunded priorities for fiscal year 2003.

The committee believes that the aging H-46D fleet should be retired as soon as practical, and recommends $372.2 million, an increase of $88.0 million for four additional MH-60S helicopters and for advance procurement of long-lead components for five additional helicopters in fiscal year 2004.

P-3 series modifications

The budget request contained $102.7 million for P-3 series modifications, of which $84.0 million was included for four anti-surface warfare improvement program (AIP) kits, but included no funds for procurement of the advance multiband optical surveillance system (AMOSS) or for communications, navigation, and surveillance global air traffic management (CNS/ATM) modifications for VP- and UP-3A aircraft.

The AIP improves the P-3's communications, survivability, and over-the-horizon targeting capabilities through the installation of commercial-off-the-shelf components. The committee understands that the Commanders-In-Chief (CINCs) require 146 AIP-configured aircraft, but notes that the Department of the Navy has budgeted for a total of only 83 in its future years defense program. The committee also notes that the Chief of Naval Operations (CNO) has included additional AIP kits among his unfunded priorities for fiscal year 2003.

The committee recommends an increase of $27.0 million to procure two additional AIP kits. Additionally, the committee understands that some AIP-configured P-3 aircraft have also been equipped with the tactical common data link (TCDL), which provides real-time imagery downlink to commanders, weapons delivery platforms and other end-users, and that these aircraft have been primary surveillance and intelligence contributors during Operation Enduring Freedom. Since the committee believes that future conflicts are likely to require the increased capabilities that the TCDL provides, it urges the Department of the Navy to include the TCDL in all its AIP-configured P-3 aircraft.

The AMOSS is an electro-optical, multi-spectral surveillance camera system designed for use in the Navy's six special project P-3 aircraft to detect the presence of substances used in the development and production of weapons from standoff ranges in both day and nighttime conditions. The

AMOSS would replace the special project P-3's existing electro-optical surveillance camera system, which is limited to day-only operations and cannot be used from standoff ranges. The committee understands that funds appropriated for fiscal year 2002 are being used to deliver a prototype AMOSS and that production of the first three AMOSSs can begin in fiscal year 2003 so that all six special project P-3 aircraft could be equipped with this capability by fiscal year 2005. To provide improved weapons development and production reconnaissance capabilities to the special project P-3 aircraft, the committee recommends an increase of $9.0 million to procure three AMOSSs.

VP- and UP-3A aircraft are configured to support the travel requirements of senior naval commanders and theater CINCs. The committee understands that the majority of these aircraft are not configured with the CNS/ATM requirements for preferred air traffic routing, nor are they configured with the appropriate communications systems required for senior naval commander and CINC connectivity. To address these deficiencies in the Navy's VP- and UP-3A fleets, the committee recommends an increase of $6.0 million for the CNS/ATM modification, and notes that the CNO has also included this upgrade among his unfunded priorities for fiscal year 2003.

The committee recommends $144.7 million for P-3 series modifications, an increase of $42.0 million.

T-45 training system (TS)

The budget request contained no funds for the advance procurement of T-45C aircraft. The T-45TS is an integrated training system that combines the T-45 aircraft, simulators, and computer-based training for the Navy's intermediate-level undergraduate pilot training.

The committee notes that, while the Navy requires 234 T-45 aircraft, its inventory will be only 181 aircraft after eight T-45C's are produced in fiscal year 2003, and that T-45 production is not planned for years beyond fiscal year 2003.

Since the committee believes that T-45 production should continue in order to meet the requirement for 234 T-45 aircraft, it recommends an increase of $10.0 million for advance procurement of T-45C aircraft in fiscal year 2004.

UC-35

The budget request contained no funds for procurement of UC-35 aircraft.

The UC-35 is a medium-range, medium-lift operational support aircraft. The committee understands that the Marine Corps conducts the operational support airlift mission with the short-range C-12 aircraft, which is increasingly expensive to operate, and does not meet payload, range, or avionics requirements. The committee notes the Commandant of the Marine Corps has included the procurement of UC-35s among his unfunded priorities for fiscal year 2003.

The committee recommends an increase of $8.3 million for one UC-35 aircraft for the Marine Corps.

Weapons Procurement, Navy

Overview

The budget request contained $1,832.6 million for Weapons Procurement, Navy in fiscal year 2003. The committee recommends authorization of $1,916.6 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

AIM-9X missile

The budget request for the Department of the Navy contained $53.3 million for 295 AIM-9X missiles and the budget request for the Department of the Air Force contained $57.0 million for 286 AIM-9X missiles. The AIM-9X missile is a fifth generation, launch-and-leave, infrared-guided air-to-air missile.

The committee notes that the AIM-9X missile is superior to all fielded short-range air-to-air missiles, is pleased that both the Departments of the Navy and the Air Force have included its procurement in the fiscal year 2003 budget request and restored its procurement in their future years defense programs, and understands that cost improvement initiatives have been, and continue to be, underway to achieve lower future unit costs.

The committee strongly encourages the Departments of the Navy and the Air Force to take the necessary actions to leverage cost improvement initiatives and to maximize economies of scale in order to procure the most AIM-9X missiles possible in the future years defense programs within the programmed budget.

Hellfire II missile

The budget request contained no funds for Hellfire II missiles.

The Hellfire II missile is a laser-guided, anti-armor and anti-ship weapon used by the Marine Corps on the AH-1W helicopter and by the Navy on the SH-60B helicopter as their primary precision-guided munition. The committee notes that, despite increased funding provided by Congress in fiscal years 1998, 2000 and 2001, the Navy is currently at only 54 percent of its inventory requirement for these missiles. The committee further notes that, as a result of this situation, both the Chief of Naval Operations and the Commandant of the Marine Corps have identified procurement of Hellfire II missiles among their unfunded requirements in fiscal year 2003.

Consistent with its prior actions, the committee recommends an increase of $40.0 million to procure additional Hellfire II missiles.

Tomahawk missile

The budget request contained $145.8 million for 106 block IV low-rate initial production tactical tomahawk (TACTOM) missiles but included no funds for special tooling and test equipment to increase the production rate of the block IV

TACTOM missile from 450 to 600 missiles per year.

The Tomahawk missile is a long-range, precision strike cruise missile launched from surface ships or submarines, and the block IV TACTOM missile will provide improved performance at a lower unit cost than previous missile versions. The committee understands that existing special tooling and test equipment will provide a capacity to produce 450 TACTOM missiles per year, but believes that the ability to produce 600 TACTOM missiles per year would be critical in a time of national emergency.

The committee recommends $167.8 million for the Tomahawk missile, an increase of $22.0 million, to procure the special tooling and test equipment necessary to increase the production of block IV TACTOMs from 450 to 600 per year.

Ammunition Procurement, Navy/Marine Corps

Overview

The budget request contained $1,015.2 million for Ammunition Procurement, Navy/Marine Corps in fiscal year 2003. The committee recommends authorization of $1,104.5 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Marine corps ammunition procurement

The budget request contained $276.3 million for procurement of ammunition. The committee recommends an increase of $38.9 million for the following types of ammunition, which are among the top unfunded requirements identified by the Commandant of the Marine Corps in fiscal year 2003:

[In millions of dollars]

Cartridge, 7.62mm, linked	1.3
Cartridge, .50 caliber, linked	2.3
Cartridge, 120mm HEAT-MP-T	10.0
Cartridge & Lnchr., 84mm AT-4 M136	10.0
Projectile, 155mm HE M795	9.0
Non-lethal Ammunition	6.3

Shipbuilding and Conversion, Navy

Overview

The budget request contained $8,191.2 million for Shipbuilding and Conversion, Navy in fiscal year 2003. The committee recommends authorization of $9,279.5 million for fiscal year 2003.

The committee recommends approval of the request except for

those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.
<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Carrier replacement program advance procurement

The budget request contained $243.7 million for advance procurement of plans, nuclear components, materials and equipment for CVN(X)-1. The CVN(X)-1, the first of a new class of Navy aircraft carriers, is currently scheduled for contract award in fiscal year 2007 with delivery to the fleet in fiscal year 2014.

The committee notes that fiscal year 2003 CVN(X)-1 program of record delays its contract award and delivery schedule by one year compared to the plan provided to the Congress for fiscal year 2002, and believes that this delay will increase long-term construction costs due to disruption in the supplier base and higher labor costs.

The committee recommends $472.7 million, an increase of $229.0 million, for carrier replacement program advance procurement and encourages the Navy to budget its future years defense program so that the CVN(X)-1 contract award will occur in fiscal year 2006 and be delivered in fiscal year 2013.

CVN-69 refueling complex overhaul (RCOH)

The budget request contained no funds for the CVN-69 RCOH. The CVN-69, one of 12 Navy aircraft carriers and also known as the U.S.S. Eisenhower, is undergoing a prior-year funded mid-life RCOH that refuels its reactors, upgrades its main propulsion components, modernizes its warfighting combat systems, and repairs the ship's infrastructure to meet continued service life requirements.

The committee understands that procurement of deferred and high priority habitability work could most efficiently be accomplished while the CVN-69 is undergoing its mid-life RCOH, and notes that the Chief of Naval Operations has included the CVN-69 RCOH among his unfunded priorities for fiscal year 2003.

The committee recommends an increase of $24.0 million for the CVN-69 RCOH.

Landing craft air cushion (LCAC) service life extension program (SLEP)

The budget request contained $67.6 million for three LCAC SLEPs, but included no funds for an additional buoyancy box.

The LCAC is the only surface platform that can provide high-speed, heavy lift for Marine Corps amphibious operations from over-the-horizon. The SLEP would extend the LCAC's service life from twenty years to thirty years, and the buoyancy box, part of the LCAC SLEP, is the hull section component enabling the LCAC to be properly buoyant in the water. The committee understands that, while only three buoyancy boxes are planned for production in fiscal year 2003, four is the minimum rate of production necessary to preclude a termination of the buoyancy box production line.

The committee believes that uninterrupted buoyancy box

production is critical to continuation of the LCAC SLEP, and recommends $78.6 million, an increase of $11.0 million for the procurement of one additional buoyancy box for the LCAC SLEP.

Minehunter small waterplane area twin hull (SWATH) boats

The budget request contained no funds for procurement of Minehunter SWATH boats or for their associated mine countermeasures equipment suites.

The Minehunter SWATH boat is a 40-foot, twin hull vessel that can operate in very shallow water with increased stability in rough seas compared to a similar size mono hull ship. The Navy's minehunting fleet includes one Minehunter SWATH boat, which is its only surface mine warfare vessel capable of operating in very shallow water or capable of transport by C-5 aircraft for operational deployment within 24 hours. The committee understands that the Minehunter SWATH boat has completed highly successful testing and notes that senior naval officers support increased procurement to meet shallow water minehunting requirements.

The committee recommends an increase of $8.3 million for the procurement of two Minehunter SWATH boats and their associated mine countermeasures equipment suites.

Other Procurement, Navy

Overview

The budget request contained $4,347.0 million for Other Procurement, Navy in fiscal year 2003. The committee recommends authorization of $4,527.8 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Advanced integrated electronic warfare system (AIEWS)

The budget request contained $15.8 million to procure the AIEWS.

Subsequent to the submission of the fiscal year 2003 budget request, the Department of the Navy notified the committee that it had terminated the AIEWS program due to cost overruns and continued schedule delays, which has adversely impacted the Navy's ability to field urgently needed surface electronic warfare improvements. Therefore, the committee recommends denial of funds for this program.

Environmental support equipment

The budget request contained $20.0 million for the procurement of environmental support equipment, but no funds were included for the procurement of high resolution, side scanning, bottom mapping sonars.

High resolution, side scanning, bottom mapping sonars,

temporarily on loan to the Naval Oceanographic Office from the Naval Mine Countermeasures Command (MCM), are currently being used by T-AGS class ships to map underwater features and terrain of ports in support of homeland security requirements. Only three of these sonars are currently available to perform this mission. The shortfall of available sonars for this mission will greatly delay the data collection required for port security and may degrade MCM mission fulfillment.

Understanding the critical need for dedicated, permanent mapping equipment for homeland security requirements and continued MCM operations, the committee recommends $27.5 million for environmental support equipment, an increase of $7.5 million, to procure high resolution, side scanning, bottom mapping sonars for T-AGS class ships.

Gun fire control equipment

The budget request contained $27.1 million to procure gun fire control equipment, of which $17.6 million was for the procurement of three AN/SPQ-9B radars.

The AN/SPQ-9B radar provides early and reliable detection and tracking of very low radar cross-section, sea skimming missiles in natural and man-made clutter increasing the time for ship self defense systems to potentially counter them. The committee notes that by increasing fiscal year 2003 funds, this system can be accelerated from its planned fiscal year 2005 initial procurement for DDG-51 class destroyers.

Because the committee is keenly aware of the increasing proliferation of sea skimming cruise missiles, it recommends $46.8 million, an increase of $19.7 million, to accelerate procurement of three additional AN/SPQ-9B radars for DDG-51 class destroyers.

Operating forces industrial plant equipment

The budget request contained $17.1 million for operating forces industrial plant equipment, but included no funds for expeditionary maintenance facilities (EMF).

The committee is aware that the Navy is continuing to decommission its repair tenders, thereby limiting its ability to rapidly deploy a ship and equipment repair capability to support forward deployed forces. However, the committee is also aware that EMF, which are surface and air transportable, self-contained facilities, can be operational within 72 hours of deployment, and can meet the service's needs for a rapidly deployable repair and maintenance capability.

The committee believes the EMF concept may enhance forward deployed repair requirements, and recommends $22.1 million for operating forces industrial plant equipment, an increase of $5.0 million, for procurement of one EMF.

Other aviation support equipment

The budget request contained $12.4 million to procure aviation support equipment, but included no funds to expand the resource allocation management plan (RAMP) data base for naval aviation requirements.

The RAMP is a resource planning software-based system fielded to fixed wing Naval Aviation Depots (NADEP) that provides planning, scheduling, and financial assessments for

aircraft maintenance requirements. The committee understands that this system is not incorporated into Department of the Navy rotary wing NADEPs and may enhance the efficiency of those facilities.

Therefore the committee recommends $15.4 million for other aviation support equipment, an increase of $3.0 million, for the expansion of the RAMP into rotary wing NADEPs.

Other supply support equipment

The budget request contained $11.0 million for the procurement of other supply support equipment, but no funds were included for automatic identification technology (AIT) in support of the serial number tracking system (SNTS).

The SNTS uses commercial AIT to provide web-based, cradle-to-grave, total asset visibility of individual components throughout the supply, maintenance, and transportation transfer process within Naval and Marine Corps aviation depots and will enhance the maintenance, remanufacture, and rebuild process of Navy and Marine Corps aircraft. The committee believes that streamlined business processes, such as SNTS, can be accelerated by implementing AIT and has recommended increases for this technology for this purpose in the Navy in fiscal year 2002, and for maintenance and ammunition tracking systems for other services in prior fiscal years.

The committee recommends $19.0 million for other supply support equipment, an increase of $8.0 million, for the SNTS.

Other training equipment

The budget request contained $15.4 million for other training equipment, of which $32.5 million was for the procurement to support the battle force tactical training (BFTT) program.

The BFTT system allows surface combatants and aircraft carriers to conduct realistic coordinated training scenarios using ownship equipment instead of shore-based training simulators. The committee notes that Congress has provided funds in fiscal years 2000, 2001, and 2002 to upgrade the BFTT system in order to provide an air traffic control (ATC) training capability for aircraft carrier battle groups and amphibious readiness groups. However, the committee understands that AEGIS combat training systems on both CG-47 Ticonderoga class cruisers and DDG-51 Arleigh Burke class destroyers require BFTT upgrades to enable SPY-1 radar operators to also receive advanced radar on-board training within carrier battle groups via BFTT. Because of the enhanced benefits to ships' crews from integrated battle group training, the committee recommends $21.4 million for other training equipment, an increase of $6.0 million, to procure BFTT advanced radar on-board training systems for AEGIS class ships.

Procurement, Marine Corps

Overview

The budget request contained $1,288.4 million for Procurement, Marine Corps in fiscal year 2003. The committee recommends authorization of $1,352.0 million for fiscal year

2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Family of construction equipment

The budget request contained $14.7 million to remanufacture or product improve D-7G dozers, 621B scrapers, and 130G graders. The dozer/scraper/grader fleet is used by Marine Corps combat engineer and support units for airfield construction, as well as combat clearing and debris excavation.

The committee notes that the service's dozer, scraper and grader fleet is over 15 years old and that the Commandant of the Marine Corps has identified a fiscal year 2003 unfunded requirement to accelerate remanufacture of this equipment. The committee also notes that the remanufacturing/product improvement program will extend the life of this equipment for an additional 10 years.

Consistent with its actions in prior years, the committee recommends $21.2 million for the family of construction equipment, an increase of $6.5 million, to remanufacture/ product improve D-7G dozers, scrapers, and graders.

Night vision equipment

The budget request contained $23.2 million to procure night vision equipment, but included no funds to procure AN/PVS-17 night vision sights.

The AN/PVS-17 is a lightweight, rifle-mounted, generation III image intensification night vision sight that replaces obsolete, post-Vietnam era AN/PVS-4 sights. The committee notes that the Commandant of the Marine Corps has identified a $12.7 million fiscal year 2003 unfunded requirement to procure additional AN/PVS-17 night vision sights, which would complete this system's acquisition objective. Consistent with prior year actions, the committee continues to recognize the increased benefits of generation III technology, and recommends $36.0 million for night vision equipment, an increase of $12.8 million, for AN/PVS-17 night vision sights.

Radio systems

The budget request contained $25.5 million to procure radio systems, but no funds were included to procure Tactical Hand Held Radios (THHR), and $1.0 million was included for the Lightweight Multiband Satellite Terminal (LMST).

The THHR is a military-ready, multi-band, secure voice and data radio that will provide Marine reconnaissance teams, and squad-/platoon-size units with a lightweight, standardized, maintainable communications capability that is interoperable with numerous Department of Defense legacy communications radios.

The LMST is a joint mobile military tri-band satellite communications terminal deployed in transit cases, which allow

rapid set up and tear down required in rugged, tactical and expeditionary operations. The LMST provides enhanced long-haul communications for forward deployed forces.

The committee notes that the Commandant of the Marine Corps has identified a $5.0 million unfunded requirement for THHRs and a $20.0 million unfunded requirement for LMSTs in fiscal year 2003. Because the committee believes that the services must have interoperable communications to successfully operate in joint military deployments and supports the need for greater communications capability within small units, the committee recommends $50.5 million for radio systems, an increase $5.0 million to complete the acquisition objective for THHRs, and an increase of $20.0 million to begin procurement of LMSTs.

Aircraft Procurement, Air Force

Overview

The budget request contained $12,067.4 million for Aircraft Procurement, Air Force in fiscal year 2003. The committee recommends authorization of $12,522.8 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

B-2 modifications

The procurement budget request contained $72.1 million for various B-2 modifications, of which $9.9 million was included to upgrade two B-2 aircraft with satellite communications (SATCOM), but included no funds for the B-2's windshield tape alternative (WTA) modification. Additionally, the research, development test and evaluation (RDTE) budget request contained $225.3 million in PE 64240F for B-2 system development, but included no funds for low observability (LO) maintenance improvements. The B-2 is the Department of Defense's most advanced long-range strike aircraft, capable of global force projection in a highly defended target environment.

The B-2 SATCOM provides beyond-line-of-sight secure voice and data communications that will ensure global command and control of this aircraft. The committee notes that only nine B-2s are budgeted to receive SATCOM, and believes that the entire fleet of 21 B-2 aircraft should be upgraded with this critical modification. Consequently, the committee recommends an increase of $25.2 million to configure the remaining B-2s with SATCOM.

The WTA modification would replace the current tape around the exterior of the B-2's windshield which is rapidly deteriorating due to vibration and cabin pressurization cycles. The committee understands that this modification would improve the B-2 mission capable rate by 1.75 percent, reduce operations and support costs by $24.5 million, save 25,000 maintenance

man-hours per year, and reduce the aircraft's signature to enemy radar. The committee recommends an increase of $6.8 million to modify 16 B-2 aircraft with the WTA and encourages the Air Force to budget funds to complete the WTA modification for the remaining aircraft in fiscal year 2004.

The committee understands that B-2 LO maintenance improvement development is required in three parts of the aircraft: door seals, engine exhaust area coatings, and tailpipe coatings. The B-2's current door seals, which are prone to damage causing decreased signature performance, could be repaired by the development of alternate door edge treatment (ADET) that would simplify maintenance procedures and reduce radar signature degradation. Secondly, the B-2's engine exhaust environment, which causes existing hot trailing edge coatings to degrade and delaminate resulting in costly repairs, could be improved with the development of the advanced hot trailing edge (AHTE) which would retrofit new high-temperature composite coatings in the engine exhaust area, improving the B-2's availability. Thirdly, the B-2's current tailpipe coating, which requires time-consuming repairs resulting from ablation during routine engine operating conditions, could be improved by the development of new materials and processes that would decrease the expenditure of maintenance man-hours and improve the B-2's mission capable rate. The committee recommends an increase of $17.0 million in PE 64270F for the ADET, AHTE, and new tailpipe coating development.

The committee recommends $104.1 million for B-2 procurement modifications, an increase of $32.0 million, and $242.3 million in RDTE PE 64240F, an increase of $17.0 million.

C-130H

The budget request contained $18.7 million for C-130H procurement, but included no funds for the conversion of an Air Force Reserve Command (AFRC) C-130H3 unit level trainer (ULT) to the C-130H2 configuration.

The committee understands that the AFRC's C-130H2 formal training unit (FTU) currently possesses a C-130H3 ULT that requires conversion to the C-130H2 configuration to property train C-130H2 FTU students, and believes that, without the conversion of the ULT, projected student throughput will not be achievable.

The committee recommends $23.7 million for C-130H procurement, an increase of $5.0 million for the conversion of the AFRC's C-130H3 ULT to the C-130H2 configuration.

C-130J

The Department of the Air Force budget request contained $175.9 million for program management, logistics, and training support for the fleet of 37 Air Force C-130J aircraft. Additionally, The Department of the Navy Defense Emergency Response Fund (DERF) budget request contained $334.0 million for four KC-130J aircraft. The committee notes that the Air Force budget request includes a proposal to begin a five-year, 40-aircraft C-130J multiyear procurement, and understands that funds that would be provided to the Department of the Navy for the Marine Corps' KC-130J program in the DERF for fiscal years 2003 through 2008 would add 24 KC-130J aircraft throughout the five-year period and be included in the Air Force C-130J

multiyear procurement for a total of 64 aircraft to be procured under the Air Force C-130J multiyear proposal.

In past years, the committee has strongly supported both the Air Force's C-130J and the Marine Corps' KC-130J aircraft variants to modernize these fleets. While the committee continues to support procurement of both variants, it is concerned that the Air Force C-130J is experiencing difficulty in meeting established operational effectiveness and suitability parameters. However, the committee believes that continued senior management attention to the achievement of its operational effectiveness and suitability goals will result in a successful initial operational test and evaluation, and that the multiyear procurement contract should proceed subsequent to the Secretary of Defense's certification to the congressional defense committees that satisfactory progress is being made towards a successful operational test and evaluation. The committee views satisfactory progress to include, but not be limited to, the aircraft's ability to conduct worldwide airland operations, assault operations, and the completion of both software block 5.3 installation and its associated hardware components.

Additionally, despite the fact that over two months have elapsed since the committee received the budget request and its associated budget justification documents, the Department of the Air Force has still not provided the committee the necessary findings outlined in section 2306b(a) of title 10, United States Code, for the committee to fully understand and evaluate the savings that would be achieved by the proposed C-130J multiyear procurement contract. The committee recommends a provision (Section 121) that would authorize the Secretary of Defense to enter into a multiyear procurement contract for Air Force C-130J and Marine Corps KC-130J aircraft beginning with the fiscal year 2003 program year, subject to a certification to the congressional defensecommittees that satisfactory progress is being made towards a successful operational test and evaluation, and that each of the conditions specified in section 2306b(a) of title 10, United States Code, have been satisfied with respect to that contract.

C-130 modifications

The budget request contained $138.5 million for C-130 modifications, but included no funds for the fourth-generation terrain awareness and warning system (TAWS) or for the MC-130P universal aerial refueling receptacle slipway (UARRSI) modification.

The fourth-generation TAWS, the most advanced TAWS version, projects an aircraft's position relative to the ground and improves pilot situational awareness by warning of potential ground impact, thus preventing controlled flight into terrain. The committee understands that the Air Force has directed that all passenger and troop carrying aircraft be equipped with a fourth-generation TAWS by fiscal year 2005, but also understands that the C-130 avionics modernization program, which provides avionics upgrades for the C-130 fleet, does not schedule the installation of a fourth-generation TAWS until fiscal years 2006 to 2014. Therefore, the committee recommends an increase of $31.0 million to procure and install the fourth-generation TAWS on the Air Force fleet of C-130 aircraft.

The MC-130P UARRSI modification, which allows the MC-130P

to be refueled in flight, has been installed on all but two of the Air Force's operational MC-130P fleet, but the committee understands that it has not been installed on the four aircraft used to train new MC-130P pilots. Since the committee believes that in-flight air refueling training is critical for new MC-130P pilots, it recommends an increase of $11.6 million to procure and install the MC-130P UARRSI modification on the four aircraft used to train new MC-130P pilots.

The committee recommends $181.1 million, an increase of $42.6 million for C-130 modifications.

F-15 modifications

The budget request contained $232.5 million for F-15 modifications, of which $33.0 million was included for six ALQ-135 band 1.5 countermeasures system modifications, but included no funds to convert the Air National Guard's (ANG) F100 engines in their F-15 aircraft to the F100-220E configuration.

The ALQ-135 band 1.5 countermeasures system modification provides a self-protection jamming capability against modern surface-to-air enemy missiles and is integrated with the F-15E's existing internal countermeasure set and its ALR-56C radar warning receiver to provide full threat coverage. The committee believes that improved self-protection capability such as the ALQ-135 band 1.5 countermeasures system modification addresses critical deficiencies identified subsequent to Operation Allied Force in 1999, and that the ALQ-135 band 1.5 countermeasures system should be produced at the most efficient rates and installed in F-15E aircraft as rapidly as possible.

The committee recommends an increase of $25.0 million to procure 20 additional ALQ-135 band 1.5 countermeasures systems, and strongly encourages the Air Force to establish a consistent funding approach for the ALQ-135 band 1.5 countermeasures system that will complete production and installation of this modification on all F-15E aircraft by fiscal year 2005.

Conversion kits for the F-15's F100 engine, also known as ``E-kits,'' provide increased thrust, greater reliability, better fuel efficiency, and reduced operations and maintenance costs. The committee notes that the ANG's F-15 aircraft make a critical contribution to the Air Force's Air Expeditionary Forces, and believes that engine conversion kits for the ANG's F-15 aircraft should be accelerated. Therefore, the committee recommends an increase of $34.0 million for engine conversion kits for the ANG's F-15 aircraft.

The committee recommends $291.5 million for F-15 modifications, an increase of $59.0 million.

F-16 modifications

The budget request contained $265.0 million for various F-16 modifications, but included no funds for Litening advanced airborne targeting and navigation (AT) pods for the Air Force Reserve Command (AFRC), for the Air National Guard's (ANG) Theater Airborne Reconnaissance System (TARS) pods, or for F100-229 re-engine kits for the ANG's block 42 F-16 aircraft. Additionally, the research, development test and evaluation (RDTE) budget request contained $66.8 million in PE 35206F for airborne reconnaissance systems, but also included no funds for the TARS.

The Litening AT pod is the next generation Litening pod system that will incorporate an advanced forward-looking infra-red radar and other enhancements to the existing multi-sensor and precision strike capability. Since the committee understands that Litening AT pods are among the Air Force Reserve Commander's top unfunded modernization priorities, it recommends an increase of $14.4 million for eight Litening AT pods for the AFRC.

The two ANG F-16 units equipped with TARS pods provide a responsive under-the-weather reconnaissance capability to support the intelligence and targeting requirements of military users. The committee understands that current TARS pods require a data link system upgrade to connect with the joint force air component commander's command and control (JFACC C2) structure and a synthetic aperture radar (SAR) to enable night and all-weather reconnaissance capability. Since the committee believes that night and all-weather reconnaissance operations and the ability to data link to the JFACC C2 structure are essential to identify and engage time-critical targets, it recommends an increase of $11.1 million in PE 35206F to complete the development of the data link and SAR integration into the TARS, and a procurement increase of $6.6 million for upgraded TARS pods.

The committee notes that the ANG's F-16 block 42 aircraft are underpowered compared to F-16 block 40, block 50, and block 52 aircraft, and believes that this limitation does not provide sufficient power to adequately defend against opposition air defense systems in likely theaters of operation. To provide increased thrust for the ANG's F-16 block 42 aircraft, the committee recommends an increase of $62.0 million to re-engine ten F-16 block 42 aircraft with the F100-229 re-engine kit.

In total, the committee recommends $348.0 million for F-16 procurement modifications, an increase of $83.0 million, and $77.9 million in RDTE PE 35206F, an increase of $11.1 million.

Fixed aircrew standardized seats

The budget request contained $54.7 million for other modifications, but included no funds for fixed aircrew standardized seats (FASS).

FASS would provide crewmembers and passengers on C-130, C-135, C-141, C-5, E-3, KC-10, C-17, and E-8 aircraft protection against aircraft crash loads up to 16 times the force of gravity. In prior years, the committee has supported the development of the FASS, understands that it is now ready for production, and continues to believe that its implementation will not only increase safety but also reduce supply and maintenance costs through the commonality and interchangeability of its parts.

The committee recommends $59.5 million for other modifications, an increase of $4.8 million, for procurement of FASS.

HH-60G pave hawk upgrades

The budget request contained $40.6 million for H-60 modifications, but included no funds to upgrade the 13 student training HH-60G Pave Hawk helicopters.

The committee understands that the HH-60G Pave Hawk helicopters used for student training are not configured with

701C engines, forward looking infra-red (FLIR) systems or helicopter infrared suppression systems (HIRSS), which are configurations used in the combat air force (CAF) HH-60G Pave Hawk fleet. The committee further understands that, as a result of these deficiencies, pilots who complete training in those HH-60G Pave Hawk helicopters not configured with the 701C engine, FLIR systems or the HIRSS are not proficient in the use of these systems when they arrive at their operational units.

Since the committee believes that student training in operational HH-60G Pave Hawk CAF configurations is critical to mission readiness, it recommends an increase of $29.5 million to procure and install 701C engines, FLIR systems, and the HIRSS on the 13 HH-60G Pave Hawk helicopters used for student training.

Miscellaneous production charges

The budget request contained $349.5 million for miscellaneous production charges, of which $14.2 million was included for the P4 refurbishment contract (P4RC), but included no funds for the P4RC for the Air National Guard (ANG) or for the comet infra-red (IR) countermeasures pod.

The P4 is an airborne instrumentation subsystem pod used by fighter and attack aircraft which provides the capability to conduct air-to-air, air-to-surface, and electronic warfare combat training while providing real-time aircraft monitoring and recording events for post-mission debrief and analysis. While the P4 pods can only be used at ranges equipped with ground-station instrumentation, the P4RC upgrades the P4 pods with global positioning receivers, data recorders, and on-board weapons simulations so that training can occur at locations without ground-station instrumentation. Since ANG units and aircraft have experienced increased operations tempo and may not have the opportunity to conduct training at ranges equipped with ground-station instrumentation, the committee believes that ANG units should also be included in the P4RC. The committee recommends an increase of $30.0 million to upgrade 150 ANG P4 pods to the P4RC configuration.

The comet IR countermeasures pod is designed for use on military fighter and transport aircraft to provide preemptive and extended duration protection from man-portable surface-to-air missiles (SAMs) by dispensing a continuous stream of pyrophoric material that oxidizes on contact with the atmosphere producing a decoy IR signature. The committee notes that both instances of battle damage to an A-10 aircraft during Operation Allied Force occurred due to IR SAMs that were not seen by the pilot, or other aircraft in the formation, because of the SAM's small size, high speed, and short engagement range, and understands that the comet IR countermeasures pod could provide the long-duration self-protection necessary for an A-10 aircraft to accomplish its mission while operating in the target area. Due to its importance in protecting both combat and mobility aircraft, the committee also notes that the Air Force Chief of Staff has included the comet IR countermeasures pod among his top unfunded priorities for fiscal year 2003. In addition to the research and development increase described elsewhere in this report, the committee recommends an increase of $18.0 million to procure 48 comet IR countermeasures pods and 576 decoy cartridges for use in A-10 aircraft.

The committee recommends $379.5 million for miscellaneous production charges, an increase of $48.0 million for miscellaneous production charges.

Predator B unmanned aerial vehicle (UAV)

The budget request contained $23.1 million for procurement of seven Predator UAV systems but included no funds for the turbo prop-powered Predator B, a larger, faster variant with increased payload capacity.

The Predator UAV system provides long-dwell, real-time intelligence information to Joint Task Force Commanders. The committee notes that following the accomplishments of the Predator UAV system in its reconnaissance role in Operation Enduring Freedom, the system has also successfully demonstrated its capability to be weaponized to deliver Hellfire missiles. As missions for the Predator UAV system expand, the committee believes that the improved speed and payload capacity of the turbo prop-powered Predator B UAV is critical to future combat operations.

The committee recommends an increase of $26.0 million for six turbo prop-powered Predator B UAV systems and associated spare parts.

Ammunition Procurement, Air Force

Overview

The budget request contained $1,133.9 million for Ammunition Procurement, Air Force in fiscal year 2003. The committee recommends authorization of $1,176.9 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Air Force Ammunition Procurement

The budget request contained $1,129.5 million for procurement of ammunition. The committee recommends an increase of $29.9 million, for the following types of ammunition programs:

[In millions of dollars]

Practice Bombs: Cast Ductile Iron (BDU-56)	3.0
General Purpose Bombs: Cast Ductile Iron (MK-84)	3.0
Sensor Fuzed Weapon	20.0
Flares:	
MJU-52 Training Flares	2.0
MJU-52 War Reserve Flares	1.9

Missile Procurement, Air Force

Overview

The budget request contained $3,575.2 million for Missile Procurement, Air Force in fiscal year 2003. The committee recommends authorization of $3,482.6 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Advanced extremely high frequency satellite

The budget request contained $94.5 million in missile procurement Air Force, budget activity 05, Item 19, for advanced extremely high frequency (AEHF) satellite advanced procurement.

The committee is aware that the AEHF satellite program has been restructured, and therefore cannot execute the $94.5 million funds requested for advanced procurement.

The committee recommends no funds in missile procurement Air Force for AEHF satellite advanced procurement, a decrease of $94.5million.

AGM-65 modifications

The budget request contained $300 thousand for AGM-65 modifications, but included no funds for conversion of AGM-65 missiles to an upgraded configuration.

Two configurations of the AGM-65, a precision guided tactical missile employed on the F-16, F-15E and A-10 aircraft, are currently undergoing conversion to be upgraded for improved capability. The ``G'' configuration, with an infrared target seeker is being upgraded to the ``K'' configuration, which uses an updated electro-optical (EO) seeker. The ``B'' configuration, with an obsolete EO target seeker, is being upgraded to the ``H'' configuration, which also uses an updated EO seeker. The committee understands that planned production of AGM-65H and AGM-65K missiles in fiscal year 2003 will not occur at economic rates, and also will not provide sufficient training missiles for Air Force Reserve Command (AFRC) or Air National Guard (ANG) pilot proficiency training.

The committee recommends $5.3 million, an increase of $5.0 million to upgrade an additional 160 AGM-65 missiles to the ``H'' or ``K'' configuration, of which 100 missiles are for pilot proficiency training in the AFRC and ANG.

Minuteman III modifications

The budget request contained $580.7 million for Minuteman III (MM III) modifications, of which $237.5 million was for the guidance replacement program (GRP) and $290.3 million was for the propulsion replacement program (PRP). The MM III is a strategic ballistic missile capable of delivering special weapons against enemy targets at very long range.

The GRP replaces the MM III's guidance system with updated and more reliable components and the PRP refurbishes the MM III's booster to provide extended service life. The committee notes that the Air Force Chief of Staff has included MM III modifications contract cost growth and renewal among his unfunded priorities for fiscal year 2003 due to contract rate increases and higher than planned consumption of government furnished equipment in both the GRP and PRP. The committee also notes that the Air Force Chief of Staff has included the procurement of additional warhead shipping containers in this unfunded priority because the Nuclear Posture Review-directed warhead download options were revealed only after the fiscal year 2003 budget request had been submitted.

The committee recommends $603.9 million for MM III modifications, an increase of $23.2 million to address GRP and PRP deficiencies and to procure warhead shipping containers.

Other Procurement, Air Force

Overview

The budget request contained $10,523.9 million for Other Procurement, Air Force in fiscal year 2003. The committee recommends authorization of $10,907.7 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Combat arms training system (CATS)

The budget request contained $11.3 million for base procured equipment, but included no funds for CATS. CATS is a computer-based simulation system that provides marksmanship training for security force personnel as well as training to manage less-than-lethal judgmental scenarios.

The committee understands that since September 11, 2001, Air National Guard (ANG) bases, which are each equipped with one CATS, are used daily to train security force personnel, and that, as a result of this daily use, a second CATS is required at each ANG base leaving a shortfall off 117 systems. With limited access to firing ranges and training munitions, the committee believes that the CATS is proving to be an essential asset to meet the marksmanship and weapons certification training, and situational scenario readiness requirements, of ANG personnel.

The committee recommends $25.3 million for base procured equipment, an increase of $14.0 million, for the CATS.

Combat training ranges

The budget request contained $17.2 million for combat training ranges, but included no funds for the unmanned threat emitter (UMTE) program.

The committee understands that both the Nellis and Eielson air combat training ranges are not configured with training systems which emulate the most advanced adversary surface-to-air missile and anti-aircraft artillery systems, and believes that the UMTE program will address this requirement.

Consequently, the committee recommends $53.2 million for combat training ranges, an increase of $36.0 million for the UMTE program.

Eagle vision

The budget request contained $9.0 million for intelligence communication equipment, but included no funds for procurement of the eagle vision system.

Eagle vision is a mobile off-the-shelf downlink and processing system that utilizes commercial satellites for imagery. The committee understands that the eagle vision system will incorporate the ability to overlay high-resolution national imagery over unclassified commercial data, and will also provide a capability to transmit this data to warfighters in the field within minutes. The committee notes its past support for the eagle vision system and believes that it should be continued to provide the warfighter with imagery support capability that is not available by other means.

The committee recommends an increase of $5.0 million for procurement of the eagle vision system.

General information technology

The budget request contained $55.8 million for general information technologies, but included no funds for procurement of the parts and repair item support (PARIS) program or for the science and engineering lab data integration (SELDI) program.

The PARIS program is a computer-based system that facilitates the management of technical data related to source qualification and outsourced repairs for use by the Air Force's Air Logistics Centers. The committee understands that the PARIS program has demonstrated the ability to accurately and rapidly identify both defective parts and their vendors, so that the those parts, identified as defective, could be quickly removed from service and the applicable vendors could be removed as the approved supplier of those parts. Additionally, the committee understands that use of the PARIS program has already saved an estimated $15.0 million in fiscal year 2001, and believes that its increased use will result in future parts, repair and labor cost savings. The committee recommends an increase of $9.0 million for the PARIS program.

The Air Force Material Command's science and engineering lab captures, analyzes and disseminates lab test data to the Air Force's engineering and system overhaul operations, and the committee understands that the SELDI program would facilitate this mission by providing more rapid lab data access affecting overhaul operations, providing accident investigators with immediate access to lab results of failed components, enabling component failure trend analysis, and implementing new acoustic signature sensors to ensure the proper chemical composition of materials and equipment. Since the committee further understands that the SELDI would improve operational aircraft readiness, increase flight safety and reduce support costs, it recommends an increase of $9.5 million, for procurement of the

SELDI program.

The committee recommends a total increase of $18.5 million for general information technologies.

GeoBase centralized geographic information system (GIS)

The budget request contained $202.9 million for base communications infrastructure, but included no funds for procurement of the GeoBase centralized GIS.

The GeoBase centralized GIS would link all aspects of a base's infrastructure information to a computer-generated map display so relationships between people and processes can be displayed in a geographical context. The committee understands that the Air Force's major and minor installations currently use disparate and outdated systems and processes that do not facilitate the visibility of assets, requirements, and processes in a geographic context to allow enhanced management efficiency, and believes that the GeoBase centralized GIS would standardize base management functions in a more accessible, easily-understood, and effective manner.

The committee recommends $217.9 million for base communications infrastructure, an increase of $15.0 million for procurement of the GeoBase centralized GIS.

Point of maintenance initiative

The budget request contained $25.6 million for mechanized material handling equipment, but included no funds for procurement of the point of maintenance initiative (POMX).

The POMX is a maintenance data collection program that was designed and developed by the Logistics Systems Office of the Air Force Materiel Command. The committee notes that the POMX objective is to increase the timeliness and accuracy of maintenance data collection while reducing the administrative burden on maintenance technicians, and understands that its use has already been validated at one Air Force base.

To ensure the efficiency and accuracy of maintenance-related data, the committee recommends $33.6 million for mechanized material handling equipment, an increase of $8.0 million, for the POMX.

Thinpack parachutes

The budget request contained $9.3 million for personal and safety items of less than a $5.0 million value, but included no funds for procurement of thinpack parachutes.

Due to its longer repack cycle and extended service life, the committee believes that replacement of existing parachutes with the thinpack parachute would result in substantial life cycle cost savings as it has in the Navy's P-3 and E-2C aircraft programs. For this reason, the committee has strongly supported thinpack parachutes, previously known as the lightweight environmentally sealed parachute assembly, and understands that both the Air Force Special Operations Command and Air Mobility Command are developing the thinpack parachute in fiscal year 2002 so that production can commence in early 2003.

Consistent with its previous actions, the committee recommends $4.0 million to procure thinpack parachutes for use in Air Force aircraft.

Procurement, Defense-Wide

Overview

The budget request contained $2,688.5 million for Procurement, Defense-Wide in fiscal year 2003. The committee recommends authorization of $2,621.0 million for fiscal year 2003.

The committee recommends approval of the request except for those programs adjusted in the following table. Unless otherwise specified, adjustments are without prejudice and based on affordability considerations.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Army special operations aviation (ARSOA) avionics re-capitalization and enhanced situational awareness

The budget request contained $289.8 million for special operations forces (SOF) rotary wing upgrades, but included no funds for the ARSOA avionics re-capitalization and enhanced situational awareness program.

The committee understands that the ARSOA avionics re-capitalization and enhanced situational awareness program would replace obsolete avionics with mission processors, multifunction displays and intelligence broadcast receivers for 13 helicopters in the Army's 160th Special Operations Aviation Regiment, and would preclude time-sensitive parts obsolescence problems beginning in fiscal year 2004.

Since the committee notes that the Commander-in-Chief of the Special Operations Command has included the ARSOA avionics re-capitalization and enhanced situational awareness program as his highest unfunded priority for fiscal year 2003, it recommends $309.0 million for SOF rotary wing upgrades, an increase of $19.2 million, for the ARSOA avionics re-capitalization and enhanced situational awareness program.

Chemical/biological defense procurement program

The budget request contained a total of $435.7 million for chemical/biological defense (CBD) procurement, including $125.3 million for procurement of individual protection equipment, $15.6 million for decontamination equipment, $143.2 million for the joint biological defense program, $34.7 million for collective protection equipment, and $116.9 million for contamination avoidance equipment.

The committee recommends an increase of $8.0 million for procurement of automatic chemical agent alarms (ACADA) for the Army National Guard and Army Reserve, an increase of $13.4 million for procurement of the biological integrated detection system for newly organized Army Reserve biological detection units, and a total of $49.6 million for collective protection equipment, including an increase of $14.9 million for procurement of chemical-biological protective shelters for Army medical companies and Marine Corps forward surgical teams.

Computer assisted medical diagnostics

The committee is aware that off-the-shelf medical diagnostic technology is available that could significantly improve the ability of health care professionals to more quickly and accurately diagnose diseases, using a digital clinical library and decision support software. This technology could enable clinicians to rapidly sort and review thousands of medical photographs, match them to the patient's symptoms and other relevant factors, and quickly develop a priority list of potential diagnoses. The committee understands that the surgeons general of the Army and the Air Force are evaluating such technology, and urges the Secretary of Defense to closely evaluate this technology for procurement by all the services.

Portable intelligence collection and relay capability (PICRC)

The budget request contained $8.2 million for special operations forces (SOF) intelligence systems but included no funds for PICRC systems.

The PICRC system integrates commercial-off-the-shelf, full-dimensional mapping and display software; desktop computers; hand-held computing devices; and wireless communications to provide SOF operators with high-resolution imagery for precision navigation, annotation of real-time visual observations, and a capability to relay information to command elements. The committee understands that this system would significantly enhance SOF capabilities to accurately collect, quickly report, and promptly act upon real-time intelligence data.

The committee recommends $14.2 million for SOF intelligence systems, an increase of $6.0 million, for procurement of PICRC systems.

Special operations forces (SOF) small arms and weapons

The budget request contained $4.8 million to procure SOF small arms and weapons, of which $3.7 million was to procure the advanced lightweight grenade launcher (ALGL), but included no funds to procure the AT4-confined space (CS) anti-armor and bunker defeat and breeching weapon.

The committee notes the Commander-in-Chief of the Special Operations Command has identified fiscal year 2003 unfunded requirements of $4.4 million for accelerated procurement of ALGLs, and $10.5 million to accelerate and field the first production lot of 4,000 AT4-CS special operations insensitive munition weapons.

The committee recommends $19.7 million for SOF small arms and weapons, an increase of $4.4 million for additional ALGLs, and an increase of $10.5 million for additional AT4-CS weapons, for a total increase of $14.9 million.

Chemical Agents and Munitions Destruction, Defense

Overview

As described elsewhere in this report, the committee recommends transferring the budget request of $1,490.2 million for Chemical Agents and Munitions Destruction, Army (CAMD, A)

to Chemical Agents and Munitions Destruction, Defense (CAMD, D), and recommends a total of $1,490.2 million for Chemical Agents and Munitions Destruction, Defense, including $974.2 million for research, development, test, and evaluation, $302.7 million for procurement, and $213.2 million for operations and maintenance. Unless otherwise specified, adjustments are without prejudice and based on affordability consideration.
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Items of Special Interest

Chemical agents and munitions destruction

The committee notes that chemical demilitarization for 90 percent of the stockpile at eight stockpile storage sites in the continental United States is under contract. To date, more than 8,000 tons of chemical agent, over 25 percent of the total U.S. stockpile, have been safely destroyed in operational demilitarization facilities at Johnston Atoll and Tooele, Utah, using the baseline incineration process. Stockpile demilitarization operations at the Johnston Atoll facility have been completed and shutdown of that facility begun. Construction of demilitarization facilities at Anniston, Alabama, and Umatilla, Oregon, has been completed and systematization operations are in progress at those locations, while construction of the Pine Bluff, Arkansas, facility is over 75 percent complete. Mustard agent in bulk storage at Aberdeen, Maryland, and VX nerve agent in bulk storage at Newport, Indiana, will be destroyed using neutralization, rather than the baseline incineration process. In September 2001, the Defense Acquisition Executive completed a comprehensive review of the chemical demilitarization program that resulted in new schedule milestones (completion of stockpile destruction in 2011 vice 2007 as required under the Chemical Weapons Convention Treaty) and a new life cycle cost estimate: $24,000.0 million, an increase of $9,000.0 million over the previous estimate. The review provided the basis for the selection of neutralization as the technology to be used for destruction of mustard-filled munitions and bulk agent at Pueblo, Colorado, and the yet-to-be-designated technology to be used for destruction of assembled chemical weapons at Blue Grass, Kentucky. The committee understands that the Defense Acquisition Executive directed the Army to propose alternatives for accelerating the destruction of the stockpile and reducing the overall life cycle costs.

The committee is aware of actions being taken in the aftermath of the September 11th terrorist attacks in New York and against the Pentagon, to increase the safety and security of the stockpile against potential terrorist attack. A decision has been made to accelerate the destruction of bulk mustard at Aberdeen and acceleration of the destruction of bulk VX at Newport is under consideration. The committee notes that funding for accelerated destruction of bulk agent was not included in the fiscal year 2003 budget request or in the fiscal year 2002 supplemental request. Should additional funds for the accelerated destruction of bulk agent not be included in the fiscal year 2002 supplemental appropriation, the committee strongly recommends that they be included in the President's subsequent budget request for authorization and

appropriation of the Defense Emergency Fund.

The committee notes the shift in program management oversight responsibility within the Army Secretariat from the Assistant Secretary of the Army (Acquisition, Technology, and Logistics) to the Assistant Secretary of the Army (Installations and Environment). The committee believes that the cost, complexity, and importance of the program require that it continue to be managed as a major defense acquisition program, and elsewhere in this report has recommended a provision (section 143) to that effect.

The committee notes on-going efforts in the chemical stockpile emergency preparedness program (CSEPP) to insure the readiness of the military installations on which the chemical demilitarization facilities are located and of the surrounding localcivilian jurisdictions to respond to a chemical accident or incident involving the stockpile. The committee believes that close working relationships between the Department of the Army and the Federal Emergency Management Agency (FEMA) and its regional activities, state and local emergency management activities, and local government and the Army installations are absolutely essential to ensuring that the Army's chemical stockpile storage and destruction mission are capable of being carried out so as to ensure the maximum protection for the environment, the general public, and the personnel who are involved in the storage and destruction of the stockpile. The committee expects both the Secretary of the Army and the Director, FEMA to carry out their respective responsibilities with regard to the CSEPP program in accordance with the memorandum of agreement between the two agencies.

In the report that accompanied H.R. 2586 (H. Rept. 107-194), the committee directed the Secretary of Defense to update the assessment required by Section 141(a) of the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65) by March 1, 2002, in order to identify those actions taken or planned by the Secretary to significantly reduce the cost of the program and ensure its completion in accordance with the obligation of the United States under the Chemical Weapons Convention. The committee has not yet received this report, but plans to hold hearings on the chemical stockpile destruction program later this year to address these and other program issues.

Finally, the committee directs the Comptroller General to review and assess the status and management of the chemical stockpile destruction program and to report the results of that assessment to the congressional defense committees not later than March 1, 2003.

LEGISLATIVE PROVISIONS

Subtitle A--Authorization of Appropriations

Sections 101-107--Authorization of Appropriations

These sections would authorize the recommended fiscal year 2003 funding levels for all procurement accounts.

Subtitle B--Navy Programs

Section 111--Shipbuilding Initiative

This section would authorize $810.0 million for one additional Arleigh Burke Class destroyer, or DDG-51, in fiscal year 2003 if the Secretary of the Navy certifies to the congressional defense committees on, or before the date of the enactment of this Act, that the prime contractor for the Virginia Class submarine program has committed to expend from its own funds an amount not less than $385.0 million for economic order quantity procurement of nuclear and non-nuclear components for Virginia Class submarines beginning in fiscal year 2003. If this certification is not provided, then $810.0 million shall be allocated as follows: $415.0 million for Virginia Class submarine advance procurement, $210.0 million for cruiser conversion advance procurement, and $185.0 million for nuclear attack submarine engineered refueling overhaul.

Additionally, if the terms of the agreement between the prime contractor for the Virginia Class submarine program and the United States include a requirement for the Secretary of the Navy to seek to acquire Virginia Class submarines through a multiyear procurement contract, the Secretary of the Navy may, in accordance with section 2306b of title 10, United States Code, enter into a multiyear contract for the procurement of Virginia Class submarines beginning in the fiscal year 2003 program year, subsequent to his certification that the conditions in subsection (a) of that section have been satisfied with respect to that contract and a period of thirty days has elapsed after the date of transmission of such certification to the congressional defense committees.

Subtitle C--Air Force Programs

Section 121--Multiyear Procurement Authority for C-130J Aircraft Program

This section would authorize the Secretary of Defense to enter into a multiyear procurement contract for Air Force CC-130J and Marine Corps KC-130J aircraft beginning with the fiscal year 2003 program year, subject to a certification to the congressional defense committees that satisfactory progress is being made towards a successful operational test and evaluation, and that each of the conditions specified in section 2306b(a) of title 10, United States Code, have been satisfied with respect to that contract.

Subtitle D--Other Programs

Section 141--Revisions to Multiyear Contracting Authority Relating to Structuring of Contracts

This section would change section 2306b(i) of title 10, United States Code to require the Department of Defense to structure multiyear procurement contracts so that complete end items are procured through yearly appropriated amounts, and would restrict advance procurement to those long-lead items necessary in order to meet the planned delivery schedule for complete major end items programmed under the contract to be acquired with funds appropriated in a subsequent fiscal year.

Section 142--Transfer of Technology Items and Equipment in Support of Homeland Security

This provision would authorize the Secretary of Defense to enter into an agreement with an independent, non-profit, technology-oriented entity, which has demonstrated a proven ability to facilitate technology transfer of promising defense technologies developed by both the private and public sectors that will aid federal, state and local law enforcement, fire fighting, and emergency medical ``first responders''. The entity would develop and deploy items and equipment through coordination between government agencies and private sector, commercial developers and suppliers oftechnology that would enhance public safety and emergency response. The entity would also work in coordination with the InterAgency Board (IAB) for Equipment Standardization and Interoperability to develop items and equipment that meet the standardization requirements established by the IAB. The entity would evaluate the equipment items that have been identified through the standards development process accomplished to date by the IAB and other state-of-the-art items and equipment that may benefit first responders. An increase of $1.0 million is included in PE 65384BP to facilitate this agreement and establish an InterAgency Consequence Management Equipment Transfer program.

Section 143--Destruction of Existing Stockpile of Lethal Chemical Agents and Munitions

This section would require that the Secretary of Defense ensure that the program for destruction of the United States stockpile of lethal chemical agents and munitions is managed as a major defense acquisition program in accordance with the essential elements of such programs as may be determined by the Secretary. The provision would also require the Under Secretary of Defense (Comptroller) to certify annually to the congressional defense committees that the budget request for the chemical agents and munitions destruction program has been submitted in accordance with the requirements of applicable federal laws. As noted elsewhere in this report, the committee cites section 1412 of the National Defense Authorization Act for Fiscal Year 1986 (Public Law 99-145), as amended.

Section 144--Report on Department of Defense Unmanned Aerial Vehicle Systems

This section would require the Secretary of Defense to submit a report to the Congress no later than January 1, 2003 for each unmanned aerial vehicle system to include: (1) a description of the system infrastructure, (2) the system Operational Requirements Document, (3) a description of the system training and basing infrastructure, (4) a description of the how the department acquires unmanned aerial vehicle systems, (5) the system acquisition plan and (6) recommended changes in law that would facilitate unmanned vehicle acquisition.

Section 145--Report on Impact of Army Aviation Modernization Plan on the Army National Guard

This section would require the Chief of the National Guard Bureau to submit a report to both the Senate Committee on Armed

Services and the House Committee on Armed Services no later than February 1, 2003, regarding the impact of the Army Aviation Modernization Plan on the Army National Guard to conduct its aviation missions, the plan and timeline outlined within the Army Aviation Modernization Plan to transfer aircraft from the active Army to the Army reserve components, and the suitability of existing, commercial off-the-shelf, light-twin engine helicopters to perform Army National Guard aviation missions. The provision would also allow for the Chief of Staff of the Army to submit views on the report.

TITLE II--RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

Overview

The budget request contained $53,924.2 million for research, development, test, and evaluation (RDT&E), including $67.2 million for the Defense Health Program. The committee recommends $56,491.5 million, an increase of $2,567.4 million to the budget request.

The committee strongly supports this much needed increase and notes that the Department of Defense and the military services have all initiated major efforts to transform military warfighting capabilities to better prepare for future threats and challenges. The committee notes that the largest portion of the total RDT&E request is contained in the fielded system development category, the area primarily dedicated to upgrades of existing systems. The committee remains concerned that the Department will not be able to budget for sufficient funds to sustain all of the planned system upgrades and also adequately fund priority transformation efforts.

The committee urges the Secretary of Defense to outline clearly the overall Department priorities for RDT&E investment strategies for both transformation efforts and existing system upgrades and sustainment.

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Army RDT&E

Overview

The budget request contained $6,918.5 million for Army RDT&E. The committee recommends authorization of $6,933.3 million, an increase of $283.4 million and a transfer of $268.6 million for missile defense programs from Army RDT&E to Defense-wide RDT&E.

The committee recommendations for the fiscal year 2003 Army RDT&E program are identified in the table below. Major changes to the Army request are discussed following the table.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

155mm extended-range guided projectile

The budget request contained $70.9 million in PE 64814A for artillery munitions.

The committee notes that the Army is merging the trajectory

correctable munitions (TCM) program and the Excalibur (XM-982) guided munition program into a single extended-range guided munition program. The committee is aware that combining these programs has the potential to reduce cost, improve performance and accelerate fielding of a 155mm extended-range guided projectile for our ground forces.

The committee strongly supports merging TCM and Excalibur and recommends the budget request in PE 64814A.

Advanced Army composite bridge

The budget request contained $229.8 million in PE 63005A for combat vehicle and automotive advanced technology, but included no funds for the development of the Advanced Army Composite Bridge.

The committee is aware that the Army has evaluated a composite bridge technology demonstrating a capacity to carry military loads in excess of 110 tons. The committee understands the potential benefits composite materials offer, especially in terms of weight savings, corrosion resistance, and battle damage tolerance. As a result, the committee urges further development of this initiative to facilitate a full-scale demonstration and complete design and fabrication.

The committee recommends an increase of $3.0 million in PE 63005A to mature the full-scale demonstration of the Advanced Composite Bridge.

Advanced battery technology demonstration and validation program

The budget request contained $7.4 million in PE 63308A for Army missile defense systems integration, but included no funds for the advanced battery technology demonstration and validation program.

The committee is aware that the advanced battery technology demonstration and validation program has produced notable successes such as a new thermal battery for the Patriot PAC-3 missile and a prototype battery for the compact kinetic energy missile. He committee supports continuation of the program to: (1) continue development of a thermal battery simulation and modeling tool, (2) develop advanced electrochemical batteries to support the missile technology sector, and (3) provide the government with a second source for critical-use thermal batteries.

The committee recommends an increase of $8.0 million in PE 63308A for the advanced battery technology demonstration and validation program.

Advanced fuel cell technology

The budget request contained $27.5 million in PE 62705A for electronics and electronic devices, but included no funding for advanced fuel cell technology.

The committee notes that the military is becoming increasingly dependent on electrical power for its personal warfighting systems, and supports development of advanced fuel cell technology to meet those requirements.

The committee recommends $32.5 million for PE 62705A, an increase of $5.0 million for advanced fuel cell technology.

Advanced threat infrared countermeasures/common missile warning system

The budget request contained $22.8 million in PE 64270A for the development of EW equipment, but included no funds to complete an Advanced Threat Infrared Countermeasures/Common Missile Warning System (ATIRCM/CMWS) installed test facility upgrade.

The ATIRCM system integrates defensive infrared (IR) countermeasures into currently fielded aircraft for more effective protection against a greater number of IR-guided missiles than is provided by currently fielded technology. The CMWS provides warning of a threat IR-guided missile on a variety of tactical aircraft and helicopters. While the committee notes the transfer of this system to the United States Special Operations Command for continued development and initial fielding, the committee is aware of a critical requirement to upgrade Army test facilities in order to perform effective tests on helicopter self-protection systems installed and integrated on aircraft against multi-mode missile seekers.

To complete this test facility system upgrade, the committee recommends an increase of $7.0 million in PE 64270A, for this purpose.

Aircrew coordination training

The budget request contained $3.5 million in PE 63007A for manpower, personnel, and training technology but included no funds for aircrew coordination training (ACT).

The committee notes that ACT has almost completed development. The committee is aware that ACT has demonstrated the ability to improve aircrew safety and efficiency, which is especially critical in combat operations.

The committee recommends $5.6 million in PE 63007A, an increase of $2.1 million for aircrew coordination training.

Applied communications and information networking (ACIN) program

The budget request contained no funds in PE 64805A for the ACIN program.

The committee understands that the ACIN program includes projects intended to integrate commercial off-the-shelf components and adapt commercial technologies to fulfill military communications applications for 21st century warfare. The committee notes that the Army has implemented the ACIN program and recommends that the Secretary of the Army coordinate with the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) to expand applicable aspects of the ACIN program within the Department of Defense. Consistent with its prior year actions to promote increased partnering with commercial industry, the committee recommends an increase of $17.0 million in PE 64805A for ACIN.

Anti-material sniper rifle

The budget request contained $6.0 million in PE 63607A for the joint service small arm program, but included no funding for the anti-material sniper rifle.

The committee is aware that the Army unfunded requirements list contains a requirement for improvements to the long-range sniper rifle. The anti-material sniper rifle offers the potential to reduce weight and improve reliability of the

existing sniper rifle.

The committee recommends $15.8 million in PE 63607A, an increase of $9.8 million for the anti-material sniper rifle.

Asbestos pilot project

The budget request contained $9.3 million in PE 63779A for environmental quality technology, but included no funds for an asbestos pilot project.

The committee is aware that asbestos is an environmental hazard and supports research and development to improve hazardous waste reduction, and reduce the cost of disposal.

The committee recommends $11.3 million in PE 63779A, an increase of $2.0 million for an asbestos pilot project.

Automated document conversion

The budget request contained $229.8 million in PE 63005A for combat vehicle and automotive advanced technology, but included no funds for advanced data conversion.

The committee notes that only a small portion of the Tank and Automotive Command's legacy product data is in computer aided design formats. The committee is aware that CAD-based technical data is recognized as an enabler for cost effective recapitalization.

The committee recommends an increase of $750 thousand in PE 63005A for development and evaluation of existing and emerging technologies for conversion of paper/raster to 2-dimensional and 3-dimensional CAD along with advanced formats.

Bipolar wafer cell nickel-metal hydride battery

The budget request contained $61.0 million in PE 78045A for end item industrial preparedness, but included no funds for the bi-polar wafer cell nickel-metal hydride battery.

The committee is aware that the future military will be increasingly dependent on portable electric power, and notes that bi-polar wafer cell nickel-metal hydride battery technology has the potential to meet some of these needs.

The committee recommends $63.0 million in PE 78045A, an increase of $2.0 million for bi-polar wafer cell nickel-metal hydride battery.

Clothing and equipment technology

The budget included $25.5 million in PE 62786A for clothing and equipment technology, but included no funding to improve the affordability and reliability of inflatable textile-based structures for deployable shelters.

The committee is supportive of the Army's Transformational Campaign Plan, and particularly of development of technologies to improve soldier survivability and performance. The committee notes that the Army's logistics development plan appears to be inconsistent with all Objective Force requirements, particularly with regard to achieving rapid rates of deployment into areas with likely chemical or biological weapons threats. The committee is aware that advanced shelter development incorporating innovative weaving technologies may simultaneously facilitate deployments and improve soldier survivability and urges the Army to pursue further development

of this initiative.

The committee recommends $27.5 million in PE 62786A, an increase of $2.0 million, for advanced development in deployable shelters.

Crusader

The committee is aware that the Crusader advanced field artillery system is the Army's next generation self-propelled howitzer that has increased lethality, mobility, and survivability. The committee notes that the requirement for Crusader directly addresses the shortfalls in mobility and range of U.S. artillery systems that were evident during the Gulf War. Crusader capitalizes on mature, state-of-the-art technologies to improve range and volume of fire, responsiveness, re-supply, command and control and sustainability. The committee notes that the Army proposes to transition Crusader from program definition and risk reduction (PDRR) to systems development and demonstration (SDD) in fiscal year 2003. A milestone B decision is scheduled in the 3rd quarter of fiscal year 2003 to support this transition.

The committee notes Crusader's continuing progress in development and is aware that Crusader has already met all of its milestone B firing performance requirements in government testing at Yuma Proving Ground. The government-industry team contract performance continues to be on schedule and budget. The Assistant Secretary of the Army (Acquisition, Logistics, and Technology) and the Director of the Army's Objective Force Task Force have testified before this committee regarding the need for Crusader and the capabilities it brings to the battlefield.

The committee is concerned that the transformational war-fighting potential of Crusader has not been fully recognized by the Department of Defense and cannot be properly assessed until the Army completes its comprehensive Analysis of Alternatives (AOA) for the Crusader Milestone B decision. The committee believes that alternatives to Crusader's capabilities suggested by the Department of Defense should be included in the AOA and assessed on an equal basis.

Therefore, the Committee directs that there be no change to the Crusader development schedule, funding or procurement requirements, to include termination, until the completion of the Army's Milestone B Analysis of Alternatives. The Secretary of the Army shall present a report of the completed analysis to the congressional defense committees by March 1, 2003. The committees will respond to that analysis within 30 days so that the scheduled Milestone B review can be completed in April 2003.

Digital glue technology

The budget request contained $31.9 million in PE 62303A for missile technology, but included no funds for digital glue technology.

The committee is informed that digital glue technology can reduce the number of lines required to integrate systems by as much as a factor of 10.

The committee recommends an increase of $3.4 million in PE 62303A for digital glue technology.

Dismounted situation awareness system

The budget request contained $28.9 million in PE 23758A for digitization, but included no funds for the dismounted situation awareness system (DISM).

The committee endorses the use of commercial-of-the-shelf (COTS) technology to meet warfighting requirements while reducing costs and schedules. The committee notes that the dismounted situation awareness system (DISM) map has successfully demonstrated its ability to significantly improve combat unit situational awareness during a night live fire exercise with paratroops. The committee is also aware that this system was developed using small business innovative research program funding.

The committee recommends $32.9 million in PE 23758A, an increase of $4.0 million for DISM.

Distance learning

The budget request contained $14.3 million in PE 62785A for manpower/personnel/training technology, but included no funds for distance learning.

The committee notes that education is essential both for career advancement and to support a well-educated work force, and further notes that distance learning is a new and innovative means to provide such required education.

The committee recommends $15.8 million in PE 62785A, an increase of $1.5 million for distance learning.

Eliminating arthropod-borne infectious disease

The budget request contained $67.5 million in PE 62787A for medical technology, but included no funds for eliminating arthropod-borne infectious disease.

The committee is aware that arthropod-borne infectious disease represents a significant health problem over a growing portion of the United States, with potential to infect members of our military.

The committee recommends an increase of $4.0 million in PE 62787A for eliminating arthropod-borne infectious disease

Energy and sustainability research

The budget request included $2.9 million in PE 63734A for military engineering and advanced technology, but included no funding for energy and sustainability research.

The committee supports initiatives designed to improve infrastructure life cycle operations and cost effectiveness, as well as enhancing the overall quality of life on military installations. The committee further supports those efforts aimed at achieving efficiencies in energy-consumption while concurrently experiencing reductions in overall pollution levels and waste-streams. The committee understands that innovative technologies can be brought to bear on these issues in a collaborative environment involving both academia and government resources. The committee notes that energy and sustainability audits of Department of Defense facilities have produced numerous operational efficiencies. The committee encourages further development in this initiative.

The committee recommends $5.9 million in PE 63734A, an

increase of $3.0 million, for energy and sustainability research.

Enhanced area air defense system short range air defense integrated kinetic energy system

The budget request contained $31.9 million in PE 62303A for missile technology, but included no funds for the Army enhanced area air defense system (EAADS) short range air defense integrated kinetic energy (E-STRIKE) system.

The committee is aware that the Army's SWORD program, a component of E-STRIKE, is scheduled to complete science and technology efforts at the end of fiscal year 2002, and will be without funding until the E-STRIKE program begins in fiscal year 2004.

The committee recommends an increase of $3.0 million in PE 62303A for SWORD.

Explosively formed penetrators

The budget request included $3.0 million in PE 62624A for research on smaller, more lethal Explosively Formed Penetrators (EFPs).

The committee strongly endorses the Army's Future Combat System (FCS) and supports initiatives aimed at fielding a lighter, faster, more survivable, and more lethal combat force. The committee recognizes that warhead requirements and technologies must consequently adapt to FCS characteristics and is concerned that the present level of EFP investment may prove insufficient to meet both existing and future requirements. The committee further recognizes that the eventual FCS combat vehicles may involve a variety of smaller caliber guns and rocket launchers requiring smaller and more lethal warheads to defeat, among other things, active protection systems. Indeed, a next-generation warhead technology could benefit mortars, artillery, rockets, missiles, and hand-emplaced munitions. The committee encourages the Army to place greater emphasis on such an effort.

The committee recommends an increase of $3.0 million in PE 62624A for smaller, more lethal, next-generation Explosively Formed Penetrators.

Eye-safe laser

The budget request contained $22.3 million in PE 62709A for night vision technology, but included no funds for eye-safe lasers.

The committee is aware that eye-safe laser technology is applicable to detection and identification of diverse objects, such as wires, vehicles, and chemical/biological clouds.

The committee recommends $25.3 million in PE 62709, an increase of $3.0 million for combustion driven eye-safe laser technology.

Family of systems simulator

The budget request contained $7.4 million in PE 63308A for Army missile defense systems integration, but included no funds for the family of systems simulator (FoSSim).

The committee is aware that FoSSim integration capability

can be used to evaluate and improve new operational concepts, and analyze interfaces for missile defense capabilities.

The committee recommends an increase of $6.0 million in PE 63308A for FoSSim.

Fuel catalyst research and evaluation

The budget request contained $229.8 million in PE 63005A for combat vehicle and automotive advanced technology, but included no funds for fuel catalyst research and evaluation.

The committee is aware that a fuel catalyst technology has been developed that causes hydrocarbon fuels to combust more completely, leading to reduced emissions and better fuel economy. The committee notes that a demonstration of this catalyst technology could validate its potential for significant operational savings for military vehicles.

The committee recommends an increase of $2.0 million in PE 63005A for fuels catalyst research and evaluation.

Global combat support system

The budget request contained $71.9 million in PE 33141A for global combat support system-Army (GCSS-A).

The committee is aware that the Army initiated an information systems program in 1997 that was intended to transform the Army's information technology support systems. The committee notes that the Army is still attempting to implement the first, and generally accepted easiest of five modules intended to replace 16 legacy systems. The committee additionally notes that the Army is changing its acquisition strategy forsubsequent modules, and questions the requirement for research and development until the revised strategy is clear.

The committee recommends $51.9 million in PE 33140A, a decrease of $20.0 million for GCSS-A

Helmet mounted thermal imaging system

The budget request contained $36.5 million in PE 63710A for night vision advanced technology, but included no funds for the helmet-mounted thermal imaging system.

The committee is aware that thermal imaging offers potential for improved detection of personnel involved in casualties where emergency crews, be they military or civilian, must work in environments where visibility is obscured.

The committee recommends an increase of $2.8 million in PE 63710A for the helmet mounted thermal imaging system.

Hemoglobin based oxygen carrier

The budget request contained $67.5 million in PE 62787A for medical technology, but included no funds for the hemoglobin-based oxygen carrier.

The committee is aware of a 2001 Department of Defense (DOD) Inspector General audit of the DOD Blood Program that highlights programmatic shortfalls in the Department's ability to meet its stated requirements. The committee is aware of a promising hemoglobin-based oxygen carrier technology that would minimize, and in some cases eliminate, the storage and transportation problems identified in the report. A hemoglobin-based oxygen carrier has extended life and innovative health

benefits due to its ability to deliver oxygen directly to human tissue. The committee supports this innovation and urges the Department of the Army to move expeditiously in a manner that will soon field this capability.

The committee recommends an increase of $7.0 million in PE 62787A specifically for the hemoglobin-based oxygen carrier.

Human factors engineering technology

The budget request included $17.4 million in PE 62716A for Human Factors Engineering Technology, but included no funding for the Army's manpower and personnel integration (MANPRINT) modeling technologies.

The committee supports efforts to maximize soldier performance and to match soldier effectiveness with the technological advances imbedded in the Army's Objective Force concept. The committee endorses efforts of the Army Research Laboratory to conduct field studies and collect performance data on the capabilities and limitations of soldiers, particularly in the area of soldier-equipment interaction. Further, the committee recognizes and fully encourages the cross-service integration of tools and methodologies in an effort to minimize total ownership costs of future weapons systems through improvements in design, operations, and maintenance.

The committee recommends $20.4 million in PE 62716A, an increase of $3.0 million, for development of MANPRINT modeling and related technologies.

Hyperspectral long-wave imager for the tactical environment

The budget request included $4.9 million in PE 305206A for Airborne Reconnaissance Operational Systems Development.

The committee remains supportive of long-wave infrared (LWIR) hyperspectral imagery technology as a means for providing a unique, next-generation, all-terrain, day/night detection capability for camouflaged or concealed targets. The committee notes that the Army's planned efforts in this program include the development of greater integration of a variety of imaging techniques. The committee supports these initiatives yet remains particularly concerned with the need to integrate the stabilization of the LWIR sensor for ensuring enhanced target detection algorithms in pursuit of a full system capability.

The committee recommends an increase of $5.2 million in PE 35206A for hyperspectral long-wave imager.

Intelligence command global information portal

The budget request contained $5.4 million in PE 33028A for Security and Intelligence Activities, but included no funding for the Army intelligence and security command (INSCOM) global information portal.

The committee notes that INSCOM is developing the global information portal to provide intelligence analysts with timely information and to provide software applications that improve analysis. The committee is aware that INSCOM is using commercial-off-the-shelf software to continue to develop the global information portal.

The committee recommends $10.4 million in PE 33028A, an

increase of $5.0 million for the INSCOM global information portal.

Javelin

The budget request contained $489 thousand in PE 64611A for Javelin missile upgrades; however, no funds were included for upgrades to defeat advanced active protection systems (APS).

The Javelin missile system is a fire-and-forget antitank weapon designed to defeat the most current armored systems fielded today. However, the committee understands some armored vehicles use APS to detect incoming missiles and defeat them by interfering with the missile guidance system.

The committee is aware of an ongoing technology insertion program to overcome this problem that uses current off-the-shelf technologies to develop counter APS (CAPS) for Tube-launched, Optically-tracked, Wire-guided and Hellfire missiles to defeat existing generation I and II APS. The committee notes that the Army Chief of Staff has identified a $13.1 million unfunded requirement in fiscal year 2003 for future generation III CAPS development, integration and testing for the Javelin.

Based on increased threats and the need to develop CAPS for generation III APS threats to the Army's antitank missiles, the committee recommends $13.6 million, an increase of $13.1 million, in PE 64611A for this purpose and strongly urges the Army to include funds in its fiscal year 2004 budget to accelerate this program.

Landmine warfare/barrier engineering development

The budget request contained $129.0 million in PE 64808A for landmine warfare/barrier engineering development, of which $28.3 million was for non-self-destruct anti-personnel landmine alternatives (NSD-A).

The committee understands that the Army has used a portion of the $37.2 million of fiscal year 2001 NSD-A funds as a reprogramming source and that $13.0 million of the funds remain withheld by the Department of Defense Comptroller. Since a portion of fiscal year 2001 funds have not been obligated for their intended purpose, additional funds remain on withhold, and the program is delayed, the committee believes that the remainder of these funds can be used to meet fiscal years 2002 and 2003 requirements until the Department of Defense determines its course of action on this initiative.

The committee recommends $101.7 million in PE 64808A for fiscal year 2003, a decrease of $27.3 million.

Lightweight x-band radar

The budget request included $29.1 million in PE 12419A for Joint Land Attack Cruise Missiles Defense, but included no funding for lightweight x-band radar technology.

The committee is aware of efforts to improve the discrimination capability of the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS) to better address the increased cruise missile threat. The committee understands the challenge of maintaining an advanced, cost-effective, long endurance, precision-tracking defensive system. According to justification documents provided to the committee, JLENS has a requirement to develop, test, and provide a

contingency-deployable Fire Control radar demonstration prototype to address this challenge. The committee understands that a lightweight electronically-steerable X-band antenna may be ideal. Therefore, the committee urges the Army to pursue further development of such technology.

The committee recommends $31.1 million in PE 12419A, an increase of $2.0 million, for lightweight x-band radar technology.

M795 extended range, high explosive baseburner projectile

The budget request contained $38.1 million in PE 62624A for weapons and munitions technology, but included no funds for the M795 extended range, high explosive baseburner projectile.

The committee notes that modern warfare requires greater artillery range and is aware that the M795 extended range baseburner projectile offers the potential to enhance conventional field artillery capabilities.

The committee recommends an increase of $6.0 in PE 62624A million for the M795 extended range, high explosive baseburner projectile.

Metabolically engineered tissues for trauma

The budget request contained $67.5 million in PE 62787A for medical technology, but included no funds for metabolically engineered tissues for trauma care.

The committee notes that technologies are being developed to permit long-term storage of cells and tissues in an ordinary environment that would allow better treatment of battlefield casualties.

The committee recommends an increase of $2.0 million in PE 62787A for metabolically engineered tissues for trauma.

Metallic particles in defense applications obscurant smokes

The budget request contained $3.7 million in PE 62622A for chemical, smoke and equipment defeating technology, but included no funds for metallic particles in defense applications obscurant smokes.

The committee notes that metallic particles in defense applications obscurant smokes may have potential benefits for the warfighter.

The committee recommends an increase of $3.0 million in PE 62622A for metallic particles in defense applications obscurant smokes.

Metrology

The budget request contained $50.3 million in PE 63001A for warfighter advanced technology development, $37.8 million in PE 64215N for Navy standards development, and $1.3 million in PE 72207F for precision maintenance and calibration.

The Department of Defense's metrology research and development program develops new measurement standards and capabilities to support the development, test, evaluation, and maintenance of emerging military systems. The committee understands that shortfalls in the metrology budget of all the military departments have led to the erosion of critical calibration standards development and measurement services to

the detriment of the development and support of new weapons systems.

The committee recommends an increase of $1.5 million in PE 63001A for the Army's metrology research and development program, an increase of $5.2 million in PE 64215N for the Navy program, and an increase of $1.5 million in PE 72207F for the Air Force metrology research and development program.

Micro electro-mechanical systems inertial measurement unit/global positioning system

The budget request contained $31.9 million in PE 62303A for missile technology, and included $10.0 million for micro electro-mechanical systems (MEMS) inertial measurement units (IMU).

The committee is aware that MEMS integrated inertial measurement unit-global positioning systems (IMU-GPS) offer the potential to provide affordable precisionnavigation capability for a family of platforms and weapons. The committee notes that the Army has been designated as the lead service for this program.

The committee recommends an increase of $10.0 million in PE 62303A for MEMS IMU-GPS.

Mini-backpack unmanned aerial vehicle

The budget request contained $46.5 million in PE 35204A for night vision advanced technology, and included $9.6 million for night vision airborne systems.

The committee is aware that an advanced mini-backpack unmanned air vehicle (UAV) with day/night sensor capability has been developed and is ready for testing. The committee notes that this UAV has potential applications both with existing forces and as part of the future combat system.

The committee recommends an increase of $5.0 million in PE 35204A for mini-backpack UAV.

Mobile tactical high energy laser

The budget request contained $7.4 million in PE 63308A, including $3.5 million for the Mobile Tactical High Energy Laser (MTHEL), a mobile version of an existing high energy chemical laser system jointly developed by the United States and Israel to demonstrate the feasibility of defeating short range rockets using directed energy.

The committee is aware of promising results with the current THEL, but believes that much work remains to be accomplished before the technology develops to a lethal and militarily useful capability.

The committee recommends an increase of $25 million in PE 3308A for MTHEL.

Night vision fusion

The budget request contained $36.5 million in PE 63710A for night vision technology, but included no funds for night vision fusion.

The committee is aware that the ability to see significantly better at night and under conditions of obscured visibility than an adversary is critical to the success of the military. The committee notes that digital pixel-level fusion

has demonstrated the potential to greatly enhance night vision.

The committee recommends an increase of $9.0 million in PE 63710A for night vision fusion.

Non-traditional intelligence analysis toolset

The budget request contained $42.3 million in PE 64321A for support of the All Source Analysis System (ASAS), but included no funds for the continued development of the non-traditional intelligence analysis toolset (NTIAT).

The committee strongly supports the Army's objective force concept, yet remains concerned with the Department's lack of commitment to develop an open-architecture, information-exchange capability as part of the more mobile, ASAS-Light alternative. The committee strongly supports the ASAS-Light modernization initiative as a means for maintaining situational awareness, battle-management interoperability, and targeting advantages at all echelons of command and in all deployment environments. The committee supports further investment in this multi-source fusion and processing effort.

The committee recommends an increase of $4.0 million in PE 64321A to continue NTIAT development.

Nuclear biological, and chemical agent removal

The budget request contained $11.4 million in PE 63804A for logistics and engineering equipment, and included $7.9 million to develop and demonstrate prototype petroleum and water distribution technologies.

The committee strongly supports Army efforts to protect against potential contamination of water supply systems and recognizes the shortcomings of current analytical methods. The committee is particularly supportive of proposals designed to improve the real-time detection and removal of nuclear, biological, and chemical (NBC) contamination and is aware of promising analytical approaches in this field.

The committee recommends $16.4 million in PE 63804A, an increase of $5.0 million, specifically for evaluating technologies and analyzing concepts for applicability to NBC contamination detection and removal.

P3 micro-power devices for missile defense applications

The budget request included $7.4 million in PE 63308A for Army missile defense systems integration, but included no funding for the P3 micro-power device.

The committee endorses the development work at the Army Space and Missile Defense Command aimed at producing a micro-power device suitable for applications in autonomous and remote conditions. The committee notes the infinite number of applications for such a technology, particularly in intelligence, battle management, and missile defense systems. The committee understands the need for such technological weight and volume efficiencies and supports additional development.

The committee recommends an increase of $3.0 million in PE 63308A for further development of the P3 micro-power device.

Rotary multi-fuel auxiliary power unit

The budget request contained $229.8 million in PE 63005A for combat vehicle and automotive advanced technology, and included $39.2 million for combat vehicle mobility.

The committee is aware that rotary multi-fuel auxiliary power unit (APU) technology may offer a reduced cost alternative to existing turbine APUs. The committee notes that rotary multi-fuel technology may also offer weight advantages suitable for a broad range of applications.

The committee recommends an increase of $5.0 million in PE 63005A for the rotary multi-fuel auxiliary power unit.

Stable hemostat

The budget request contained $16.6 million in PE 63002A for medical technology, but included no funds for the stable hemostat.

The committee is informed that 50 percent of combat deaths are due to uncontrollable blood loss. The committee is aware that a hemostat has been developed that promotes blood clotting and has the potential to reduce the death rate on the battlefield.

The committee recommends an increase of $3.5 million in PE 63002A for stable hemostat.

Textile electronic garments for combat casualty care

The budget request contained $16.6 million in PE 63002A, including $4.4 million for combat injury management, but included no funding for rugged textile electronic garments for combat casualty care.

The committee is aware of advances in sensor technology, textile electronics, information management and medical science that have opened up the potential for remote diagnosis, monitoring, and treatment of a range of medical conditions. The committee notes positive results from combat casualty care and electronic textiles research strongly suggesting that major improvements can be made in wounded soldier survival. To benefit from these advances, the committee urges the Secretary of the Army to institute a program to develop, implement, and assess rugged textile electronic garments for combat casualty care. The committee expects the proposed effort to develop, implement and assess advanced textile electronic garments in an integrated system.

Accordingly, the committee recommends an increase of $2.0 million in PE 63002A to develop rugged textile garments for combat casualty care.

Thermionic technology

The budget request contained $7.4 million in PE 63308A for Army missile defense systems integration, but included no funding for thermionics technology.

The committee notes that progress is being made in advanced thermionics technology to make it a more viable power option for space applications.

The committee recommends an increase of $5.0 million in PE 63308A for thermionics technology.

Unmanned aerial vehicle/unmanned ground vehicle demonstration program

The budget request contained $4.8 million in PE 63006A for command, control, communications advanced technology, but included no funds for an unmanned aerial vehicle /unmanned ground vehicle (UAV/UGV) demonstration program.

The committee notes that integrated operations of unmanned aerial and ground vehicles may provide means to reduce personnel vulnerability especially while fighting in a complex urban environment.

The committee recommends $7.2 million in PE 63006A, an increase of $2.4 million for the UAV/UGV demonstration program.

Volumetrically controlled manufacturing

The budget request contained $87.9 million in PE 63313A for missile and rocket advanced technology, but included no funding for volumetrically controlled manufacturing (VCM).

The committee is aware that the Army Medical Research and Material Command successfully conducted a research program for biomaterial application using an innovative process, VCM. The committee notes that VCM is a precision synthetic manufacturing process that precisely calculates the 3D material matrix coefficients, in discrete volumes, and then replicates the properties within a manufacturing process. The material matrix has the capability to vary, based on loading tolerances, and is scalable to macro, micro and the nano level, and could lead to new and higher performance materials for aerospace applications.

The committee recommends an increase of $11.5 million in PE 63313A for volumetrically controlled manufacturing.

Weapons and munitions engineering development

The budget request contained $41.8 million in PE 64802A for weapons and munitions engineering development, but no funds were included to complete development of the shoulder-launched multipurpose assault weapon-disposable (confined space) (SMAW-D(CS)) or the common remotely operated weapon system (CROWS).

Shoulder-launched multipurpose assault weapon-disposable (confined space)

The SMAW-D(CS) will enable soldiers to fire this single-shot, disposable launcher weapon against earthen, timber bunkers and light armored vehicles and breech masonry walls from and an enclosed space, which is not possible with the current SMAW-D. This requirement is necessary due to the termination of the multipurpose individualized munition, which provided soldiers with a confined space launch capability. Due to the increased urban terrain engagements that soldiers are training for and operating in and the need for this confined space, launch and breeching requirement, the committee recommends an increase of $6.0 million in PE 64802A to complete development of the SMAW-D(CS).

Common remotely operated weapon system

The CROWS provides armored and light armored vehicles with remotely operated machine guns, allowing crewmembers to fire from and remain within the protection of their vehicles. The committee recommends an increase of $3.4 million in PE 64802A to continue development of the CROWS.

Wire detection and obstacle avoidance system for helicopters

The budget request contained $36.5 million in PE 63710A for night vision advanced technology, but included no funds for a wire detection and obstacle avoidance system for helicopters.

The committee is aware that helicopter combat operations are increasingly conducted at low level and at night. The committee notes that wire and other obstacle detection and avoidance is more difficult under those conditions.

The committee recommends an increase of $4.0 million in PE 63710A for a wire detection and obstacle avoidance system for helicopters.

Navy RDT&E

Overview

The budget request contained $12,501.6 million for Navy RDT&E. The committee recommends authorization of $13,274.5 million, an increase of $772.9 million.

The committee recommendations for the fiscal year 2003 Navy RDT&E program are identified in the table below. Major changes to the Navy request are discussed following the table.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Acoustic rapid commercial-off-the-shelf technology insertion

The budget request contained $98.5 million in PE 64503N for submarine system equipment development, including $64.6 million for acoustic rapid commercial-off-the-shelf technology insertion (ARCI) of submarine sonars.

The ARCI program upgrades current submarine sonar systems with open architecture commercial-off-the-shelf computer technology allowing continued upgrades as technology develops. Full implementation is currently planned for fiscal year 2008, but conversion of all submarines can be accelerated with additional funds. The committee believes that this technology upgrade is essential for the submarine fleet, and recommends an increase of $25.0 million in PE 64503N to continue the research and development necessary for the insertion of multi-purpose processor technology into submarine and other naval sonar systems.

Advanced cable design for mine/submarine warfare

The budget request contained $31.1 million in PE 64212N for anti-submarine warfare and other helicopter development.

The committee recommends an increase of $2.0 million in PE 64212N for the development and evaluation of improvements in the cables used for towing mine and submarine warfare sensors and countermeasures.

Advanced camouflage coating demonstration

The budget request contained $78.2 million in PE 63114N for power projection advanced technology development, including $16.3 million for advanced development of autonomous operations technology.

The committee recommends an increase of $5.0 million in PE 63114N for development and flight demonstration of an integrated set of advanced camouflage coatings and treatments for unmanned aerial vehicles that will dramatically decrease the detection range of threat sensors.

Advanced composite radome materials

The budget request contained $60.8 million in PE 25601N for operational systems development of the high-speed, anti-radiation missile (HARM), including $48.7 million for continued development of the advanced anti-radiation guided missile (AARGM).

The committee notes the progress in the AARGM program, a Phase III Small Business Innovative Research (SBIR) follow-on program designed to demonstrate an advanced multi-mode seeker on an existing high-speed anti-radiation missile (HARM) airframe. Successful controlled, captive flight, and guided vehicle test flights in the AARGM advanced technology demonstration and success in phase I of the Quick Bolt advanced concept technology demonstration have resulted in the Navy's decision to transition AARGM technology into the system development and demonstration phase.

The committee notes that use of AARGM technology in the high-speed anti-radiation demonstration requires a new radome. The committee also notes that the speed of next-generation missiles for the suppression of improved enemy air defense and other time critical targets will require materials for radomes and conformal antennas that withstand higher temperatures and permit the use of higher frequency radars. The committee further notes the identification of several new material systems that have the potential for meeting both needs.

The committee recommends $62.3 million in PE 25601N, an increase of $1.5 million to develop and qualify new composite materials for next-generation high-speed missile system applications.

Advanced composite sail

The budget request contained $107.4 million in PE 63561N for advanced submarine system development.

The committee notes that the Navy's technology insertion plan for the Virginia class submarine includes installation of an advanced sail on the seventh Virginia class submarine. The advanced composite sail program is intended to provide substantial additional payload capacity and stealth improvements over conventional submarine sails. Phase II of the program addresses the incorporation of full-scale design features and the complete spectrum of full-scale load specifications that would be encountered by operational submarines, including damage assessment and repair.

The committee recommends an increase of $5.0 million in PE 63561N for development, demonstration, and validation of technologies and techniques for advanced monitoring of the operational condition of composite sails, repair procedures, and procedures for enabling future payloads to be inserted into a composite sail without major redesign of the sail structure.

Advanced deployable system burial capability

The budget request contained $35.9 million in PE 64784N to continue development of the advanced deployable system (ADS).

ADS is an undersea surveillance system that is designed to detect and track modern diesel electric and nuclear submarines, as well as provide the capability for tracking surface ships and detecting sea mine laying. ADS is composed of distributed sensors that can be rapidly and unobtrusively deployed in regional contingency areas for use against enemy submarines and in support of littoral warfare. The committee notes that in fiscal year 2002 Congress added $4.0 million to the ADS program to accelerate the development of improvements in the ADS cable burial capability to enhance ADS cable survivability and installation of cable trunk extensions. Congress also added $4.0 million to the program to reduce risk in the development of remotely powered all optical array technology for the ADS.

The committee recommends an increase of $16.0 million in PE 64784N for the ADS program, including $6.0 million to accelerate development of the ADS cable burial capability, $4.0 million for the development of ADS off board sensors, and $6.0 million to continue the program for development of remotely powered, all optical array technology for application in the ADS program.

Advanced ducted electric propulsion pod

The budget request contained $57.6 million in PE 63123N for force protection advanced technology development, including $14.9 million for surface ship and submarine hull, mechanical, and electrical advanced technology development.

The committee notes the Navy's development of an advanced podded propulsion module that will demonstrate an advanced, hydrodynamically efficient, externally mounted electric ship propulsion module that reduces fuel consumption; eliminates the need for large and costly reduction gears, propeller shafts and hull penetrations; and offers quieter operation and higher power in a smaller diameter package, compared to other propulsor options.

The committee recommends an increase of $10.0 million in PE 63123N to accelerate the development and demonstration of the advanced ducted electric propulsion pod.

Advanced extended echo-ranging sonobuoy development

The budget request contained $13.9 million in PE 64261N for development of acoustic search sensors, including $8.3 million for advanced extended echo ranging (AEER) development.

The committee notes the role of multi-static active acoustic sonar systems in the Navy's airborne anti-submarine warfare capability and on-going programs to improve the capabilities of extended echo ranging (EER) sensors for undersea warfare in the shallow waters of the littoral.

The committee recommends $33.9 million in PE 64261N for the development of acoustic search sensors, including $20.0 million to continue the program for development of the AEER sensor system.

Advanced land attack missile

The budget request contained $108.7 million in PE 63795N for land attack technology demonstration and validation. No

funds were requested for the advanced land attack missile program.

The committee notes that Navy programs for development of the extended range guided munition (ERGM), land attack standard missile (LASM), and advanced land attack missile (ALAM) have focused on addressing the operational requirements for naval surface fire support for land forces operating in the littoral and the shortcomings in current naval surface fire support capabilities.

In the statement of managers accompanying the conference report on H.R. 4205 (H. Rept. 106-945), the conferees placed a high priority on completing the analysis of alternatives to determine the appropriate course of action for providing Naval fire support and directed the Secretary of the Navy to report to the congressional defense committeesrecommended revisions to the ALAM program with the submission of the fiscal year 2002 budget request.

In April 2002, the Comptroller of the Navy executed a below-threshold reprogramming which redirected funds authorized and appropriated for ALAM and effectively halted the ALAM program. The Navy completed an ALAM analysis of alternatives in May 2001, which determined that a boost glide missile system was the most cost effective system, supersonic cruise missiles showed merit, and additional detailed design studies were warranted. In November 2002, the Assistant Secretary of the Navy for Research Development, and Acquisition terminated the LASM program. Section 211 of the National Defense Authorization Act for 2002 (Public Law 107-107) required the Secretary of Defense to carry out an assessment of the requirements for naval surface fire support of ground forces operating in the littoral environment, including the role of an advanced fire support missile system for navy combatant vessels and to submit a report of the result of that assessment to the congressional defense committees by March 31, 2002. The committee has not yet received the Secretary's report.

In the Navy's unfunded requirements list that was submitted to the committee following submission of the fiscal year 2003 budget request, the Chief of Naval Operations identified the program as a high priority unfunded requirement.

The committee has consistently supported the requirement for improvements in naval surface fire support to land forces operating in the littoral and believes that the Navy should proceed promptly to reestablish the program for development and demonstration of an advanced land attack missile.

The committee recommends an increase of $11.0 million in PE 63795N for the ALAM program.

Advanced light strike vehicle

The budget request contained $51.6 million in PE 63640M for Marine Corps advanced technology demonstration, but included no funds for the advanced light strike vehicle.

The committee is aware that an advanced light strike vehicle is needed to give Marines on ground mobility and lethality.

The committee recommends an increase of $6.0 million in PE 63640M for advanced light strike vehicle.

Advanced smart propulsor product model

The budget request contained $89.4 million in PE 62123N for force protection applied research, including $46.0 million in surface ship and submarine hull, mechanical, and electrical applied research.

The committee notes prior efforts by the Navy in the development of smart propulsor product models that use advanced computational analysis, modeling, and simulation in the design, performance modeling, and analysis of ship propulsors. Integration of advanced hydromechanical, hydroacoustic, and mechanical analysis tools in the product models would permit tighter coupling of performance modeling and simulation to analyze and make tradeoffs in the design and manufacture of propulsors that could improve performance, yet reduce manufacturing and life cycle costs.

The committee recommends an increase of $4.0 million in PE 62123N for the development of an advanced smart propulsor product model that would incorporate advanced hydromechanical, hydroacoustic, and mechanical analysis tools to permit tighter coupling of performance.

Advanced stealth ship radar

The budget request contained $65.1 million in PE 63271N for radio frequency systems advanced technology demonstration.

The committee notes that Sea Lion is a small combatant craft that has been used as a baseline platform to design, build and test advanced high-speed craft for U.S. Special Operations Forces. The committee also notes that for small combatant craft operating in the littoral the capabilities for covert detection and avoidance of other forces are highly desirable for enhanced self and force protection.

The committee recommends an increase of $5.8 million in PE 63271N for demonstration and evaluation of low probability of intercept and low observable radars on small combatant craft such as the Sea Lion technology demonstration platform.

Advanced variable speed drive systems

The budget request contained $243.1 million in PE 63513N for shipboard system component development, but included no funds for the advanced variable speed drive (VSD) system.

The committee is aware that the development of the advanced VSD system will enable fleet-wide implementation of state of the art variable speed motor controls, without the size and weight restrictions of existing VSD.

The committee recommends $245.1 million in PE 63513N, an increase of $2.0 million for the advanced variable speed drive system.

AEGIS baseline 7 phase II open architecture

The budget request contained $300.7 million in PE 64307N for AEGIS combat systems engineering, of which $13.2 million was included for continued development of the AEGIS baseline 7 phase II open architecture effort on AEGIS combat systems.

The AEGIS baseline 7 phase II open architecture effort provides upgraded computer programs for sensor improvements and to reduce life cycle costs, as well as development of a solid state replacement for the SPY-1 radar, aimed at providing increased sensitivity and bandwidth required for long range

ballistic missile defense.

The committee recommends $310.7 million in PE 64307N, an increase of $10.0 million, to accelerate AEGIS baseline 7 phase II open architecture efforts.

Affordable towed array construction

The budget request contained $98.5 million in PE 64503N for submarine system equipment development, including $5.2 million in the submarine sonar improvement program to continue development of affordable towed array technology initiatives.

The submarine sonar improvement program delivers block updates to sonar systems installed on SSN 688, 688I, 21 and TRIDENT class submarines to maintain clear acoustic, tactical and operational superiority over submarine and surface combatants in all scenarios through detection, classification, localization and contact following. The TB-29, TB-21A and TB-16 towed array sonar systems support these requirements. The committee notes that the Navy initiated the affordable towed array technology program to develop fiber optic technology for more cost effective, more reliable towed arrays.

The committee recommends an increase of $16.0 million in PE 64503N to accelerate the Navy's affordable towed array technology development program.

Affordable weapon

The budget request contained $78.2 million in PE 63114N for Power Projection Advanced Technology development.

The Office of Naval Research (ONR) Affordable Weapon program is an advanced technology demonstration to design, develop, and build a 600-mile range, 200 lbs-payload, precision strike missile with global positioning system/inertial navigation system guidance and control and a data link. The committee notes the significant progress made in the Affordable Weapon development and flight test program to date, including launch and flight test. The committee has been advised that key to ONR's success has been the effective use and modification for military applications of commercially available equipment. The success of the program indicates that the demonstration program should continue with the development and integration of the seeker, data link, special survivability measures, ground station, and improved performance propulsion.

The committee recommends an increase of $15.4 million in PE 63114N for continuation of the Affordable Weapon demonstration project.

Anti-submarine warfare, mine countermeasures, and ship self-defense initiative

The committee notes the Navy's capabilities for anti-submarine warfare, mine countermeasures, and ship self-defense are key enablers for the ability of the Navy to operate in the littoral regions of the world. For the last six years, the General Accounting Office (GAO) at the committee's request has conducted a series of assessments regarding the Navy's capabilities for mine countermeasures, antisubmarine warfare and ship self-defense, and completed a comprehensive update of the assessments in May 2001.

In responding to the GAO assessments, the Department of the

Navy has acknowledged that it lacks or has degraded capabilities in a number of key warfighting areas needed for operations in littoral regions: breaching enemy sea mines in the surf zone, detecting and neutralizing enemy submarines in shallow water, and defending naval ships against cruise missiles. The committee notes that the Navy has had programs under way to improve its capabilities in each of these areas for several years. However, even though mine countermeasures, anti-submarine warfare, and ship self-defense are regarded as essential core naval capabilities, progress has been slow. During committee hearings on the fiscal year 2002 budget request, the Chief of Naval Operations cited the continuing existence of shortfalls in these essential core naval capabilities.

To address these shortfalls, the committee has recommended the following increases for the Navy's anti-submarine warfare, mine countermeasures, and ship self-defense programs. These recommendations are discussed further in the classified annex to this report:

	RDT&E	Procurement
Anti-submarine warfare.....	$126.1	$82.0
Mine countermeasures.....	18.0	0.0
Ship self-defense.....	61.4	24.7

The committee intends to review the Navy's response to these initiatives and actions taken to improve its capabilities for anti-submarine warfare, mine countermeasures, and ship self-defense in hearings on the fiscal year 2004 budget request.

Anti-submarine warfare synthetic training environment

The budget request contained $31.4 million in PE 24571N for consolidated training systems development.

The committee is aware that the anti-submarine warfare (ASW) capability of the fleet is directly tied to the proficiency and level of training of the ASW component of the naval battle force. The committee also understands that, like most combat operations, ASW is a perishable skill that requires frequent practice of complex tasks on both the individual and the team level.

The committee notes that the limitations of current ASW training facilities and systems inhibit the ability for integrated training and result in most integrated training being done at sea. The committee further notes that the Navy's ASW community has affirmed the need for a common, integrated ASW training environment that could link real and synthetic ASW forces in realistic operational training situations for training, mission planning, and mission rehearsal. The committee believes that such a capability can probably not be achieved by a simple integration of existing incompatible training systems and that an incremental migration to an integrated, interactive ASW training system will be required. The committee also believes that the first step toward realizing such a capability in the fleet should be the linking of air ASW simulators to the existing Battle Force Teams

Trainers.

The committee recommends $41.4 million in PE 24571N, an increase of $10.0 million to initiate a program for integration of fixed and rotary wing air ASW and other simulators into the Battle Force Tactical Trainer to establish an ASW synthetic training environment.

Autonomous maritime navigation

The budget request contained $5.8 million in PE 63563N for advanced ship design, but included no funds for autonomous maritime navigation.

The committee notes that autonomous maritime navigation will allow unmanned surface vessels to operate alone, or in a coordinated group without the need for continuous control from a remote operator, even near shore or other vessels.

The committee recommends $10.8 million in PE 63563N, an increase of $5.0 million for the autonomous maritime navigation.

Aviation integrated life support system

The budget request contained $7.5 million in PE 63216N for aviation survivability, but included no funds for the aviation integrated life support system (AILSS).

The committee is aware that the AILSS effort, which commenced in 1996, is ready to transition into a tactical variant for the F-18.

The committee recommends an increase of $6.5 million in PE 63216N for aviation integrated life support system.

Aviation-shipboard information technology initiative

The budget request contained $24.6 million in PE 64512N for shipboard aviation systems development, but included no funds for development of the aviation-shipboard information technology initiative (AS/ITI), which would upgrade and integrate aircraft carrier information systems to reduce cost and improve the effectiveness of carrier aircraft launch and recovery operations.

The committee notes that the Navy views the AS/ITI as a promising technology for both its next-generation aircraft carriers and those currently in service, which can enhance accuracy and minimize latency of information; distribute information where required; improve shipboard aircraft sortie rates and safety; and reduce carrier operating costs.

The committee recommends $32.8 million in PE 64512N, an increase of $8.2 million, for development of the AS/ITI.

Biomedical research imaging

The budget request contained $19.0 million in PE 63729N for warfighter protection advanced technology development.

The committee notes the progress being made in the use of advanced imaging technology in biomedical research. New imaging technology has allowed the observation of tumors as small as 1mm in diameter and has allowed scientist to observe critical biochemical changes associated with tumor, strokes, and other disease states. These findings have important implication for advances in real-time medical diagnosis and treatment.

The committee recommends an increase of $5.0 million in PE 63729N to continue research in the application of advanced imaging technology to biomedical research.

Chemical agent warning network demonstration

The budget request contained $12.2 million in PE 65873M for Marine Corps program-wide support, but included no funding for the chemical agent warning network demonstration.

The committee recommends $15.2 million in PE 65873M, an increase of $3.0 million to continue the development of the chemical agent warning network for use by the Marine Corps Chemical-Biological Incident Response Force.

Commercial off-the-shelf (COTS) carbon fiber qualification

The budget request included $68.9 million in PE 62236N for warfighter sustainment applied research, but included no funding for COTS carbon fiber qualification.

The committee is supportive of efforts to transition new materials and processes for use on present and future aircraft and missile systems. The committee notes that the Department of Defense is currently required to use high-priced single-source fiber to reinforce composite structure. The committee is encouraged with efforts to establish a second source for intermediate modules fiber to ensure more competitive practices and supports further efforts in this regard.

The committee recommends an increase of $3.0 million in PE 62236N to qualify COTS fibers for further applications to Navy weapons platforms.

Compatible processor upgrade

The budget request contained $13.0 million in PE 63739N for Navy logistics productivity demonstration and validation. No funds were provided for continuation of the compatible processor upgrade program (CPUP).

The committee notes that CPUP system-on-a-chip processor products are used to modernize existing computer systems while preserving legacy software and infrastructure, adapt commercial designs for high radiation environments, and optimize system designs. Congress provided funds in fiscal year 2001 to initiate a program for the development of application-specific CPUP processors to upgrade the capability of the Navy's AN/AYK-14, AN/AYK-44, and AN/UYK-20 computers at a fraction of the cost and time required to reengineer legacy software for new computer systems, and provided an additional $2.5 million to continue the program in fiscal year 2002.

The committee recommends an increase of $6.0 million in PE 63739N to complete the CPUP program.

DP-2 thrust vectoring system

The budget request contained $78.3 million in PE 63114N for power projection advanced technology development, but included no funding for the DP-2 thrust vectoring system demonstration project.

DP-2 is a proof-of-concept program to demonstrate the use of thrust vector control to achieve vertical takeoff and conventional takeoff capabilities in a one-half scale flight

test vehicle. The technology offers the potential for a low cost, medium range aircraft of advanced composite construction.

The committee notes the progress to date in the DP-2 program and the initial hover test of the one-half scale test vehicle in January 2002. The committee believes that test progress and the potential of the DP-2 proof-of-concept justify continuation of the program.

The committee recommends an increase of $7.0 million in PE 63114N to continue development and demonstration of the DP-2 thrust vector system concept.

Electric propulsion/ship power system distributed test bed

The budget request contained $57.6 million in PE 63123N for Force Protection Advanced Technology development.

As a part of the Navy's program leading to the development of an all-electric ship, the committee continues to support the development of a virtual, distributed test bed which will provide the software and hardware modeling tools for shipboard machinery design and allow government and industry ship designers and engineers to evaluate machinery alternatives in a virtual prototype before committing to full-scale development.

The committee recommends an increase of $5.0 million in PE 63123N to continue the program for advanced development of a distributed test bed for electric propulsion and ship power systems.

Electronic interconnection research and development program

The budget request contained $82.5 million in PE 63236N for warfighter sustainment advanced technology development.

The committee notes that printed circuit boards (PCB) are fundamental to the operation of military navigation, guidance and control, electronic warfare, missile, and surveillance and communication equipment. High density, highly ruggedized, highly reliable interconnection technology is essential to the performance of many PCB used in military systems. The committee notes that industry PCB focuses on high-volume, low-cost boards rather than the high performance, reliability, and extreme environmental requirements of PCB for use in military systems and at the same time the United States has lost much of its PCB manufacturing capability to overseas sources. The committee recognizes the need to enhance the U.S. capability for development and production of high density, high reliability PCB for use in military systems.

The committee recommends an increase of $3.0 million in PE 63236N to accelerate improvements in PCB technology to meet military requirements now and in the future.

Electronic warfare development

The budget request contained $74.7 million in PE 64270N for electronic warfare (EW) development, but included no funds for risk reduction activities to develop an EA-6B electronic jamming aircraft replacement or to evaluate the location of global positioning system interferers (LOCO GPSI) system in fleet operations.

Airborne electronic attack follow-on

The committee notes that the December 2001 Airborne Electronic Attack Analysis of Alternatives recommended 27

options to replace the EA-6B aircraft and that a final decision on its replacement is planned for fiscal year 2002. Consistent with the fiscal year 2002 decision, the committee further notes that the Department of the Navy has included funds in its future years defense program to develop an airborne electronic attack follow-on beginning in fiscal year 2004 and that the Chief of Naval Operations has included development funding for an EA-6B follow-on aircraft among his unfunded priorities for fiscal year 2003. To accelerate the development of the EA-6B successor, the committee recommends an increase of $10.0 million in PE 64270N for pre-engineering and manufacturing development risk reduction activities.

Location of global positioning system interferers

Location of global positioning system interferers (LOCO GPSI) is a state-of-the-art precision surveillance and targeting system for location of global positioning systems interferers that is designed to protect global positioning system-guided weapons against jamming and interference. The committee understands that Naval operational fleet commanders continue to request deployment of the LOCO GPSI system in fleet exercises to demonstrate and evaluate the military utility of this system. The committee recommends an increase of $3.0 million in PE 64270N to continue to evaluate LOCO GPSI capabilities in fleet operations in fiscal year 2003.

Electro-optical framing sensor

The budget request contained $5.5 million in PE 35206N for airborne reconnaissance systems, but included no funds for electro-optical framing.

The committee is aware that additional improvement is required for SHARP sensors.

The committee recommends $11.5 million in PE 35206N, an increase of $6.0 million for continued development of an integrated electronic shutter to upgrade SHARP sensors and prototype development of a cellular neural network airborne processor.

Extended range guided munitions

The budget request contained $108.7 million in PE 63795N for land attack technology demonstration and validation, including $44.8 million for naval surface fire support and development of the Extended Range Guided Munition (ERGM).

The committee notes the progress in the ERGM program as it completes the controlled test flight phase of the development program and prepares to begin full-scale firings. The committee notes that the schedule for program risk reduction is being reviewed as a result of the decision to adopt a unitary warhead for the projectile. The committee also notes that both the Navy and the prime contractor have funded the development of low cost guidance electrical units to reduce the production cost of the projectile. The committee also notes that the Navy is also evaluating the ANSR projectile, not as a replacement for ERGM, but as a complementary capability to ERGM with the possible application of being fired from both current 5-inch, 54 caliber and 5-inch, 62 caliber gun systems.

The committee recommends an increase of $14.5 million in PE 63795N for risk reduction in the ERGM program, acceleration of guidance and control system redesign and test, and continued

evaluation of the ANSR projectile.

Fibrous monolithic materials insertion

The budget request contained $68.9 million in PE 62236N for warfighter sustainment, but included no funds for fibrous monolithic materials insertion

The committee recommends an increase of $7.0 million in PE 62236N for fibrous monolithic materials insertion.

Formable aligned carbon thermosets

The budget request contained $68.9 million in PE 62236N for warfighter sustainment applied research, but included no funds for formable aligned carbon thermosets (FACTS).

The committee is aware that development of FACTS will allow increased use of advance fibers in tactical aircraft with the attendant benefits of such materials.

The committee recommends an increase of $2.5 million in PE 62236N for FACTS.

Hawk AN/TPS-59 radar service life extension program

The budget request contained $174.7 million in PE 26313M for Marine Corps communications systems, and included $2.6 million for the Hawk AN/TPS-59 radar service life extension program.

The committee is aware that operational experience and engineering analysis has shown that the Hawk AN/TPS-59 radar requires an automatic false alarm reduction mode as part of the service life extension program. The Hawk radar has been continually upgraded and is still a high priority asset for rapid deployment forces.

The committee recommends an increase of $5.0 million in PE 26313M for the AN/TPS-59 radar service life extension program.

High brightness electron source program

The budget request contained $56.3 million in PE 62271N for RF systems applied research, but included no funds for the high brightness electron source program.

The committee is aware that the high brightness electron source program is vital to maintenance of the microwave vacuum tube electronics for high power applications

The committee recommends an increase of $3.0 million in PE 62271N for the high brightness electron source program.

High temperature superconducting AC synchronous Navy propulsion motor and generator

The budget request included $57.6 million in PE 63123N for Force Protection Advanced Technology and included no funding for the High Temperature Superconducting (HTS) AC Synchronous Navy Propulsion Motor and Generator.

The committee supports the Future Naval Capabilities (FNC) program and recognizes that its success depends heavily on innovative scientific breakthroughs in areas such as electronics, sensor development, and propulsion. The committee understands the importance of component miniaturization to achieving FNC goals. In the area of propulsion development in

particular, the committee is aware of engineering analyses and tests that have illuminated the potential benefits offered by HTS motors and generators, particularly in the areas of weight, cost, and noise reduction. The committee supports development in this field and encourages greater investment.

The committee recommends an increase of $7.0 million in PE 63123N for the HTS AC Synchronous Navy Propulsion Motor and Generator development.

Human factors and improved performance integration tool

The budget request included $6.6 million in PE 62236N for Manpower, Personnel, and Human Factors, but included no funding for the Improved Performance Integration Tool and related methodologies.

The committee supports the development of modeling tools that optimize sailor job performance as a means for fulfilling the requirements of the Navy's Future Naval Capabilities. The committee is aware of several Navy force management initiatives and not only encourages a continuation in these areas, but also urges further sailor/unit performance optimization through the use of non-Navy methodologies found elsewhere in the Department of Defense. The committee is particularly interested in the potential benefit of the Improved Performance Integration Tool (IMPRINT) and the Army's manpower and personnel integration (MANPRINT) initiative. The committee urges the Navy to adopt IMPRINT and MANPRINT methodologies in an effort to minimize the total ownership costs of future acquisition programs.

The committee recommends an increase of $2.0 million in PE 62236N for the Improved Performance Integration Tool and related modeling applications.

Hybrid fiber optic/wireless communications

The budget request contained $76.6 million in PE 62114N for common picture applied research.

The committee notes progress being made in applied research for hybrid fiber optic/wireless communications that are characterized by having very high bandwidth, mobility, and low probability of intercept. The overall goal of the program is to develop the technology for versatile, mobile, secure communications systems for military and commercial use that will combine the most desirable features of fiber optic and wireless communications.

The committee recommends an increase of $2.0 million in PE 62114N to continue the program for applied research in hybrid fiber optic/wireless communications.

Integrated maritime picture system of systems

The budget request contained $37.8 million in PE 63235N, including $17.5 million for development of advanced technology for knowledge superiority and assurance.

The committee notes ongoing activities in the Navy and in the other military departments to improve situational awareness and develop an integrated common operational picture for air, land, and sea commanders and their staffs. The committee also notes that the emphasis on increasing force protection for the fleet both in port and at sea will require the integration of information about sea ports, harbors, anchorages, and the

maritime operational environment in the integrated maritime operational picture.

The committee recommends an increase of $3.0 million in PE63235N for advanced development of an integrated maritime common operational picture that will include both force protection and seaport security information and systems.

Interrogator for high-speed retro reflectometer communications

The budget request included $76.6 million in PE 62114N for power projection applied research, but included no funding for a high-speed retro-reflectometer communication interrogator.

The committee strongly supports advanced sensor, processor, and data-link exchange technologies as a means to support, among other things, a greater reliance on unmanned aerial vehicles. High-speed data links are especially needed to rapidly download high resolution imagery from airborne sensors. The committee is aware of a ground-based interrogator technology with the potential for developing fleet-deployable exploitation algorithms and processes for large-bandwidth applications.

The committee recommends an increase of $5.0 million in PE 62114N for developing a laser interrogator for high-speed covert retro-reflectometer communication.

Joint mission high-speed vessel

The budget request contained $51.6 million in PE 63640M, but included no funding for the joint mission high-speed vessel.

The committee notes that the Army, Navy and Marine Corps have been conducting very successful exploration of concepts and capabilities with commercially available advanced hull and propulsion capabilities. The committee also notes the desire to continue concept-based experimentation to enable networked sea-basing as a future joint force expeditionary capability. The committee notes that the objective is to identify a transformational capability enabling high-speed, sustained, sea-based joint operations.

The committee recommends an increase of $9.0 million in PE 63640M for the joint mission high-speed vessel.

Joint operational test bed

The budget request contained $206.4 million in PE 35204N for tactical unmanned aerial vehicles, but included no funds for the joint operational test bed system (JOTBS).

The committee is aware that as a result of the revised unified command plan, the Joint Forces Command will focus on its responsibilities of helping transform the military, including improving joint interoperability and innovation. The committee notes that the JOTBS is fundamental to these responsibilities and vital to future joint use of unmanned aerial vehicles (UAVs). The committee also notes that the JOTBS is vital, not only to complete tactical control system (TCS) development for Predator, but also use by multiple UAVs such as Shadow, Marine Shadow, and other UAVs.

The committee directs the Commander in Chief (CINC), Joint Forces Command to competitively contract for the new Government Flight Activity support contract as follows:

(1) Preparation of the contract solicitation, analysis of responses to the solicitation, and contract award must be conducted in accordance with Department of Defense regulations by an established government contracting organization/office with previous extensive experience in writing GFA support contracts.

(2) The solicitation must be open to all commercial vendors certified in the flight activities covered by the solicitation.

Additionally, the committee directs the Secretary of the Navy and the CINC Joint Forces Command to robustly fund the JOTBS in future years to remove any dependency on congressional increases for its viability. The committee strongly recommends that the Deputy Chief of Naval Operations for Naval Warfare (N7/N78), which sponsors both unmanned aerial vehicles and tactical control system development be designated as the Navy program sponsor for the JOTBS.

The committee recommends an increase of $7.0 million in PE 35204N for JOTBS.

Knowledge projection for fleet maintenance

The budget request contained $57.6 million in PE 63123N for force protection advanced technology development, but included no funds to continue the ``Knowledge Projection for Fleet Maintenance'' project.

Congress provided $2.5 million in fiscal year 2002 to support the initiation by the Navy of a collaborative program for the development of a new system to remotely monitor Navy ships and enable off-board technical experts to assist on-board technicians who are part of the ship's crew in ship maintenance and repair. The committee believes that the successful development and implementation of this approach to knowledge-based system diagnosis and repair could be increasingly important as the Navy makes the transition to ships with reduced numbers of personnel and as electronic equipment and other ships systems continues to be more complex and powerful.

The committee recommends an increase of $3.0 million in PE 63123N to continue the Knowledge Projection for Fleet Maintenance project.

Laser aim scoring system

The budget request contained $31.1 million in PE 64212N for anti-submarine warfare and other helicopter development, but included no funds for the sea-target laser aim scoring system (LASS).

The LASS provides real-time quantitative feedback on critical aspects of laser-guided weapon employment not currently available from existing Navy laser scoring systems, and is being adapted to existing Navy seaborne targets to support Navy H-60 armed helicopter training and readiness events that require laser scoring capability. Since the committee continues to believe that the sea-target LASS could address a Navy training deficiency by allowing in-flight laser designation practice against a moving at-sea target while also providing immediate laser aiming result feedback to the pilot, it recommends an increase of $4.0 million in PE 64212N to develop the sea-target LASS.

Laser welding and cutting

The budget request included $89.4 million in PE 62123N for force protection applied research, but included no funding for the laser welding and cutting program.

The committee supports efforts to improve ship design processes and performance while simultaneously lowering overall construction costs. The committee is aware of laser welding and cutting as a means for design and fabrication enhancements. The committee supports further efforts in this area.

The committee recommends an increase of $3.0 million in PE 62123N for the laser welding and cutting program.

Littoral support craft--experimental

The budget request contained $57.6 million in PE 63123N for Force Protection Advanced Technology development, but included no funding to continue the development of the Littoral Support Craft--Experimental (LSC-X).

The committee notes the continued progress by the Office of Naval Research (ONR) in the development of designs and operational concepts for a littoral support craft: a fast (above 40 knots), high performance, low cost platform that could be an effective adjunct to the major surface combatant and carrier battle group operating in the littoral. The committee strongly supports ONR proposals for a phased program for development of an experimental littoral support craft demonstrator (LSC-X) that would provide the basis for operational experiments on the contribution that such a craft and its variants could make to naval operations in the littoral. The committee understands that the LSC-X design will include development of a modular payload capability to allow the use of different technology demonstrators and warfare mission modules. As such, the committee believes that LSC-X could be an effective experimental test bed for many of the technologies that might be chosen for use on the Littoral Combat Ship (LCS). The committee also notes that among combat related features linked to the LSC-X program is continued development of the Affordable Weapon that is discussed elsewhere in this report.

The committee notes that the ONR has made significant progress on the LSC-X, culminating recently in comprehensive and successful tow tank tests that have resulted in the authorization to proceed with fabrication of the LSC-X full scale prototype in fiscal year 2002.

The committee recommends an increase of $13.7 million in PE 63123N to continue development of the LSC-X.

Low cost swarm unmanned aerial vehicle program

The budget request contained $76.6 million in PE 62114N for power projection applied research, but included no funds for the low cost swarm unmanned aerial vehicle (UAV).

The committee is aware that cost reduction is important to make UAVs affordable at the small unit level. The committee notes that the swarm UAV has achieved significant cost reduction while maintaining meaningful performance, and has the potential to cost-effectively meet close-in surveillance requirements.

The committee recommends an increase of $5.0 million in PE 62114N for low cost swarm unmanned aerial vehicle.

Marine mammal research program

The budget request included $393.6 million in PE 61153N for defense research sciences.

The committee supports the efforts of the Office of Naval Research (ONR) to research marine mammals' behavior and the broad aspects of the underwater environment. The committee is aware of a heightened public concern about underwater acoustic effects on these animals. To address these concerns and better understand the potential contributions of marine mammals to Department of Defense priorities, the committee encourages additional behavioral and acoustics research.

The committee recommends $395.7 million in PE 61153N an increase of $2.1 million for marine mammal research.

Mark-48 advanced capability torpedo improvements

The budget request contained $107.4 million in PE 63561N for Advanced Submarine System Development.

The committee notes that the advanced rapid COTS insertion (A-RCI) program, which uses advanced processing builds (APB) and a multi-purpose processor (MPP) hardware architecture (developed under a small business innovative research (SBIR) phase III project) to achieve rapid, cost-effective advances in signal processing, has successfully and improved the performance of submarine sonar systems in the most cost-effective manner. In fiscal year 2002 Congress provided funds to establish a similar A-RCI program for the MK-48 torpedo, leveraging the experience gained in the submarine sonar program. If successful, the MK-48, A-RCI program could have significantpotential to cost effectively improve performance of the MK-48 torpedo in the demanding littoral waters sonar environment.

The committee recommends an increase of $8.0 million in PE 63561N to continue the program for application of the advanced processing build/multipurpose processor technology insertion process to the MK-48 ADCAP torpedo.

Medical threat detection system

The budget request contained $7.2 million in PE 64771N for medical systems engineering development, but included no funds to develop a real-time medical threat detection system.

The committee is aware of a medical surveillance and informatics system which would use advanced signal processing methods to routinely collect data and identify deviations for normal patterns of illness and detect potential health and medical threats. This system would augment existing Navy medical surveillance and information capabilities to provide real-time surveillance and clinical data for early medical threat detection of both naval force and civilian populations in support homeland security requirements.

The committee is supportive of technologies enhancements for medical safety of personnel and recommends $10.3 million in PE 64771N, an increase of $3.1 million, to establish a real-time medical threat detection system.

Mine countermeasures mine sweep mid-life assessment and upgrade

The budget request contained $155.0 million in PE 63502N

for surface and shallow water mine countermeasures demonstration and validation.

The committee recommends an increase of $5.0 million in PE 63502N to conduct a mid-life assessment of the MCM class Mine Sweeping suite and to evaluate potential upgrades to the system. This recommendation is a part of the committee's mine countermeasures initiative that is discussed in the classified annex to this report.

Mobile fire support system

The budget request contained $51.6 million in PE 63640M for Marine Corps Advanced Technology Demonstrations and included $3.2 million for emerging fires and targeting technologies.

The committee is aware of ongoing efforts at the Marine Corps Warfighting Lab to develop innovative medium-caliber indirect fire support technology to support rapid mobility on the battlefield. Known as Mobile Fire Support System (MFSS), the 120mm rifled mortar program has exhibited unparalleled accuracy, automation, and advanced fire control technology. Additional development is required to further lighten the system and incorporate other design improvements, such as an innovative breach loading capability for extreme firing angles. As a result, the committee is encouraged with the potential applications of this program.

The committee recommends an increase of $5.0 million in PE 63604M, specifically for the acceleration of MFSS development. Furthermore, the committee urges the Secretary of the Army to conduct a comprehensive assessment of MFSS to determine potential applications in accordance with transformational objectives. The committee recommends $1.0 million in PE 63004A for this purpose, as reflected elsewhere in this report.

Modeling and simulation of surgical procedures for battlefield trauma

The budget request contained $19.0 million in PE 63729N for warfighter protection advanced technology development, including $7.6 million for development of advanced technology for casualty care and management.

The committee notes advances in the use of modeling and simulation for the development of advanced surgical procedures for battlefield trauma and the utility of such simulations for the training of field medical personnel.

The committee recommends an increase of $3.5 million in PE 63729N for the development of new protocols for modeling surgical procedures applicable to battlefield trauma.

Multi-purpose sensor

The budget request included $65.1 million in PE 63271N for radio-frequency (RF) systems advanced development, but no funding for the multi-purpose power sensor.

The committee is aware of a promising new surveillance radar detection capability managed by the Office of Naval Research. During initial concept of operation validation, the sensor demonstrated a capability for detecting the presence and intensity of radio frequency energy across a broad spectrum of frequencies. Additional field-testing and development is necessary to deliver a prototype capable of measuring RF exposure with consistent accuracy. The committee supports this

initiative and recognizes the importance of this type of technology for meeting the Navy's future naval capabilities.

The committee recommends an increase of $2.4 million in PE 63271N for the multi-purpose sensor.

National shipbuilding research program

The budget request contained $9.9 million in PE 78730N for the Navy's National Shipbuilding Research Project Advanced Shipbuilding Enterprise (NSRP ASE).

The committee recognizes this innovative Navy-industry collaboration as a credible, cost-effective high-leverage focal point for productivity improvements across all navy ship construction programs. The projects in lean manufacturing, process re-engineering, and other new construction and ship repair technologies funded through the NSRP ASE address both prior year shipbuilding cost growth and the cost of future ships. Adequately funding this investment now helps to ensure that the resultant efficiencies are in place before the pending increase in naval ship construction rates needed to re-capitalize the fleet. This program is a key imperative that enables significant reductions in the cost and time required for affordable naval ship construction, conversion, and repair.

The committee recommends $9.9 million in PE 78730N for the NSRP ASE and recommends that all funds in this program element be focused only on those critical elements of the NSRP ASE program that identify and adopt improved business practices which maximize actual U.S. Navy ship production within available Navy shipbuilding and construction funding. The committee strongly urges the Secretary of the Navy to continue to place a high priority on the NSRP ASE program by funding it in future budget requests at an annual amount equal to or greater than the fiscal year 2002 level of $22.4 million.

Naval collaboration tool set

The budget request contained $43.2 million in PE 65013N for Navy information technology development and modernization.

The committee notes the development and application of emerging network centric information systems and collaboration tools that use basic web technology and commercial-off-the-shelf computer and software products to enable operational commanders and their staffs to rapidly share battlespace information and situational awareness and achieve greater mission effectiveness and speed of command and operations. The accelerating proliferation and application of information sharing and collaboration tools create the opportunity for the Navy to capitalize on the experience gained in prototype web-based information systems being used in the fleet in various warfare areas and develop a ``best of breed'', web-based set of collaboration tools that will enhance the ability of naval commanders and their staffs to operate in a common, integrated data environment.

The committee recommends $48.2 million in PE 65013N, an increase of $5.0 million to accelerate the development of a naval collaboration toolset that can be used in all warfare areas and domains, including building a common undersea picture and facilitating collaboration in homeland security and counterterrorism.

Navy common command and decision system

The budget request contained $40.5 million in PE 63582N for the Navy's combat systems integration demonstration and validation program.

The common command and decision (CC&D) program is a pre-planned product improvement (P3I) to the AEGIS Weapons System and the Ship Self Defense System MK 2 that replaces the command and decision capability presently in these systems with a common set of application computer programs and associated supporting software infrastructure which will perform selected command and decision functions in an identical manner across multiple Navy ships.

The committee notes that the Navy has established a collaborative program for development of the CC&D that will build on the Multi-purpose Processor/Advanced Processor Build techniques developed and proven in the submarine Acoustic Rapid Commercial-off-the-shelf Insertion (A-RCI) program. The program of record would result in initial introduction of the CC&D system in the fleet in 2010; however, the committee notes that the Navy has indicated that with appropriate funding the CC&D capability could be fielded as early as 2005.

The committee strongly believes that the Navy should accelerate the program for upgrade and insertion of advanced technology in combat systems of legacy surface ships of the battle fleet. The committee recommends an increase of $20.0 million in PE 63582N to accelerate development of the CC&D system.

Navy support of research in oceanography

The budget request contained $55.2 million in PE 62435N for ocean warfighting environment applied research.

The committee believes that scientific knowledge of the oceans and ocean environments makes a critical contribution to U.S. national security and commercial vitality. The committee notes, that in large part, U.S. scientific expertise in oceanography and ocean sciences is sustained by the Office of Naval Research and the National Science Foundation partnership that provides oversight of the University-National Oceanographic Laboratory System (UNOLS) fleet.

The committee recognizes the age of the UNOLS fleet and the need for a rational plan for renewal of the fleet over the next ten years. Therefore, the committee directs the Secretary of the Navy to submit to the Senate Committee on Armed Services and House Committee on Armed Services no later than February 1, 2003, a report detailing specific requirements and outlining a specific plan for UNOLS fleet renewal. The report should include specific recommendations on the numbers of each class of ship to be maintained in the UNOLS fleet, their geographic distribution, the schedule for their replacement, and estimates of ship construction costs.

In the committee report on H.R. 1401 (H. Rept. 106-162), the committee noted the finding of the National Ocean Research Leadership Council's Ocean Research Advisory Panel that one of the most pressing concerns in oceanography is the need for integrated ocean observation systems. The committee notes recommendations that have been made for what it believes to be a piecemeal commitment to establishing regional coastal ocean observing systems without a clear concept or plan for how these

regional systems will fit into a national integrated ocean and coastal observation system. The committee requests that the Secretary of the Navy as in his role as a member of the National Ocean Research Leadership Council encourage the Council to develop standards and plans for the establishment and administration of an integrated ocean and coastal observing system that provides for long-term, continuous, and real-time observations of the coastal oceans of the United States and to report those plans to Congress in the Council's next annual report on the National Oceanographic Partnership Program.

The committee recommends $60.2 million in PE 62435N, an increase of $5.0 million for the coastal ocean observation system. The committee directs that the increase for the coastal ocean observation system may not be obligated until 30 days after the Council's report detailing the standards and plans for the establishment and administration of an integrated ocean and coastal observation system is received by the Senate Committee on Armed Services and the House Committee on Armed Services.

Navy tactical unmanned aerial vehicle

The budget request contained $206.4 million in PE 35204N for tactical unmanned aerial vehicles (TUAV), and included $43.6 million for vertical TUAV (VTUAV), and $9.1 million for the tactical control system (TCS).

The committee is aware that the Navy terminated the Fire Scout VTUAV program and has requested funds for developing the Air Force Global Hawk endurance UAV for broad area maritime surveillance. The committee notes that though the Navy, which is the lead service for the joint tactical control system (TCS) development, no longer has a TUAV program, its responsibilities for program management for TCS remain. The committee further notes that both the Army and Marine Corps are fielding variants of the Shadow UAV, are committed to TCS for Shadow, and are critically dependent on successful Navy program management of TCS.

The committee recommends a decrease of $43.6 million in PE 35204N for the Fire Scout VTUAV.

Nonlinear dynamics stochastic resonance

The budget request contained $13.2 million in PE 63254N for anti-submarine warfare (ASW) systems development, for the continued development and evaluation of nonlinear dynamics and stochastic resonance (NDSR) for acoustic, magnetic, and other ASW sensor and signal processing applications.

The NDSR program was initiated in 1999 to apply the principles and results from the emerging science of nonlinear dynamics towards critical problems in shallow water anti-submarine warfare (ASW) with the goal of producing dramatic improvements in ASW system capability. The committee notes that the research conducted to date has demonstrated that there is a strong potential for greatly increased ASW system performance resulting from significantly extended electromagnetic detection ranges, enhanced sonar target discrimination and improved noise reduction.

The committee recommends $18.2 million in PE 63254N, an increase of $5.0 million to continue the development, demonstration, and evaluation of NDSR technology for ASW

applications.

Ocean modeling for mine and expeditionary warfare

The budget request contained $43.7 million in PE 63782N for mine and expeditionary warfare advanced technology development, including $19.3 million for advanced surveillance and reconnaissance.

The committee notes the Navy's need for improved tactical and strategic information for the littoral battlespace environment, improved detection of submarine and mines in turbid littoral regions, development of predictive models for the littoral environment, and development of improved sensor technologies.

The committee recommends $46.7 million in PE 63782N, an increase of $3.0 million for advanced technology development of ocean modeling for mine and expeditionary warfare.

Organ transfer technology

The budget request contained $19.0 million in PE 63729N for warfighter protection advanced technology development. No funds were requested for continuation of the organ transfer technology program.

The committee notes continued progress in the development of immune therapies by investigators at the Naval Medical Research Center that have been shown to prevent the rejection of tissue and organ transplants without the need for continuous use of immunosuppressive drugs. In fiscal year 2001, the Chief of Naval Research initiated a program to capitalize on these newly developed methods of treatment. Congress provided $3.0 million to initiate a clinical trials program in fiscal year 2001 and $2.0 million to continue the program in fiscal year 2002.

The committee notes the initial progress in the clinical trials program and plans to bring additional patients into the program to broaden the program base. The committee believes that the ability to transplant massive tissue segments without rejection could revolutionize the treatment of combat casualties who suffer significant tissue loss or organ damage from blast, missile fragments or burns.

The committee recommends an increase of $5.0 million in PE 63729N to continue the organ transfer technology clinical trials program.

Photovoltaic energy park

The budget request contained $2.1 million in PE 63725N for demonstration and validation of improvements in naval facilities.

The committee notes that rising energy costs, the availability and reliability of traditional sources of fossil fuels, and increased concerns about the effect of gaseous emissions on the environment and fossil fuel pollution have fostered great interest in developing renewable energy sources such as solar power, hydrogen, and fuel cells. The committee is aware of ongoing discussions for the development of prototype large-scale solar powered electrical generating systems and also understands that public/private partnerships have been established for development and evaluation of advanced fuel

cells. The committee believes that renewable energy from electricity generated using solar power and from advanced fuel cells could meet the need for reliable and secure sources of non-polluting electric power and energy for military forces.

The committee recommends $4.6 million in PE 63725N, including an increase of $2.5 million for development and demonstration of renewable energy sources, including solar-powered electrical generation plants, hydrogen, and fuel cells.

Portable digital precision location system

The budget request contained $76.6 million in PE 62114N for power projection applied research, but included no funds for the portable digital precision location system.

The committee is aware that many shipboard functions are being automated, in order to reduce crew size. The committee notes that in order to maintain vigilance and combat effectiveness under reduced manning, personnel identification and location technologies are required.

The committee recommends an increase of $4.4 million in PE 62114N for the portable digital precision location system.

Portable sterile water production device

The budget request included $19.0 million in PE 63729N for warfighter protection advanced technology, but included no funds for the portable sterile water production device.

The committee supports efforts by the Office of Naval Research to leverage ongoing research in the field of sterile water production and managed by the Army's Medical Research and Development Command. The committee understands this research promises to produce a lightweight portable remote water-for-injection purification system for combat casualty care. The committee supports additional research on this project to facilitate testing of potential military applications.

The committee recommends an increase of $2.6 million in PE 63729N for the portable sterile water production device.

Rapid deployment fortification wall

The budget request included $51.6 million in PE 63640M for Marine Corps advanced technology demonstrations, but included no funding for the rapid deployment fortification wall.

The committee is aware of a potentially innovative technology for improving ground forces barrier defense. The Rapid Deployment Fortification Wall is an expandable, stackable, modular wall made of tough, lightweight, environmentally responsible plastic that can possibly serve as a replacement for sandbags. The committee believes that the technology can serve to rapidly construct field fortifications for bunkers, standoff blast and ballistic protection units, and other hardened shelters, and may prove more easily transportable and re-usable. The committee urges additional testing of this technology, with a particular focus given to transport (ground and aerial), manning, live-fire, and recycling requirements and capabilities.

The committee recommends an increase of $1.5 million in PE 63640M million for the rapid deployment fortification wall.

Rapid retargeting

The budget request contained $13.0 million in PE 63739N for Navy Logistic Productivity demonstration and validation, including $4.9 million for rapid retargeting. The committee notes that, within the logistics productivity program, the Navy has implemented a rapid retargeting project to address obsolete designs in electronic systems.

The project provides the technology to eliminate obsolete components and reduce multiple electronic modules to single programmable designs. The committee understands that the rapid retargeting process is also being employed to replace different types of standard electronic modules with programmable commercial-off-the-shelf components, thereby reducing the requirements for spare parts on board naval vessels.

The committee recommends an increase of $5.0 million in PE 63739N for the Navy's rapid retargeting project.

Real-time heart rate variability monitor

The budget request contained $7.5 million in PE 63216N for aviation survivability, but included no funds for real-time heart rate variability monitor.

The committee notes that real time heart rate variability monitor technology can be used to automate protective systems, aid in survivor identification and remotely determine physiological status.

The committee recommends an increase of $8.0 million in PE 63216N for real-time heart rate variability monitor.

Real-time precision tracking radar

The budget request contained $78.3 million in PE 63114N for power projection technology, but included no funds for real-time precision tracking radar.

The committee is aware that real-time precision tracking radar will provide the warfighter with a lightweight, low-cost, high-resolution synthetic aperture radar with moving target detection capability.

The committee recommends an increase of $9.0 million in PE 63114N for real-time precision tracking radar.

SEALs Mark 5 patrol craft modification

The budget request contained $57.6 million in PE 63123N for force protection advanced technology development.

The committee notes the progress in the Office of Naval Research (ONR) program to evaluate the ability of Project M technology to mitigate the high shock and vibration experienced by the Navy SEALs Mark V patrol craft crew and passengers in high-speed special operations. Project M is an active noise and vibration cancellation system that was developed in the Navy's advanced submarine technology program.

The committee recommends an increase of $6.0 million in PE 63123N to continue the ONR program for application of Project M technology to mitigate physical shock to crew and passengers in the Mark V patrol craft.

Shipboard integrated data environment

The budget request contained $82.5 million in PE 63236N for

war fighter sustainment advance technology development, including $17.0 million for expeditionary development and demonstration.

The committee notes that the installation of fiber optic and Ethernet local area networks on ships makes possible not only the use of web-based communications and data sharing among the various elements in the network on board the ship, but also provides the capability for a fully interactive, ship-wide integration of physical plant and support operations, maintenance, logistics, training, and financial data systems. The committee believes that such a capability, coupled to other ships of the fleet and the Navy's shore establishment through the Navy's Information Technology 21, the Navy-Marine Corps Intranet, or the Global Combat Support System could provide a fully,integrated operations support and logistics network that would significantly improve maintenance and logistical support of the ships of the fleet and of forward-deployed shore activities, while potentially reducing Navy manpower requirements. The committee also notes that various naval operational support, engineering, and logistical activities are pursuing individual solutions for creating a capability for real-time in-service engineering, logistical, and life cycle support to the deployed ships of the fleet

The committee recommends an increase of $3.5 million in PE 63236N to initiate a program for development and demonstration of a prototype shipboard integrated data environment. The committee encourages the Secretary of the Navy to establish a common program among the various elements of the supporting shore establishment for development of the capability for providing real-time operational and logistical support to the deployed ships of the fleet.

Ship self defense electronic warfare systems

The budget request contained $28.1 million in PE 64757N for the development of engagement and soft kill capabilities of ship self defense, of which $25.9 million was for continued development of the advanced integrated electronic warfare system (AIEWS).

Subsequent to the submission of the fiscal year 2003 budget request, the Department of the Navy notified the committee that it had terminated the AIEWS program due to cost overruns and continued schedule delays, which have adversely impacted the Navy's ability to field urgently needed surface electronic warfare improvements, and requested that the all funding for AIEWS research, development, test, and evaluation be transferred to the AN/SLQ-32, shipboard electronic warfare system, to initiate a product improvement program.

The committee recommends an increase of $1.6 million in PE 64757N, including a decrease of $25.9 million to reflect the Navy's decision to terminate the AIEWS project and an increase of $27.5 for the development of AN/SLQ-32 shipboard electronic warfare system improvements.

Ship service fuel cell

The budget request contained $57.6 million in PE 63123N for force protection advanced technology development.

The committee recommends an increase of $4.0 million in PE 63123N to continue the development of a direct ship service fuel cell technology demonstrator for technology validation and

training of ship systems engineers, designers, system integrators, operators and engineering students.

Small combatant craft

The budget request contained $57.6 million in PE 63123N for force protection advanced technology.

The committee recommends an increase of $2.0 million in PE 63123N for acquisition, test, and evaluation of a high-speed, shallow draft, off-shore capable assault boat for assault and troop transport insertion and extraction operations. The committee believes that this small combatant craft research will provide Marine Corps and Special Operations Forces with potential assault craft options by examining trade-offs between weight, payload, fuel efficiency and range, durability, and tactical survivability.

Sniper rifle improvements

The budget request included $36.0 million in PE 26623M for Marine Corps ground combat/supporting arms systems.

The committee is aware that rifle accuracy is critical for long range snipers, and urges that platoon long-range sniper rifle capability be improved for maximum accuracy.

Therefore the committee recommends an increase of $750 thousand in PE 26623M for the weapons training battalion product improvement of sniper rifles and sniper rifle manufacturing capability.

Stationary lighter than air platform

The budget request contained $174.7 million in PE 26313M for Marine Corps communications systems.

The committee is aware that the Marine Corps stationary lighter than air platform (MCSLaP) would provide a means for the Marine Corps expeditionary forces to rapidly extend voice and data beyond the line-of-sight. The committee notes that the Marine Corps is investigating commercial-off-the-shelf (COTS) sensor and payload packages to combine with COTS aerostat technology to provide this over-the-horizon capability.

The committee recommends an increase of $5.0 million in PE 26313A for MCSLaP.

Submarine payloads and sensors program

The budget request contained $107.4 million in PE 63561N for development, demonstration, and validation of advanced submarine systems

The committee notes that the Defense Advanced Research Projects Agency/Navy submarine payloads and sensors program resulted in the development of a number of innovative, but realistic payload, sensor and platform concepts that would enable a revolutionary expansion of capabilities and allow the submarine to play a more decisive role in Joint Force operations, especially in the ability to exert greater influence over events on shore. The concepts provide a potential roadmap to the future through successive implementations that would use the Virginia class nuclear attack submarine as a baseline point of departure.

The committee recommends an increase of $7.0 million in PE

63561N for follow-on studies and demonstration of advanced submarine payloads and sensors capabilities.

Submarine tactical warfare system

The budget request contained $14.0 million in PE 64562N for submarine combat control system (CCS) upgrades to the Mark two (MK2) variant.

These upgrades replace obsolete equipment and converge multiple submarine CCSs into a single program, which provides component commonality, incorporates Tactical Tomahawk cruise missile launch capability, and reduces life cycle costs with an open architecture for future system enhancements.

The committee believes that this system would increase the warfighting capability of submarines, and recommends $28.3 million for PE 64562N, an increase of $14.3 million, to accelerate development of CCS MK2 upgrades.

Superconducting DC homopolar motor

The budget request contained $57.6 million in PE 63123N for force protection advanced technology development, including $14.9 million for surface ship and submarine hull, mechanical and electrical advanced technology, but included no funding to continue the program for development and demonstration of a superconducting direct current homopolar motor.

The committee notes the progress being made in the Office of Naval Research project for development of a 5000 shaft-horsepower superconducting, direct current, homopolar motor that may be used in the experimental littoral support craft program and could provide a prototype for a full-scale motor in the 25,000 to 50,000 shaft horsepower range which could be a primary power source for a major combatant or other class ship. The committee notes that completion of the program in fiscal year 2003 should provide information for the Navy to determine if development should continue on this motor for use in future integrated electric drive ships.

The committee recommends an increase of $5.0 million in PE 63123N to complete development and at-sea testing of the DC homopolar motor.

Supply chain best practices

The budget request contained $929 thousand in PE 65804N for technical information services that support cooperative advanced technology initiatives between the Navy and U.S. industry with the goals of improving affordability, and reducing the life cycle costs of new and modernized Navy systems.

The committee recommends $6.9 million in PE 65804N, an increase of $6.0 million to continue the program for development and adoption of industrial and logistical best business and management practices among government and industry in support of defense systems. The committee encourages the Office of Naval Research to include funding for this program in future Navy budgets.

Surface navy integrated undersea tactical technology

The budget request contained $155.0 million in PE 63502N

for demonstration and validation of surface and shallow water mine countermeasures.

The committee notes that in order to effectively conduct the anti-submarine warfare (ASW) and mine warfare (MIW) missions, naval forces must be able to reliably detect, locate, and target enemy mines and submarines, respond rapidly and decisively to these hostile contacts, employ integrated ASW and MIW systems with very high probability of neutralizing the target and provide all commanders with a common under sea picture of the undersea battle space. This requirement places a premium on development of a common undersea picture that includes threat and environmental characterization along with the undersea warfare platforms and sensors.

The committee recommends an increase of $10.0 million in PE 63502N for development of the common undersea picture.

Target location designated handoff system

The budget request contained $36.0 million in PE 26623M for Marine Corps ground combat/supporting arms systems, and included $14.6 million for the Marine Corps ground weaponry product improvement program, but included no funds for the target location designated handoff system.

The committee is aware that it is imperative to continue to upgrade existing targeting capabilities to ensure interoperability with the emerging joint and Marine Corps tactical command, control, communications and computer architecture.

The committee recommends an increase of $1.9 million in PE 26623M for the target location designated handoff system.

Vacuum electronics

The budget request contained $56.3 million in PE 62271N for applied research in radio frequency technology, including $4.5 million for applied research in radio frequency vacuum electronics power amplifiers.

The committee report on H.R. 1402 (H. Rept. 106-162) noted the committee's support for a robust vacuum electronics research and development program in the Department of Defense and other federal agencies. The committee has reviewed the results of the Secretary of the Navy's report to Congress on the DOD vacuum electronics program and the DOD's April 2001 Technology Area Review and Assessment (TARA) on creating a balanced tri-service investment strategy for RF vacuum electronics and solid state power technologies. The committee endorses the TARA views on the criticality of support for both vacuum electronics and solid-state power technologies. The committee notes the TARA review's recommendations for increased funding in the tri-service vacuum electronics program and for establishment of a combined tri-service initiative to rapidly advance wide bandgap semiconductor device technology to enable advanced military radar and other systems requiring power electronics in the mid-to-long term. The committee is disappointed that the Department of Defense has not implemented the recommendations from the TARA review.

The committee recommends an increase of $8.0 million in PE 62271N for applied research in vacuum electronics, an increase of $8.0 million. The committee expects the Under Secretary of Defense (Acquisition, Technology, and Logistics) through the

Director of Defense Research and Engineering to ensure a balanced investment strategy for vacuum electronics and solid state power technologies that will meet DOD requirements for current and future systems that use radio frequency power electronics.

Water purification-expeditionary warfare

The budget request contained $51.6 million in PE 63640M for Marine Corps advanced technology demonstration, but included no funds for water purification-expeditionary warfare.

The committee is aware that providing an adequate supply of water to deployed forces represents the number one logistical problem of expeditionary warfare. Expeditionary missions around the world must deal with ground water that has contaminates which range from high salinity to oil pollution. The water purification-expeditionary warfare program will conduct a field demonstration of advanced technology to show increased performance and/or reduced cost for water purification and offers to significantly upgrade existing water purification systems with advanced technology.

The committee recommends an increase of $2 million in PE 63640M for the water purification-expeditionary warfare program.

Wide band gap semiconductor materials

The budget request contained $5.5 million in PE 61153N for basic research and $30.0 million in PE 62712E and $3.5 million in PE 62271N for applied research in wide band gap semiconductor electronics.

Section 212 of the National Defense Authorization Action for Fiscal Year 2002 (Public Law 107-107) required the Secretary of Defense to carry out a cooperative program to develop and demonstrate advanced technologies and concepts for future Naval radar systems and other applications, with particular emphasis on development of high frequency and high power wide band gap semiconductor materials and devices. The provision also required the DDRE to report to the congressional defense committees on the implementation of the plan, including identification of the funding required to carry out the fiscal year 2003 program and for the future years defense program. The committee has not yet received the DDRE's report.

The committee continues to place a high priority on the development of the technology for advanced wide band gap semiconductor materials and devices for future naval radar and other applications. The committee notes the results of the December 2000 Special Technology Review on Radio Frequency Applications for Wide Band Gap Technology by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics that recommended an increased science and technology investment in wide band gap materials, devices, circuits, and packaging which would total approximately $50 million a year over a five-year period beginning in fiscal year 2002, in order to develop the technologies necessary to field advanced radar systems in time to meet the Navy's and the Department of Defense requirements in 2015.

The committee recommends a total of $47.0 million for basic and applied research in wide band gap semiconductor materials technology, an increase of $8.0 million to the budget request

and including $30 million in PE 62712N, $5.5 million in PE 61153N, and $11.5 million in PE 62271N.

Air Force RDT&E

Overview

The budget request contained $17,601.2 million for Air Force RDT&E. The committee recommends authorization of $18,803.2 million, an increase of $1,202.0 million.

The committee recommendations for the fiscal year 2003 Air Force RDT&E program are identified in the table below. Major changes to the Air Force request are discussed following the table.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Advanced aluminum aerostructures

The budget request contained $22.3 million in PE 63211F for aerospace technology development, including $9.6 million for continued development of advanced aluminum aerostructures.

The committee is aware that advanced aluminum aerostructures have demonstrated significant cost, weight, and production process reductions for the C-17 and C-130 aircraft, and offer similar improvements for future programs such as F-22 and Joint Strike Fighter.

The committee recommends $26.3 million in PE 63211F, an increase of $4.0 million for continuation of advanced aluminum aerostructures.

Advanced concept ejection seat II improvement

The budget request contained $925 thousand in PE 64706F for development of aircraft life support systems, but included no funds for the advanced concept ejection seat (ACES) II pre-planned product improvement (PPPI) program. The ACES II is the pilot ejection seat used on all Department of the Air Force combat aircraft except the B-52 bomber.

The committee understands that Air Force pilots continue to experience injuries from high-speed ejections, which can be rectified by inflatable restraints and improved parachute design. The committee further understands that an improved modular ACES II seat design has the potential to both reduce maintenance requirements, thereby lowering life-cycle costs, and to accommodate smaller-sized females and larger-sized males.

To address these improvements in the ACES II, the committee recommends $8.0 million in PE 64706F, an increase of $7.1 million, for continuation of the ACES II PPPI program and encourages the Air Force to continue to provide funds for the ACES II PPPI in its future years defense program.

Advanced thermal protection systems

The budget request contained $75.3 million in PE 62102F for materials, but included no funds for advanced thermal

protection systems (TPS).

The committee is aware that current thermal protection materials are derivatives of materials designed specifically for long range missile applications and do not provide adequate protection for current and emerging requirements to address prolonged, high temperature stresses of in-atmosphere hypersonic flight. Advanced TPS materials have demonstrated the capability to provide enhanced protection, as well as weight reduction, and offer solutions for aerostructures in development and planned for the future.

The committee recommends an increase of $3.5 million in PE 62102F for advanced TPS.

Aging landing gear life extension program

The budget request contained $19.9 million in PE 65011F for development of products and services to improve the performance of aging aircraft systems but included no funds for the aging landing gear life extension (ALGLE) program.

The ALGLE program addresses the operational, safety and maintenance consequences of increased mishaps resulting from landing gear failures as well as low mission capable rates for KC-135, C-130, C-5 and F-16 aircraft that are attributable to either unavailable or unreliable landing gear assets. The committee notes that the ALGLE program is prototyping new landing gear component modifications, developing new repair techniques, and exploiting new technologies. The committee understands that these efforts have already resulted in life cycle cost reductions of over $62.0 million, and that the program has the potential to further reduce life cycle costs by over $400.0 million.

Accordingly, the committee believes that this program should continue to address the Air Force's aging landing gear problems in fiscal year 2003 and in subsequent years. The committee recommends $34.9 million in PE 65011F, an increase of $15.0 million, for continuation of the ALGLE program.

Air combat training ranges

The budget request contained $13.5 million in PE 64735F for combat training range development but included no funds to integrate tactical data information and ground tracking in the Nellis Air Combat Training System (NACTS).

The NACTS, configured with instrumentation to determine aerial combat outcomes, is used to train aircrews and ground-based participants for combat. The committee understands that the joint tactical information distribution system (JTIDS), an aircraft data system to exchange time-critical targeting data, will be integrated into the NACTS in fiscal year 2002, but that the NACTS does not have the capability to assess the effectiveness of JTIDS uses in NACTS tactics training scenarios for aircrew and ground participants.

The committee recommends $16.5 million in PE 64735F, an increase of $3.0 million, to integrate tactical data information and ground tracking into the NACTS.

Air Force manufacturing technology program

The budget request contained $37.6 million in PE 78011F for the Air Force's Industrial Preparedness Manufacturing

Technology program, a reduction of $21.4 million from the amount provided in fiscal year 2002.

The committee is concerned by the low level of fiscal year 2003 funding requested by the Air Force for the Manufacturing Technology (ManTech) program. The ManTech Program has an outstanding record of strengthening industrial base capability, shortening lead times for manufacturing applications and defense products, improving weapon system affordability, and speeding the transition and insertion of vital technology out of the laboratory and into operational use for the warfighter. The basic capability of the industrial base to produce military weapons is supported strongly by commercial investments, but military-unique industrial capabilities required to elevate our weapon systems above those of potential adversaries depend on military investment. The ManTech Program is a critical element of the investment needed to transform the industrial capability to support the transformation of the armed forces. The requested budget of $37.6 million is far short of the level needed to support, sustain, and enable such a transformation.

The committee strongly recommends that the Secretary of the Air Force restore the program to a funding level of at least $70 million for fiscal year 2004, and to consider treating the ManTech Program as an Air Force corporate investment program with annual funding of at least 1 percent of the total funds budgeted for Air Force Research, Development, Test, and Evaluation.

Air Force/national systems cooperation

The budget request contained $8.8 million in PE 63856F for Air Force/national systems cooperation.

The committee is aware that the Air Force and national systems management are now combined within the office of the Under Secretary of the Air Force, and that therefore cooperation should result in reduced costs and should not require additional funding.

The committee recommends $2.8 million in PE 63856F, a decrease of $6.0 million for Air Force/national systems cooperation.

Ceramic matrix composites

The budget request contained $21.1 million in PE 63112F for advanced materials for weapons systems, but included no funding for ceramic matrix composites.

The committee notes that ceramic matrix composite materials offer significant weight reduction and enhanced durability for high performance jet engines used in the F-22 and Joint Strike Fighter.

The committee recommends an increase of $3.0 million in PE 63112F for continued development of ceramic matrix composites.

Compass Call upgrades

The budget request contained $3.9 million in PE 27253F for Compass Call, and included $2.5 million to develop and integrate new technologies to sustain Compass Call.

The committee notes that Compass Call is the Air Force's airborne wide area coverage offensive counter information system. The committee is aware that the Tactical Radio

Acquisition and Countermeasures Subsystem (TRACS) represents the next evolutionary capability increase in receiver/ countermeasures capability for Compass Call.

The committee recommends $11.9 million in PE 27253F, an increase of $8.0 million for TRACS.

Electronic countermeasures upgrades for the generic radar target generator

The budget request contained $46.3 million in PE 64759F for major T&E investment, but included no funds for electronic countermeasures upgrades for the generic radar target generator (RTG).

The committee is aware test ranges and training ranges are constantly challenged to provide operationally realistic threat environments for electronic countermeasures. The RTG will provide threat representative aircraft signatures and high fidelity models to represent the environments the warfighter is likely to encounter on today's battlefields.

The committee recommends an increase of $4.0 million in PE 64759F for electronic countermeasures upgrades for the generic RTG.

Electronic warfare development

The budget request contained $65.1 million in PE 64270F for electronic warfare (EW) development, of which $10.6 million was included for the precision location and identification (PLAID) technology program, but included no funds for the development of the comet infra-red (IR) countermeasures system.

Precision location and identification

The PLAID technology program will improve aircrew situational awareness by providing accurate ground emitter location and unambiguous identification. The committee understands that the budget request for fiscal year 2003 does not provide for the development of a PLAID capability that would pass ground emitter target locations to other systems nor provide for risk-reduction flight testing of this capability.

The committee recommends an increase of $14.7 million for this purpose.

Comet infra-red countermeasures system

Elsewhere in this report, the committee recommends a procurement increase for the comet IR countermeasures system, but understands that further testing is required in fiscal year 2003 to develop the comet IR countermeasures production configuration. Since the Air Force Chief of Staff included comet IR countermeasures among his top unfunded priorities for fiscal year 2003, the committee recommends an increase of $5.2 million for this purpose.

The committee recommends $85.0 million in PE 64270F, an increase of $19.9 million.

Global Hawk high altitude endurance unmanned aerial vehicle

Air Force

The budget contained $309.0 million in PE 35205F for endurance unmanned aerial vehicles, and included $306.0 for Global Hawk high altitude endurance (HAE) unmanned aerial vehicle (UAV). The Defense Emergency Response Fund (DERF) contained an additional $128.3 million for Global Hawk and

associated sensor electronics development.

The committee notes the recent operational success of Global Hawk and supports introduction of this new capability. However, the committee is aware that the joint engineering team is methodically re-baselining the Global Hawk program and recognizes that this process must be thorough and complete to form the basis for a strong, well-structured production phase. The committee recognizes that while the air vehicle definition may be more mature than sensor packages, determining the proper sensors is fundamental to the future success of Global Hawk. The committee recalls the problems associated with other programs making the transition from an advanced concept technology demonstration to formal acquisition, and believes that those experiences have shown that extra attention to detail is important as the transition to acquisition is made. Some Global Hawk documentation required by the DOD 5000 series acquisition regulations is either incomplete or in various stages of development, and must be completed.

The committee believes that the proper goal for the Global Hawk acquisition program should be to expeditiously field a meaningful operational capability for the warfighter. However, determination of a proper operational capability for Global Hawk that fits within the overall intelligence, reconnaissance and surveillance architecture, is essential to successful production.

The committee believes that cost reduction efforts are essential to allow fielding Global Hawk in meaningful numbers and notes that while production rate affects average per unit cost, the proper design, robust but not gold plated, has an even greater potential to limit cost and schedule growth. Industrial facilities can be efficiently sized for a particular rate, given stable production goals. The Secretary of the Air Force should ensure that industrial production facilities are sized at an appropriate and realistic capacity, based on a firm commitment to a sustained rate of production, rather than an overly optimistic estimate that leads to unwarranted investment in production facilities.

The committee also believes that the Air Force should make maximum appropriate use of off-the-shelf technology and open standards in order to minimize system costs and allow competition, rather than engaging in prolonged development that slightly improves performance while causing great expense and years of potential delay. The committee is also aware of the Navy's new UAV concept exploration effort examining Global Hawk and, should the Navy decide to use Global Hawk, believes that the sensors and platform should remain common with the Air Force variant unless modifications are justified as necessary to meet mission requirements.

The committee notes that basing and infrastructure development are also cost drivers and must be developed with maximum commonality and minimum duplication, again based on a realistic estimate of procurement numbers. The committee notes that shared Air Force-Navy Global Hawk basing facilities might offer cost savings should the Navy decide, after its broad area maritime surveillance (BAMS) experimentation, to acquire Global Hawk.

The committee directs the Secretary of the Air Force to re-baseline the Global Hawk by December 31, 2002. This new baseline should incorporate a clear roadmap of technology insertion leading to an objective configuration. The re-

baselining shall be established on realistic per unit costs, with and without sensors; address the evolutionary growth structure or ``spiral'' cost, schedule objectives, and milestone decisions.

The committee recommends the budget request for Global Hawk.

Navy

The budget request contained $206.4 million in PE 35204N and included $152.0 million for Global Hawk and $28.3 million in the DERF fiscal year 2003 for sensor development.

The committee is very concerned that the Navy enters the Global Hawk program with clear maritime requirements and notes that there is currently no mission needs statement, no analysis of multiple concepts, and no specific exit criteria. The committee directs the Secretary of the Navy not to obligate more that 20 percent of the Navy's Global Hawk funding until these requirements have been met for the Broad Area Maritime Surveillance (BAMS) Phase I demonstration in accordance with DOD 5000 series.

The committee directs the Secretary of the Navy to submit the acquisition strategy for the BAMS Unmanned Aerial Vehicle (UAV) to the congressional defense and intelligence committees.

The committee recommends $180.3 million in PE 35204N for Global Hawk, including $28.3 million for sensor development in the DERF for fiscal year 2003.

GPS-II program adjustment

The budget request contained $324.1 million in PE 35165F for the NAVSTAR global positioning system (GPS).

The committee is aware that recent program adjustments have eliminated funds included to modify future GPS-II satellites to increase power.

Therefore, the committee recommends $275.1 million in PE 35165F, a decrease of $49.0 million for GPS-II.

Guidance, propulsion, and re-entry vehicle demonstration/validation

The budget request contains $63.0M in PE 63851F for the development of guidance, propulsion, and re-entry vehicle technology demonstration and validation programs.

The committee is concerned that a number of Air Force science and technology efforts to develop space vehicle and missile technologies are not being effectively coordinated and tested.

Therefore, the committee recommends that the demonstration and validation efforts for development of guidance, propulsion, re-entry vehicles be executed by the Ballistic Missile Technology office and the Rocket Propulsion Laboratory, and demonstration/validation of advanced technologies and new capabilities be executed by the Space and Missile System Center Detachment Rocket Program.

High-accuracy network determination system

The budget request contained $6.5 million in PE 63444F for the Maui space surveillance system, but included no funds for the high-accuracy network determination system (HANDS).

The committee understands the importance of maintaining space situational awareness to ensure collision avoidance of

national assets and space debris. The committee is aware that potential collisions can unduly draw attention from mission space-based national requirements. Accurate determination of target satellite orbits, neighboring satellites and debris is key to collision avoidance operations and threat management. HANDS can reduce the potential for collision by reducing errors in the current space-object maintenance catalog. The committee supports further development of this initiative.

The committee recommends $11.5 million in PE 63444F, an increase of $5.0 million for the high-accuracy network determination system.

Identification of time critical programs

The budget request contained $34.3 million in PE 63789F for C3I advanced development, including $4.2 million for continued development of identification of time critical programs.

The committee is aware of the importance of reducing the sensor-to-shooter engagement time for hi-value, short-duration battlefield targets and fully supports continued development of technologies for this purpose.

The committee recommends an increase of $4.3 million in PE 63789F for accelerated testing and evaluation of time critical target identification.

Information operation technology and fusion initiative

The budget request included $9.4 million in PE 33140F for the information systems security program, but included no funds for the information operation technology and fusion initiative.

The committee notes that the Information Systems Security Program conducts research and development of information protection tools and transitions them to operational systems. The committee also notes that the effort concentrates on transitioning state of the art information operation capabilities to the warfighter by demonstrating and validating advanced technology necessary to address specific deficiencies and shortfalls identified by the Air Intelligence Agency. The committee further notes that the aim of the program is to expedite technology to the field through rapid prototyping.

The committee believes deficiencies exist in the area of information operations, information assurance, information fusion, and information security. The committee understands that advanced development can eventually eliminate these deficiencies, particularly when applied in a collaborative program utilizing industry, academia, and government resources. The committee encourages the Secretary of the Air Force to pursue this initiative.

The committee recommends $12.4 million in PE 33140F, an increase of $3.0 million, for the information operation technology and fusion initiative.

Information security and intrusion detection development

The budget request included $34.3 million in 63789F for command, control, communications, and intelligence (C3I) advanced development, and included $7.0 million for battlespace information exchange and $9.3 million for dynamic aerospace command and control execution.

The committee is concerned with the growing threat to

information exchange procedures, supports efforts to develop innovative security measures, and applauds Air Force efforts to develop and test components of a secure, deployable information grid. The committee understands that technology developments include an information assurance decision support system, advanced information management, multi-level secure communications, secure survivable networks, and communications transmission systems.

The committee is also aware of efforts to develop an intrusion defense capability as a means for detecting and defeating hostile forces trying to embed digital information as a means of deception. The committee is supportive of these and other efforts aimed at reinforcing information integrity activities and urges further investment in these areas.

The committee recommends an increase of $4.0 million in PE 63789F for development, product tests, and the fielding of intrusion defenses and system security tools.

Integrated high payoff rocket propulsion technology

The budget request contained $53.6 million in PE 62500F for Air Force Multi-disciplinary Space Technology, including $19.6 million for integrated high payoff rocket propulsion technology and $76.6 million in PE 62114N for Navy Power Projection Applied Research, including $13.6 million for integrated high payoff rocket propulsion technology.

The committee notes the improvements in large and small rocket engine propulsion capability made available through the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program and supports the increased emphasis placed on IHPRPT by the Department of Defense and the Air Force.

The committee recommends an increase of $5.0 million in PE 62500F and $5.0 million in PE 62114N for integrated high payoff rocket propulsion technology.

Joint air to surface standoff missile

The budget request contained $42.1 million in PE 27325F for the Joint Air to Surface Standoff Missile (JASSM), including $19.6 million for integrated high payoff rocket propulsion technology.

The committee notes the recent series of successful JASSM flight tests and is aware of Air Force efforts to extend the missile range to provide longer stand-off and sustain or improve accuracy. The committee is encouraged by the proposed plan to develop the extended range segment of the JASSM program, and supports acceleration of that effort.

The committee recommends $52.1 million in PE 27325F, an increase of $10.0 million for accelerated testing and evaluation of and extended range JASSM.

Joint integrated satellite communications technology

The budget request contained $148.9 million in PE 64479F for Mistar LDR/MDR satellite communications, but included no funds for joint integrated satellite communications (SATCOM) technology (JIST).

The committee is aware that JIST is a web-based satellite communications management technology that utilizes the Department's existing internet protocol router to expand the

flexibility and efficiency of military satellite communications. The committee notes that development systems like JIST, based on common standards, is key to increased satellite communications efficiency.

The committee recommends $157.0 million in PE 64479F, an increase of $8.1 million for JIST.

Joint services work station

The budget request contained $55.5 million in PE 27581F for Joint STARS, including $19.3 million for the Joint Services Work Station.

The committee is aware of the importance of maintaining multi-service interoperability for all supporting elements of the Joint STARS systems.

The committee recommends $68.2 million in PE 27581F, including $32.0 million for the continued development of the Joint Services Work Station, an increase of $12.7 million.

Laser induced surface improvement technology

The budget request contained $46.3 million in PE 64759F for major test and evaluation investment, but included no funds for laser induced surface improvement technology (LISI).

The committee is aware that the LISI technology has been demonstrated to significantly extend product life by improving surface properties and increasing resistance to the effects of wear and corrosion. The committee notes that the technology has reached prototype development stage for demonstration projects on military components.

The committee recommends an increase of $3.0 million in PE 64759F to complete the prototype processing facility to move laser induced surface improvement technology into fielded applications.

Lithium ion battery development

The budget request contained $107.7 million in PE 62203F for aerospace propulsion, and included $9.9 million for lithium ion battery development.

The committee notes the development of improved batteries and fuel cells continues to afford significant savings and enhancement in weapons and communicationsystem. The next generation, high-energy/density, lithium ion battery will enable development and production of smaller, lighter aircraft, space vehicles, and hand held electronic equipment.

The committee recommends an increase of $6.0 million in PE 62203F for continued development of the lithium ion battery.

Low emission/efficient hybrid aviation refueling truck propulsion

The budget request contained $35.8 million in PE 78611F for support systems development, but included no funds for low emission/efficient hybrid fuel truck propulsion.

The committee is informed that existing Air Force aviation refueling trucks operate short distances in a manner that causes high fuel usage, high emissions and decreased engine life. The committee notes that a heavy-duty hybrid drive technology has been developed for aviation refueling trucks.

The committee recommends an increase of $1.0 million in PE

78611F for installation and test of low emission/efficient hybrid aviation refueling truck propulsion.

Metals affordability initiative

The budget request contained $75.3 million in PE 62102F and $21.1 million in PE 63112F for materials development, and $37.6 million in PE 78011F for industrial preparedness, but included no funds for continuation of the metals affordability initiative (MAI).

The committee is aware that the MAI represents a unique government-industry collaboration to provide significant improvements in the manufacturing of specialty aerospace metals.

The committee fully supports the continuation of the MAI and recommends an increase of $4.0 million in PE 62102F, an increase of $5.0 million in PE 63112F, and an increase of $3.0 million in PE 78011F for acceleration of the initiative.

Missile technology demonstration

The budget request contained $16.2 million in PE 65860F for the rocket systems launch program, but included no funds for continuation of the missile technology demonstration (MTD-3b).

The committee is aware that the MTD-3b continues to mature technologies that support high speed weapon system platforms.

The committee recommends $27.2 million in PE 65860F, an increase of $11.0 million for MTD-3b.

Network centric collaborative targeting

The budget request contained no funding in PE 35207F for manned reconnaissance systems.

The committee recognizes the Air Force's thrust towards network centric warfare, but notes that the Air Force requested no money towards this effort.

The committee recommends $20.0 million in PE 35207F, an increase of $20.0 million for network centric collaborative targeting advance concepts technology demonstration.

Pulse detonation engine

The budget request contained $107.7 million in PE 62203F for propulsion development, including $16.0 million for continued development of the pulse detonation engine (PDE).

The committee is aware that the PDE offers significant cost and performance advantages over conventional engines

The committee supports Air Force plans to fabricate and test a flight worthy prototype and recommends an increase of $6.0 million in PE 62203F for accelerated testing and evaluation of the PDE.

Rapid attack support system

The budget request contained no funds in PE 27027F for continued development of the rapid attack support system.

The committee is aware that software development has progressed to the point that many of the systems in the DOD Joint Technical Architecture can be tied together to enhance the process of rapid targeting and attack.

The committee recommends $5.0 million in PE 27027F for transition of the rapid attack support system to production.

Scorpius

The budget request contained $42.3 million in PE 63401F for advanced spacecraft technology, but included no funds for Scorpius.

The committee is aware that Scorpius development responds to the Air Force mission need statement for operationally responsive, affordable space lift. The committee notes that Scorpius had a successful sub-orbital launch on the first attempt.

The committee recommends an increase of $3.5 million in PE 63401F for Scorpius.

Space Technology

The Air Force's budget includes significant out-year funding for Minuteman IV and future space vehicle development activities. To minimize development costs, common technologies and requirements for ballistic missiles and space vehicles should be shared between the Air Force and the Navy. To assure resources are properly focused on future strategic system development, the committee recommends that the Air Force ensure that efforts of the Space and Missile Systems Center and the Air Force ResearchLaboratory are combined so that both development and test facilities address technology requirements for future strategic missile and space systems in a coordinated fashion.

The committee recommends an increase of $1.0 million in PE 63311F, Ballistic Missile Technology, and $1.0 million in PE 62201F, Aerospace Propulsion, to coordinate future missile and space systems requirements and technology.

Streaker small launch vehicle

The budget request contained $42.3 million in PE 63401F for advanced spacecraft technology, but included no funds for the Streaker small launch vehicle.

The committee is aware that space launch remains a very expensive portion of the space program. The committee notes that a low cost launch technology is being developed for micro and nano satellites, which offers potential to significantly reduce, associated launch costs.

The committee recommends an increase of $5.0 million in PE 63401F for the Streaker small launch vehicle.

Super wideband compressive receiver

The budget contained $4.5 million in PE 63260F for intelligence advanced development, but included no funds for super wideband compressive receiver (SWCR) technology.

The committee is aware SWCR technology has near-term potential to greatly improve receiver capability for multiple applications. SWCR technology combined with software reprogrammability may also offer rapid adaptation to new wave forms.

The committee recommends $5.5 million in PE 63260F, an increase of $1.0 for million SWCR.

Synthetic theatre operations research model

The budget request contained $21.9 million in PE 27601F for Air Force Modeling and Simulation, but included no funds for the synthetic theatre operations research model (STORM).

The committee is aware that the Joint Model Transition (JMT) project has been created to support the development and upgrade of research and development models, and notes that STORM offers the potential to be an excellent candidate for the first year of the JMT initiative.

The committee recommends $23.9 million in PE 27601F, an increase of $2.0 million for the continued development of STORM within the JMT project.

Texas regional institute for environmental studies

The budget request contained no funds in PE 63723F for environmental engineering technology.

The committee continues to support the ongoing Texas Regional Institute for Environmental Studies (TRIES) research and development of environmental technologies to protect military water supply systems. The committee encourages further work in this area, and remains supportive of the cooperative partnership arrangement between TRIES and the Air Force.

The committee recommends $3 million in PE 63723F for TRIES to demonstrate new deployable bioreactor technologies.

Thermal management for space structures

The budget request contained $75.3 million in PE 62102F for materials, and more than $8.0 million the thermal management for aerospace structures.

The committee is aware that the Office of Naval Research and the Air Force Research Lab have demonstrated the potential to improve performance and reduce weight on military aircraft and spacecraft by using ultra-high thermal conductivity carbon fibers for selected electronics/avionics components and structures. The Air Force launched a program in this area in fiscal year 2000, and significant progress has been made. The committee understands that the Air Force has qualified use of these carbon fibers for manufacturing compact electronic enclosures for satellite passive cooling systems. The committee supports further development in this initiative and encourages the qualification of these composite materials for applications across all fleets of military aircraft.

The committee recommends an increase of $3.2 million in PE 62102F for continued development of thermal management for space structures.

Thrust vector control and infrared signature reduction

The budget request contained $85.7 million in PE 63216F for aerospace propulsion and power technology, but included no funding for thrust vector control and infrared signature reduction.

The committee is aware that the Air Force is experimenting with a propulsion flow control to reduce the heat signature of fighter jets that will reduce vulnerability to heat seeking missiles.

The committee recommends an increase of $3.0 million in PE

63216F for continued development of thrust vector control and infrared signature reduction.

Upper atmospheric and astronomical training

The budget request contained $219.1 million in PE 61102F for Defense Research Sciences, but included no funding for enhanced upper atmospheric and astronomical training.

The committee is aware that the Air Force has provided extensive scientific training in upper atmospheric and astronomical research to both government and non-government audiences. However, the training facilities are limited in capacity and in need of expansion and enhancement. The committee notes that an Air Force investment of $5.0 million for enhanced scientific research equipment would be combined with non-government funding to complete the project.

The committee recommends an increase of $5.0 million for enhanced upper atmospheric and astronomical training.

Vacuum pump

The budget request contained $39.9 million in PE 62605F for Directed Energy Technology, but included no funds for the vacuum pump.

The committee is aware of the potential benefits afforded by upgrades to vacuum pump systems at Air Force laser facilities, and recommends $42.25 million in PE 62605F, an increase of $2.25 million for vacuum pump system upgrades.

Wind-corrected munitions dispenser development

The budget request contained no funds in PE 64600F for munitions dispenser development.

The committee understands that the Air Force intends to terminate the Joint Stand Off Weapon ``B'' variant dispenser weapon in fiscal year 2003 due to technical delays and cost increases.

Accordingly, the Air Force Chief of Staff has identified a $16.2 million fiscal year 2003 unfunded requirement to extend the range of the unpowered wind corrected munitions dispenser (WCMD) by developing a deployable wing system for the WCMD, which would enable the weapon to glide for an extended range (ER). The committee notes the effective use of the gravity fall WCMD in Operation Enduring Freedom and believes a WCMD-ER enhancement would provide an additional stand off weapon capability within the Air Force's war reserve munition stock, and, recommends $16.2 million in PE 64600F for development of the WCMD-ER.

Defense-Wide RDT&E

Overview

The budget request contained $16,613.6 million for Defense-Wide RDT&E. The committee recommends authorization of $17,191.2 million, an increase of $309.1 million and the transfer of $268.6M million for missile defense programs from Army RDT&E to Defense-wide RDT&E.

The committee recommendations for the fiscal year 2003

Defense-Wide RDT&E program are identified in the table below. Major changes to the Defense-Wide request are discussed following the table.
<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Items of Special Interest

Advanced sensor applications program

The budget request included $16.0 million in PE 63714D8Z for the advanced sensor applications program.

The Committee is concerned that promising projects executed by the Navy's (PMA264) program office are appreciably under funded. Additional details are contained in the classified annex to this report.

Therefore the committee recommends an increase of $5.0 million in PE 63714D8Z for the advanced sensor applications program.

Aircraft affordability initiative

The budget request included $10.3 million in PE 64805D8Z for the Department of Defense Commercial Operations and Support Savings Initiative (COSSI), and included no funds for the digital electronic warfare (EW) aircraft affordability initiative. The committee notes that the stated goal of COSSI is to adapt commercial technologies to reduce operations and support (O&S) costs and to improve overall weapons systems performance.

The committee remains supportive of the EW digital product improvement program (PIP) based on its promise to substantially decrease high-performance aircraft O&S costs and increase combat performance. The committee understands the potential benefits associated with a reduction in both weight and power consumption requirements aboard such aircraft, and notes the potential savings associated with a wholesale conversion to a digital EW receiver. The committee notes significant progress to date in the requisite software development, design, and testing of a digital receiver and two associated modules for the F-22 aircraft. The committee supports a continuation of this effort, and encourages implementation of design verification testing and Lot 4 insertion in the F-22 program.

The committee recommends $18.3 million in PE 64805D8Z, an increase of $8.0 million, for the digital EW PIP aircraft affordability initiative.

Backscatter mobile truck system

The budget request contained $33.6 million in PE 63228D8Z for physical security equipment, but included no funds for the backscatter mobile truck system.

The committee is aware that the backscatter mobile truck system is a commercial-off-the-shelf system capable of detecting organic materials in shipping containers and vehicles.

The committee recommends an increase of $16.0 million in PE 63228D8Z for the backscatter mobile truck system

Ballistic missile defense

The budget request contained $7,763.0 million for ballistic missile defense and related activities, $12.6 million less than the comparable fiscal year 2002 appropriation. The request included $6,690.7 million in research, development, test and evaluation (RDT&E) and $23.4 million in military construction for the Missile Defense Agency (MDA), as well as $312.3 million in Army RDT&E, $72.9 million in Defense-Wide RDT&E, and $663.7 million in Army missile procurement.

The committee recommends $7,784.0 million for ballistic missile defense, an increase of $21.0 million. The committee authorizes $7,003.7 million for MDA, reflecting transfers of $117.7 million for the Medium Extended Air Defense System (MEADS) program from the Army PE 63869A to the MDA PE 63881C and $150.8 million for Patriot Advanced Capability-3 (PAC-3) improvements from the Army PE 64865A to MDA in PE 64865C, and a net increase of $21.0 million. The transfers are consistent with the committee's view, as expressed in Section 23X, that responsibility for research and development related to improvements of fielded systems should remain with MDA to ensure component integration and interoperability with the ballistic missile defense ``system of systems''.

Silicon carbide based wide bandgap technology

The budget request contained $121.8 million in PE 63175C for advanced technology development, but included no funds for silicon carbide based wide bandgap technology.

The committee remains concerned about the apparently small fraction of MDA's budget devoted to technology development (1.8 percent in the request), noting that these activities lead to evolving capabilities for countering advanced threats. The committee understands that significant program specific technology development occurs within individual programs, and believes that MDA should establish a means to more fully account for its technology investments across-the-board.

The committee recommends $127.3 million for technology, an increase of $5.5 million for development of silicon carbide based wide bandgap semi-conductor technology. Wide bandgap technology finds wide application in advanced power electronics, particularly ground based radar and next generation communication systems.

Ballistic missile defense system

The budget request contained $1,066.0 million in PE 63880C for the Ballistic Missile Defense (BMD) system but included no funds for wide bandwidth technology and $8.1 million for Battlespace Environment and Signatures Toolkit.

The BMD system elements comprise battle management, command and control (BM/C2), communications, targets and countermeasures, system engineering and integration, and system-wide test and evaluation. The committee understands that the globally distributed ballistic missile defense system will be the most complex architecture ever attempted by the Department of Defense. Although the scientific hurdles are relatively small, the engineering challenges associated with orchestrating an effective defense are considerable, and the committee supports MDA's efforts to build a national industry team to address system component integration and interoperability.

Wide bandwidth technology program

The committee recognizes the value of wide bandwidth information technology to improve operational efficiency and

test infrastructure, and recommends $10.0 million for the Wide Bandwidth Technology program.

Battlespace environment and signatures toolkit

The committee notes the ongoing work to develop the Battlespace Environment and Signatures Toolkit program to model threat signatures and supports the efforts to maintain a current threat signature database and tools to integrate current information into ongoing missile defense program.

The committee recommends an increase of $10.0 million to accelerate this effort.

Terminal defense segment

The budget request contained $170.0 million in PE 63881C for the terminal defense segment, including $65.7 million for Arrow.

Enhanced Arrow deployability program

The terminal defense segment includes $65.7 million for Arrow, primarily for the Arrow System Improvement Program to evolve system capabilities to counter advanced missile threats to Israel. The committee recommends an increase of $21.0 million for the Enhanced Arrow Deployability Program to enhance Arrow system operational capabilities and interoperability with missile defense systems of the United States.

Navy area program

The terminal defense segment also contains $90.0 million for a sea-based terminal program to develop alternatives to the Navy Area program, which was terminated on December 14, 2001 as a result of a Nunn-McCurdy cost breach. The committee supports the Administration's efforts to enforce fiscal discipline in major development and acquisition programs, but notes the undiminished need for lower tier sea-based defense, and encourages MDA to move expeditiously in pursuing alternatives.

The committee recommends $308.7 million, an increase of $117.7 million, which reflects transfer of MEADS into this program element, and an increase of $21.0 million for Arrow

Midcourse defense segment

The budget request contained $3,195.1 million in PE 63882C for the midcourse defense segment, including $426.6 million for sea-based midcourse defense.

Ground based midcourse defense

The budget request includes $533.9 million for the 2004 Pacific Test Bed and $2,072.5 million for ground-based midcourse defense, both down significantly from fiscal year 2002. The committee is encouraged by the recent flight test successes of this program, but more importantly by the test rate, which is now approaching three-month centers. The committee strongly believes that programs of this level of sophistication and maturity only seriously move forward when the test program reaches a critical momentum.

Aegis LEAP interceptor flight demonstration program

The committee understands that the sea based midcourse defense segment is still in its infancy, but is encouraged by the first intercept achieved in the Aegis LEAP Interceptor (ALI) Flight Demonstration Program with an interceptor launched from the Aegis cruiser USS Lake Erie in January. The committee recommends an increase of $27.0 million to purchase additional ALI test articles for threat representative testing.

Long range S-band and X-band discrimination radar development

The committee is also supportive of the new emphasis on improving existing shipboard radar to enable better ballistic

missile discrimination and tracking and recommends an increase of $25.0 million to accelerate long range S-band and X-band discrimination radar development.

The committee recommends $3,244.6 million, an increase of $52 million for ALI flight demonstration program and $25.0 million for long range radar improvements.

Boost defense segment

The budget request contained $796.9 million in PE 63883C for the boost defense segment.

The committee recommends $719.4 million, a decrease of $77.5 million.

Of the amount requested, $144.0 million is for ``hit-to-kill'' boost phase intercept programs that rely on the energy of motion (kinetic energy) of the interceptor to negate the target. The request supports two programs, consisting of $89.6 million for a sea-based boost program leading to a demonstration in fiscal year 2005, and $54.4 million for a space-based boost program leading to a demonstration in fiscal year 2006. The committee is concerned that, given the amount of tactical air power already available, and recent successes with armed unmanned aerial vehicles in Operation Enduring Freedom, MDA may have overlooked the most promising near term alternative for boost phase defense--air--based kinetic energy boost phase intercept. The committee urges MDA to give serious consideration to this option.

Of the amount requested, $625.4 million is for directed energy boost phase programs that rely on laser heating to induce structural failure of the target. The request for directed energy programs consists of $34.8 million for the space-based laser and $598.0 million for the airborne laser (ABL).

In the case of ABL, the committee is concerned by escalating costs and the slip in schedule of a lethal shoot down demonstration from fiscal year 2003 to fiscal year 2005. The committee understands the formidable technical challenges this program faces. While the committee expects that one day directed energy will play a role in ballistic missile defense, the committee notes that the 30 plus year historical record on developing lethal, militarily-useful systems is singularly unimpressive. The committee questions a boost phase defense investment strategy that relies on this difficult technology to the extent that the current program does, and encourages MDA to more seriously pursue alternative approaches. The committee recommends $520.5 million for ABL, a reduction of $77.5 million specifically to funds requested to begin payments on a second aircraft and purchase long lead optics.

Sensors segment

The budget request contained $373.4 million in PE 63884C for the boost defense segment.

The committee recommends the budget request. The committee believes that space-based sensors with play a key role in ballistic missile defense, and supports the restructured Space-Based Infrared System-low (SBIRS-low) program proposed by MDA. The restructured program will begin to place satellites in orbit in the fiscal year 2006-2007 timeframe to support, with current developmental technologies, the activities of the 2004 Pacific Test Bed, but will continue to compete and evolve more capable sensor payloads for later launches.

THAAD and PAC-3

The budget request contained $932.2 million in PE 64861C

for the Theater High Altitude Air Defense system (THAAD, and $150.8 million in PE 64865A for PAC-3 engineering and manufacturing development (EMD). Funds for these two programs were requested under separate program elements, as required for programs in EMD by section 223(b) of title 10, United States Code, as amended by Section 232 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107).

The committee supports the budget request, but moves PAC-3 EMD funding into MDA for reasons previously discussed. The committee notes that the Army began fielding limited numbers of PAC-3 missiles in September of 2001 as planned, and has begun initial operational testing while continuing an RDT&E program to improve the system's capability against an expanded threat set.

After a troubled test program culminating in intercept of two ballistic missile targets in 1999, THAAD entered EMD in fiscal year 2000. However, the program is not scheduled to resume flight tests until late fiscal year 2004. The committee understands that the THAAD interceptor is undergoing major redesign and re-engineering, but given the nearly $1 billion budget for this program, and the likelihood that certain flaws will only be uncovered in flight, the committee questions the advisability of such a long hiatus in flight testing.

Cooperative programs

Although the committee believes that the United States should lead in the development of ballistic missile defense systems, the committee does not think that missile defense should be a protection simply provided by the United States to the international community, but rather a capability whose benefits and costs are shared with friends and allies. Accordingly, the committee makes special note of support for international cooperative programs in the budget request, including $65.7 million for Israel's Arrow terminal missile defense program in PE 63881C, $69.1 million for the Russian-American Observation Satellite program in PE 63884C, $79.0 million for cooperative research with Japan on sea-based upper tier defense in PE 63882C, and $117.7 million for co-development with Italy and Germany of the Medium Extended Air Defense System (MEADS) in PE 63869A. The committee is familiar with the special difficulties associated with execution of international cooperative programs, but believes that such programs help to advance the national security agenda of the United States.

Exploration of alternative approaches

The committee understands that the Department may investigate other options for ballistic missile defense--nuclear--armed interceptors, blast fragmentation warheads, and directed energy technologies--as alternatives to current approaches based predominantly on hit-to-kill technology. The committee would consider such an examination of alternatives to be a prudent step, consistent with the commitment to evaluate all available technological options for this critical mission.

Ballistic missile defense baseline reports

The Committee is aware that the Missile Defense Agency (MDA) is in the process of completing an internal planning document known as the Technical Objectives and Goals document (TOG). As the cornerstone of this system engineering process, the TOG and applicable supporting systems engineering documents provide a development baseline for each block within the overall ballistic missile defense system that sets performance

goals at the system, project, and in some cases the component level. The Committee further understands that the TOG will be an essential document in formulating the 2004 budget request. The resulting Ballistic Missile Defense (BMD) System baseline from this process will be documented as part of the BMD System Selected Acquisition Reports, submitted annually to Congress.

The Committee directs the Director of MDA to ensure that the relevant performance goals and development baselines of the TOG be communicated to Congress as part of the budget justification materials accompanying the FY 2004 and future budget requests. Such development baselines shall be made available for each block. In particular, the baselines shall be made available for projects developing systems that may be fielded, and other programs and projects identified as congressional special interest items.

The Committee recognizes the difficulty in summarizing data to make it readily understandable for Congress. This difficulty is compounded by the transition from a requirements-based acquisition process to a capability-based process. The Committeefurther appreciates and supports the efforts made by MDA to respond in a timely fashion to requests for further information made by the Committee. To make the voluminous data that MDA provides more readily understandable, the Committee directs the Director of MDA to ensure that the annual budget justification material for each system include the funding profile for developing the major components of each of the projects that may be fielded, and for each block of that system.

The committee notes that section 232(h) of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107) requires a report by the Director of Operational Test and Evaluation (OT&E) by no later than February 15 of each year. To date, no specific report by the Director of OT&E has been received. The Committee directs the Director of OT&E to comply with the statutory requirement, and expects the Missile Defense Agency to continue to work cooperatively with the Director of OT&E so that the report may be prepared and submitted in a timely fashion in the future.

Cobra blue force tracking equipment

The budget request contained $281.4 million in PE 116404BB for tactical systems development, but included no funds for blue force tracking equipment.

The committee is aware that the Army Special Operations Command has an approved combat mission needs statement (MNS) to equip its teams with secure blue force tracking devices. It is also aware that the Marine Corps has a draft MNS for its Marine expeditionary units. The committee notes that a limited blue force tracking capability has been deployed, with unanimous praise from the units so equipped. The committee further notes that additional equipment is required to fully equip deployed Army Special Forces and Marine Expeditionary Units.

The committee recommends $283.9 million in PE 116404BB, an increase of $2.5 million to develop the next generation cobra blue force tracking equipment.

Chemical/biological defense research, development, test and evaluation program

The budget request contained a total of $932.9 million for chemical/biological defense research, development, test, and

evaluation, including $64.1 million in PE 61384BP for basic research, $262.2 million in PE 62384BP for applied research, $249.8 million in PE 63384BP for advanced technology development, $144.8 million in PE 63884BP for demonstration/validation, $169.0 million in PE 64384BP for engineering and manufacturing development, and $43.0 million in PE 65384BP for RDT&E management support. The budget request also contained $133.0 million in PE 62383E for the Defense Advanced Research Projects Agency (DARPA) biological warfare defense research program.

Engineered pathogen identification and countermeasures program

The committee notes that the potential threat of using unknown or genetically modified pathogens as biological warfare agents places a high premium on the ability to rapidly identify the pathogen and its disease producing characteristics and to develop and implement therapies for countering the agent. The committee understands that human genome mapping promises beneficial advances both in medicine and in the identification and treatment of biological warfare pathogens. Advances in biotechnology, computational biology and computational chemistry promise the capability to shrink the drug research cycle significantly. In fiscal year 2002, Congress provided $2.0 million to initiate a program for rapid identification and development of countermeasures to biological warfare and engineering pathogens.

The committee recommends an increase of $7.0 million in PE 61384BP to continue the program for applied research in identification and development of countermeasures to genetically modified or engineered pathogens.

Rapid antibody-based biological countermeasures

The committee has been advised that recent advances in molecular biology combined with advances in microbiology have resulted in the development of powerful technologies, based upon a human antibody platform, which can be used to devise effective countermeasures against biological weapons.

The committee recommends an increase of $2.0 million in PE 62384BP for applied research in human antibody-based countermeasures against biological agents.

Multi-wavelength surface scanning biological sensor

The budget request contained $16.0 in PE 63714D8Z for the advanced sensors applications program.

The committee understands that recent advances in multi-wavelength excitation spectral technology shows promise for development of high spectral resolution fluorescence systems that would provide the capability to detect and identify biologic agents not discernible with conventional sensors by exploiting the fine spectral signatures of both the biologic target and the existing background. The committee notes oversight by the Office of the Secretary the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) of a program for development and demonstration of multi-wavelength excitation spectral technology that, if successful, could provide a leap-ahead improvement in the scanning and screening of potentially contaminated locations.

The committee recommends an increase of $2.0 million in PE 63714D8Z to continue the development of active, high-resolution, broad-band infrared sensors for real-time detection and identification of pathogens. The committee directs the Assistant to the Secretary of Defense (Chemical-Biological

Defense) and the Director, Defense Advanced Research Projects Agency to review the program for coordination and potential integration in related programs in the DOD chemical-biological defense program or DARPA biological warfare defense program.

Chemical-biological regenerative air filters

The committee recommends an increase of $8.0 million in PE 62384BP to accelerate the program for applied research in chemical-biological regenerative airfiltration technology to replace activated charcoal filters in Navy and other collective protection systems.

Chemical-biological mass spectrometer II

The chemical-biological mass spectrometer (CBMS) is a detector capable of both biological and chemical agent detection and identification. The CBMS Block I system is a component of the P3I Biological Integrated Detection System (BIDS). The CBMS Block II system is an improved system that is being developed for inclusion in the NBCRS Block II system (IAV-NBCRV) and the Joint Service Lightweight NBCRS system. The CBMS II is being further enhanced to allow operation as a stand-alone system.

The committee understands that CBMS Block has demonstrated an effective chemical agent detection and identification capability and that the currently funded effort would complete the development of this chemical capability. A January 2002 peer review of further testing concluded that the CBMS Block II had demonstrated the potential capability for biological detection and that continued development should focus on the development and testing of biological agent identification algorithms, improve systems reliability and producibility, and develop a logistics and maintenance support program. Successful completion of the development program would result in a single integrated detection system for future nuclear, biological, chemical reconnaissance platforms.

The committee recommends an increase of $10.0 million in PE 63884BP to accelerate the program for development and demonstration of the CBMS Block II.

Asymmetric protocols for biological defense enhancement

The committee recommends $137.0 million in PE 62383E, an increase of $4.0 million for applied research in asymmetric protocols for biological defense with emphasis on enhancing individual non-specific immunities to and blocking pathogens from biological warfare threat agents.

Mustard gas prophylactic

The budget request included $262.2 million in PE 62384BP for the Chemical Biological Defense program, but included no funding for the development of a mustard gas prophylactic.

The committee recognizes the threat of mustard gas as a potential weapon of mass destruction and notes that existing methods of protection are focused primarily on external apparel. The committee is aware of a technology, referred to as Signal Transduction Interruption Methodology Antioxidant Liposomes (STIMAL) that might provide a prophylactic defense. The anticipated research product supports the body's immune and molecular systems to first stabilize and then accelerate the recovery process in cases of unprotected exposure. Prophylactic treatment testing has yielded a rate of treatment as high as 83% and shows some promise for even higher rates with further development. The committee supports further research, development, and testing to accelerate this initiative.

The committee recommends an increase of $3.0 million in PE

62384BP for STIMAL.

Biological defense homeland security test bed

The budget request included $485.1 million for Department of Defense (DOD) homeland security initiatives requested by the Office of Homeland Security: the biological counterterrorism research program and the biological defense homeland security support program. The committee understands that the objective of the biological defense homeland security support program is to initiate a comprehensive pilot program to build a National Biological Defense System for the Office of Homeland Security. The program will create and deploy a national, multi-component, multi-organization defense capability that is targeted to protect urban areas, other high-value assets, and special events; and to provide an integrated homeland security capability designed to detect, mitigate, and respond to biological-related incidents. The committee notes that the Department's fiscal year 2003 plans for the program include establishment of a fully equipped DOD test bed in each of the military departments, an enhanced chemical-biological monitoring system in the National Capitol Region, and an initial biological surveillance and monitoring capability in two additional urban areas.

The committee understands that the pilot project to increase chemical biological defense capabilities at DOD installations will equip nine diverse DOD installations selected by the military departments with state-of-the-art contamination avoidance, protection and decontamination equipment, enhanced emergency response capabilities for consequence management, and an integrated command and control network. The project will also include a comprehensive training and exercise plan for each installation.

The committee notes, however, that the criteria and process for selecting the locations of, and establishing the two urban area test beds have not been determined.

The committee believes that the Department of Defense should proceed promptly with a pilot program for establishing the two urban area test beds to provide the capability to develop, test, validate and deploy technologies and systems that will provide for increased homeland security. The committee also believes that selection of the sites for these test beds should take into account the factors of the potential biological threat to the area, geography, transportation and other critical infrastructure networks, military and government presence. Other criteria should include previously established crisis and consequence response capabilities, industrial, medical, and academic activities, and the availability of state, regional, local governmental, and non-governmental activities that would participate in the test bed.

The committee directs the Secretary of Defense to establish a competitive program for selection of urban area test beds in the biological defense homeland security support program. The committee believes that the regional biological defense network will serve as a national model to develop and promote integrated solutions to secure America's borders, support first responders and defend against bioterrorism.

C3I intelligence programs

The budget request contained $75.7 million in PE 35190D8Z and $5.6 million in the Defense Emergency Response Fund (DERF)

for C3I intelligence programs.

The committee notes that the program has a very significant increase over the prior year, due to a new program called horizontal fusion. This program has insufficient program definition associated with it.

The committee recommends a decrease of $34.0 million in PE 35190D8Z for C3I intelligence programs.

Combat sent data distribution upgrade

The budget request included $4.6 million in PE 35207G for manned reconnaissance systems, but included no funds for the Combat Sent data distribution upgrade.

The committee is aware that Combat Sent does not have a high data-rate communications link to allow near real-time distribution of data to theater commanders and analysis centers.

The committee recommends $12.9 million in PE 35207G, an increase of 8.3 million for the Combat Sent data distribution upgrade.

Combating terrorism technology support

The budget request contained $49.0 million in PE 63122D8Z for the combating terrorism technology support program. The program develops technology and prototype equipment that address DOD, interagency, and international technology requirements for combating terrorism.

Lightweight biological detectors

The committee notes a number of competing technologies for development of portable, light-weight, biological-detection and identification systems that are capable of rapidly detecting and positively identifying a broad range of biological agents and other organisms. The committee recommends an increase of $4.0 million in PE 63122D8Z to accelerate the competitive development and evaluation of these systems.

Chemical-biological electrostatic decontamination system

The committee notes that the electrostatic decontamination system is a photosensitive, electrostatically charged mist, which when sprayed onto a contaminated surface and illuminated with ultraviolet light destroys the chemical or biological agents that are present. Successful development and demonstration of the electrostatic decontamination system could result in a field expedient decontamination capability that would be less dependent on water and would not require the deployment of post-decontamination waste disposal equipment.

The committee recommends an increase of $4.3 million in PE 63122D8Z to continue the development and evaluation of the electrostatic decontamination system.

Facial recognition technology

Given the rise in the number of terrorist attacks against Americans, the committee remains committed to anti-terrorism efforts and biometrics technology in particular. The committee notes the potential force protection applications and surveillance benefits of facial recognition technology and is aware of ongoing operational testing in this field.

The committee understands that further development in this area is necessary to improve both image quality and automatic recognition performance rates.

The committee recommends an increase of $4.0 million in PE

63122D8Z for facial recognition technology.

Magnetic quadrupole resonance explosives detection

The committee notes the development, demonstration, and employment of scanning explosive detection systems that use magnetic quadrupole resonance technology to detect the presence of explosives in luggage and mail with a greatly enhanced detection probability and reduced false alarm rate.

The committee recommends an increase of $2.0 million in PE 63122D8Z to accelerate the development and evaluation of magnetic quadrupole resonance technology for screening of personnel for the presence of explosives and to extend the application of the technology to the screening of cargo and vehicles.

Commercial imagery to support military requirements

The budget request supported purchase of commercial imagery, products and services in support of national intelligence and military needs.

The committee believes real progress has been made in the past year with respect to understanding the desirability of integrating commercial remote sensing into the national architecture.

However, the committee believes that insufficient progress has been made by the Secretary of Defense and the Director of Central Intelligence in achieving the goals outlined by Congress in its fiscal year 2002 direction on this subject. Given the lateness of last year's defense bills, the committee appreciates the difficulty in complying fully with last year's direction. Nevertheless, the committee is genuinely disturbed by reports that the process for development and implementation of the commercial imagery strategy called for may now be on hold.

The committee also questions the wisdom and cost effectiveness of continued investment in government infrastructure for imagery, products and services that would likely be contracted out by 2005 on implementation of the desired commercial strategy. This area will receive increased scrutiny by the committee.

Finally, the committee is not satisfied with the geospatial readiness of our troops. There is no reason for them to not have the best geospatial products based on the most current geospatial data available in the United States today. Regrettably, they do not.

Complex systems engineering

The budget request contained $11.2 million in PE 63704D8Z for special technical support, but included no funds for complex systems engineering.

The committee is aware that multi-view data standards are being developed for an integrated digital design environment supporting complex systems design. The committee is also aware that this project is developing common data formats to permit data from advanced computer-based system design and analysis tools in use by DOD to be efficiently integrated, eliminating the costly and time-consuming manual interface that is standard today. The committee notes the significant success achieved in the development of the multi-view data framework and supports its application to additional pilot efforts.

The committee recommends $17.0 million in PE 63704D8Z, an increase of $5.8 million for complex systems engineering.

Computer science and internet security degree program

The budget request contained $394.3 million in PE 33140G for information systems security programs, but included no funds for the computer science and internet security degree program.

The committee notes that there is an increasing dependency within the Department of Defense on the internet. This reality has generated a growing need for individuals who are highly trained in computer and internet security tools and procedures necessary to protect systems from attack.

The committee recommends an increase of $750 thousand in PE 33140G for the computer science and internet security degree program.

Defense agency science and technology funding

The budget request contained $9,677.2 million for defense science and space technology, including all defense-wide and military service funding for basic research, applied research, and advanced development.

The committee notes that this amount represents an increase of $919.5 million, or 10.5 above the amount requested for the fiscal year 2002 budget, and 2.7 percent of the budget request. However, the committee also notes that the amount requested for science and technology is a decrease of $199.3 million from the amount provided by Congress for fiscal year 2002. The committee commends the Department of Defense commitment to a goal of 3 percent of the budget request for the defense science and technology program and progress toward this goal.

The committee views defense science and technology investments as critical to maintaining U.S. military technological superiority in the face of growing and changing threats to national security interest around the world, and believes that both the defense agencies and the military departments have vital roles in DOD's science and technology investment strategy. Defense agencies focus on science and technology specific to the particular agency or, in the case of DARPA, on problems of national-level problems, operational dominance, and exploitation of high-risk, high-payoff technology. The military departments' science and technology programs focus on the development and transition of more mature technologies into future weapons systems.

The committee notes that the defense-wide science and technology account increased over 14 percent while the Air Force account increased over 5 percent and the Army and Navy science and technology accounts each decreased more than 21 percent (over $400 million each). Although the committee is pleased with the overall progress in the defense science and technology program, the committee continues to be disturbed by the continuing trend of overall reduction in the military departments' science and technology program in comparison to significant increases in the Defense-wide science and technology account and in the amount budgeted for the Defense Advanced Research Projects Agency (DARPA), in particular. The committee concern is not directed at the content of the DARPA program, but rather on the Department's continuing trend of

placing higher priority on defense agency science and technology programs at the expense of the already inadequate service research and development budgets. The committee believes that the Department has not provided sufficient justification to support these imbalances in funding levels between defense agencies and the services, and, therefore, recommends correcting these imbalances by reductions in the DARPA accounts that appear to show disproportionate growth and distribution of those funds among service science and technology projects.

The committee recommends the reductions in the program elements listed:

[In millions of dollars]

61101E--Defense research science	12.0
62301E--Computing systems and communications technology	50.0
62712E--Materials and electronics technology	50.0
63285E--Advanced aerospace systems	50.0

The committee directs that the reduction of $50.0 million in PE 62301E not be assessed against DARPA Information Awareness Office programs.

Defense counterintelligence programs

The budget request contained $60.7 million in PE 35146D8Z for classified programs-C3I, but included no funding for an initiative to accelerate efforts to support specific counterintelligence awareness efforts.

Additional details are contained in the classified annex to this report.

The committee recommends an increase of $5.0 million in PE 35146D8Z for the Defense counterintelligence programs initiative

Defense experimental program to stimulate competitive research

The budget request contained $9.9 million in PE 61114D8Z for the Defense Experimental Program to Stimulate Competitive Research (DEPSCoR).

The committee is aware that DEPSCoR is helping to improve our nation's science and technology capability through funding of merit-reviewed research activities at universities in 21 states and Puerto Rico. The committee notes that these programs helpindividuals, institutions and states improve their research capabilities and to become more competitive for other funding sources.

The committee recommends $19.9 million in PE 61114D8Z, an increase of $10.0 for DEPSCoR.

Defense imagery and mapping program

The budget request contained $143.5 million in PE 35102BQ for the Defense imagery and mapping program. The committee is concerned that promising projects are under-funded. Additional details are found in the classified annex to this report.

The committee recommends an increase of $28.0 million in PE 35102BQ for the Defense imagery and mapping program.

Defense manufacturing supply chain management

The budget request contained $25.5 million in PE 63712S for logistics research and development technology demonstration.

The committee notes defense industry concerns about reducing lead time and increasing the quality of procured parts and equipment from their respective supply chains as a strategy to deliver weapons systems to their Department of Defense customers on time and on budget. These concerns extend to hard-to-find and obsolete spare parts and equipment.

The committee recommends $27.0 million in PE 63712S, an increase of $1.5 million to develop and demonstrate an integrated, multi-state, virtual defense manufacturing supply chain pilot capability.

Defense travel system

The budget request contained $30.4 million in PE 65124D8Z for the defense travel system.

The committee notes that the budget request for the defense travel system increased precipitously and believes that the last year's level is sufficient.

The committee recommends $20.4 million in PE 65124D8Z, a decrease of $10.0 million for the Defense travel system

Enhanced techniques for the detection of explosives

The budget request contained $33.6 million in PE 63228D8Z for physical security equipment research and development.

The committee notes that the detection of explosives is a major concern. Standoff detection of hidden or buried ordnance, including improvised explosive devices, landmines, unexploded ordnance, is critical in mitigating the risk and increasing the safety of military and civilian personnel involved in the clearance of landmines and unexploded ordnance, explosive ordnance disposal operations and the response of security forces to an incident.

The committee recommends an increase of $3.0 million in PE 63228D8Z for multidisciplinary research in the development of advanced technologies for the detection of explosives, improvised explosive devices, landmines, and unexploded ordnance that will lead toward the development of cost effective, highly reliable, computer integrated explosive detection systems.

Environmental security technical certification program

The budget request contained $28.3 million in PE 63851D8Z for the Environmental Security Technical Certification Program.

The committee believes that budget justification documents support funding at the previous year's level, but the 40 percent increase requested is not sufficiently justified.

The committee recommends $20.3 million in PE 63851D8Z, a decrease of $8.0 million for the Environmental Security Technical Certification Program.

Integrated optoelectronics technology

The budget request contained $440.5 million in PE 62712E for applied research in materials and electronics technology.

The committee notes the potential for advances in high capacity interconnects, innovative chip scale technologies,

advanced microelectromechanical systems, and miniaturization and integration of optical systems that would enable the development of advanced optoelectronics devices for defense and other applications.

The committee recommends an increase of $2.0 million in PE 62712E for applied research in integrated optoelectronics technology.

Interdisciplinary biological nanoscience research

The budget request included $175.6 million in PE 61101E for multidisciplinary science basic research, and included $9.3 million for specific research in nanostructure biology.

The committee views the Nanostructure in Biology program as potentially providing new and unprecedented opportunities to exploit a wide range of bio-functionality in a number of military application areas, including chemical and biological sensing, diagnostics, and therapeutics. Potential innovations in this area include the development of algorithms for real-time atomic level resolution of molecules. Such resolution techniques could provide unique threat countermeasures, biomolecular sensors and motors, drug delivery devices, and advanced wound healing techniques, all sharing the potential for providing far-reaching applications in future battlefield environments.

The committee notes the ongoing research involving nanospheres, nano-biosensors, and multi-crystal equipment, and encourages further work in this area for detecting cytotoxicity. The committee recognizes the unique benefit of interdisciplinary studies and strongly supports further investment in this area.

The committee recommends $10.8 million in PE 61101E for the Nanostructure Biology program, an increase of $1.5 million, for interdisciplinary biological nanoscience research.

Joint technology office

The budget request contained $13.6 million in PE 63924D8Z for high energy laser advanced technology programs.

The committee understands the challenges of developing high energy lasers for weapons applications. The committee is encouraged by the progress demonstrated in some of the large and more visible demonstration programs, but believes it necessary to proceed on a broad front to develop the full range of technologies required to bring directed energy to the battlefield.

The committee recommends $28.6 million in PE 63924D8Z, an increase of $15.0 million.

Kinetic energy-anti satellite system

The budget request contained no funding in PE 63XXXD8Z for kinetic energy-anti satellite (KE-ASAT) system.

The committee notes that the kinetic energy-anti satellite system is to develop an option for space control, a critical capability for future space operations.

The committee recommends an increase of $7.5 million in PE 63XXXD8Z for the kinetic energy-anti satellite system.

Medical free electron laser

The budget request contained no funding in PE 62227D8Z for the ongoing medical free electron laser (MFEL) program and recommended transfer of program management to the National Institutes of Health.

The committee is aware that the MFEL program has been a good example of a peer-reviewed program that is oriented toward military medical applications. The committee believes that the MFEL program transfer was inappropriate and supports MFEL retention within DOD.

The committee directs the Secretary of Defense not to transfer the MFEL program and recommends $15.0 million in PE 62227D8Z for MFEL.

Multi-function self-aligned gate

The budget contained $11.9 million in PE 35206G for manned reconnaissance systems, but included no funds for multi-function self-aligned gate (MSAG) tile antenna technology.

The committee believes that MSAG has the potential to revolutionize antenna design and result in significant improvement in data rates to meet rapidly escalating demand for information exchange in the new digital warfare environment.

The committee recommends $14.9 million in PE 35206G, an increase of $3.0 million for the development and demonstration of MSAG tile antenna technology.

Multi-link antenna system

The budget request contained $199.6 million in PE 63750D8Z for advanced concept technology demonstrations, but included no funds for the multi-link antenna system (MLAS).

The committee notes that MLAS technology has demonstrated communications using small arrays, and is at the point in development at which a larger, full-scale demonstration is appropriate. The committee is aware that the multi-link antenna system advanced concept technology demonstration (ACTD) has been planned and approved by the Secretary of Defense.

The committee recommends an increase of $14.0 million in PE 63750D8Z for the multi-link antenna system ACTD.

National collaborative environment

The committee, in the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107), directed the Secretary of Defense and Director of Central Intelligence to develop a proposed architecture for a national collaborative environment. The committee is aware that the ongoing war against terrorism has increased the need for such a capability.

The committee notes, with pleasure, that the Secretary of Defense has initiated a well-staffed program through the Defense Advanced Research Projects Agency (DARPA) to develop the fundamental architecture, technologies and tools necessary to enable a national collaborative environment. The committee realizes that architectural studies may well impact the direction and effort of the DARPA program, and requests the Secretary of Defense to ensure that the Director, DARPA is a full participant in those study efforts and is made fully aware of all related work within the Department.

The committee strongly encourages the Secretary of Defense

to provide continued support for this vital DARPA program and the ultimate establishment of a national collaborative environment.

``Smart'' fuzing

The committee believes the United States should make every effort to reduce the susceptibility of friendly forces and non-combatants to accidental death or injury--including that which results from inappropriate contact with unexploded ordnance--without impairing military effectiveness, capability, or mission accomplishment. Hence, the committee recommends the Department of Defense place greater priority on the development of affordable and effective submunition fuses that have reliability rates comparable to those found in unitary munitions fuzing, thus increasing performance of these munitions while reducing the danger of unexploded ordnance to friendly forces and non-combatants. The committee also encourages the continued development of ``smart'' landmines with higher reliability and performance rates.

Spike urban warfare system

The budget request contained $6.7 million in PE 116401BB, for special operations technology development, but included no funds for the Spike urban warfare system.

The committee is aware that enhancements are required for shoulder fired guided missiles, and improvements to the guidance system in order to better defeat hard targets and reduce collateral damage in an urban environment.

The committee recommends $11.7 million in PE 116401BB, an increase of $5.0 million for the Spike urban warfare system.

Strategic environmental research and development program

The budget request contained $60.5 million in PE 63716D8Z for the strategic environmental research and development program (SERDP).

The committee notes that insufficient budget specific justification has been provided for SERDP including an $11.0 million increase over the level of funding projected for fiscal year 2003 in the fiscal year 2002 amended budget request.

The committee recommends $30.5 million in PE 63716D8Z, a decrease of $30.0 million for the Strategic Environmental Research Program.

Tactical missile recycling

The budget request contained $8.9 million in PE 63104D8Z for explosives demilitarization technology, and included $5.8 million for tactical missile recycling.

The committee is aware that the explosive demilitarization technology program is a cooperative interservice, interagency effort focused as the sole Department of Defense program dedicated to the development of safe, efficient, and environmentally acceptable processes for resource recovery and recycling or disposition of strategic, tactical, and conventional munitions including explosives and rocket motors.

The committee recommends $11.9 million in PE 63104D8Z, an increase of $3.0 million for tactical missile recycling

technology.

Thermobaric warhead development

The budget request contained $77.4 million in PE 63160BR for development and demonstration of counterproliferation advanced technologies.

The committee notes the effectiveness of thermobaric materials, a new class of explosives that demonstrate impressive capabilities for generation of pressure and thermal effects much greater than conventional high explosives. Weapons employing thermobaric warheads were developed rapidly and employed with great effectiveness in support of tunnel defeat operations in the war on terrorism in Afghanistan. The committee also notes the progress being made in the development and demonstration of advanced thermobaric warheads in the on-going thermobaric warhead advanced concept technology demonstration lead by the Defense Threat Reduction Agency.

The committee recommends an increase of $4.0 million in PE 63160BR for thermobaric warheads advanced technology development. The committee recommends continued close coordination of the DTRA program with the Navy's insensitive munitions program and the Army's advanced warheads development program.

Unmanned aerial vehicles major acquisition programs

The committee is aware that recent successful operational employment of unmanned aerial vehicles (UAV) has heightened military service efforts to develop and field several new variants, with additional capabilities. The committee notes that though the budget request has rapidly increased overall funding for UAVs, formal acquisition management documentation is incomplete or not yet developed in many instances.

The committee expresses its concern about proper program management elsewhere in this report, and is specifically concerned that UAV programs adhere to the same standards as other acquisition programs. The committee recognizes the necessity for and benefit of acquiring a robust family of UAVs, but believes that the Secretary of Defense and military service Secretaries must ensure that the programs are managed well, to prevent unanticipated cost growth and schedule delays experienced by other new systems. The committee notes that while the acquisition per unit cost may be relatively small, in the aggregate, the acquisition cost rivals the investment in other larger weapon systems.

Operational Test and Evaluation, Defense

Overview

The budget request contained $222.1 million for Operational Test and Evaluation RDT&E. The committee recommends authorization of $222.1 million.

The committee recommendations for the fiscal year 2003 Operational Test and Evaluation RDT&E program are identified in the table below. Major changes to the Operational Test and Evaluation request are discussed following the table.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

LEGISLATIVE PROVISIONS

Subtitle A--Authorization of Appropriations

Section 201--Authorization of Appropriations

This section would establish RDT&E funding levels for the Department of Defense for fiscal year 2002.

Section 202--Amount for Basic and Applied Research

This section would establish basic and applied research funding levels for the Department of Defense for fiscal year 2002.

Subtitle B--Program Requirements, Restrictions, and Limitations

Section 211-RAH-66 Comanche Aircraft Program

This section would prohibit the Secretary of the Army from obligating any of the funds in fiscal year 2003 for engineering and manufacturing development of the RAH-66 Comanche aircraft program until the Secretary submits to the congressional defense committees a report, prepared in coordination with the Under Secretary of Defense for Acquisition, Technology and Logistics, containing an accurate estimate of funds to complete engineering and manufacturing development and the new restructured timeline for bringing the aircraft to initial operational capability.

This provision would also impose a cost cap on the total cost of engineering and manufacturing development (EMD), require an annual report by the Department of Defense Inspector General (DOD IG) that would assess the progress of EMD and its prospect of completion under the cost cap, and allow adjustments to the cost cap for economic inflation and compliance with laws enacted after September 30, 2002. The annual report would be required until EMD is complete. Finally, the provision would limit the obligation of funds authorized to be appropriated for each year to 90 percent until the DOD IG annual report is submitted.

Section 212--Management Responsibility for Navy Mine Countermeasures Programs

This section would amend section 216 of the National Defense Authorization Act for Fiscal Years 1992 and 1993 (Public Law 102-190) and would extend the implementation of the Management Responsibility for Navy Mine Countermeasures programs through fiscal year 2008.

The committee believes that the requirement that the Secretary of Defense and the Chairman of the Joint Chiefs of Staff provide an annual certification of the adequacy of the Navy's mine countermeasures program has had a positive impact on the program, increasing the visibility of and attention paid to the program by officials in the Department of Defense and the Navy. The committee notes the direction contained in the

committee report on H.R. 3616 (H. Rept. 105-532) that the annual certification by theSecretary of Defense and the Chairman of the Joint Chiefs of Staff address the adequacy of funding for the mine countermeasures program for the budget year through the end of the future years defense program and also include objective measures against which the Navy's progress in enhancing its mine countermeasures capabilities can be evaluated.

Section 213--Extension of Authority To Carry Out Pilot Program for Revitalizing the Laboratories and Test and Evaluation Centers of the Department of Defense

Section 246 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (Public Law 105-261) authorizes the Secretary of Defense to conduct a pilot program for revitalizing the laboratories and test and evaluation centers of the Department of Defense with the objective of improving cooperative relationships for the performance of research and development with universities and other private sector entities. This provision would amend section 246 to add the demonstration of improved efficiency in the performance of the research, development, test, and evaluation functions of the Department of Defense to the objectives of the pilot program and would also extend the authorization for the program until March 1, 2008.

Section 214--Revised Requirements for Plan for Manufacturing Technology Program

This provision would amend section 2525(e) of title 10, United States Code, to reduce the requirement for update and submission to Congress of the five-year plan for the Department of Defense (DOD) Manufacturing Technology Program from annually with the submission of the DOD budget to biennially. The amendment would also delete the requirement including in the report an annual assessment of program effectiveness and an annual assessment of the extent to which the costs of manufacturing technology projects are being shared.

Section 215--Technology Transition Initiative

The provision would require the Secretary of Defense, acting through the Under Secretary of Defense for Acquisition, Technology, and Logistics, to carry out an initiative to facilitate the rapid transition of new technologies from DOD science and technology programs into DOD acquisition programs. The initiative would be managed by a senior official in the Office of the Secretary of Defense, who would be assisted by a board of directors composed of the acquisition executives of the military departments, the members of the Joint Requirements Oversight Council, and the commander of the Joint Forces Command; and who would be responsible for identifying promising technology that have been demonstrated in DOD science and technology programs, identify potential sponsors and establish management agreements for the transition of such technologies into production, and provide not less that fifty percent of the funding for recommended projects that are selected for such funding support. The provision would also require the Secretary to establish a panel of highly qualified scientists and engineers to advise the Under Secretary on matters relating to

the initiative.

The provision would further require that the amount requested for activities of the initiative shall be set forth in a separate program element within amounts requested for Defense-wide research, development, test, and evaluation activities. The committee expects that the Secretary of Defense will establish a funding planning wedge for the Technology Transition Initiative program in the future years defense plan.

The committee notes that the Technology Transition Initiative established pursuant to Sec. 215 does not replace, but complements the responsibility of the senior acquisition executives of the Department of Defense and the military departments and the heads of the Defense agencies with research and development responsibilities under section 5358, title 10, United States Code (section 904, Public Law 106-301) to ensure that the science and technology programs under their authority are carried out in such manner that will foster the transition of science and technology to higher levels of research, development, test, and evaluation.

Section 216--Defense Acquisition Challenge Program

This provision would require the Secretary of Defense to establish a pilot program, the Defense Acquisition Challenge Program, to provide a person, institution, industrial corporation, or activity within or outside the Department of Defense the opportunity to propose the insertion of unique and innovative technologies (``challenge proposals'') at the component, subsystem, or system level of an existing DOD acquisition program that, compared to the incumbent component, subsystem, or system, would result in substantially superior improvements in performance, affordability, manufacturability, or operational capability of that acquisition program.

The provision would require the Secretary to establish procedures under which challenge proposals would be submitted for review and evaluation by a panel of scientists and engineers established under the auspices of the Under Secretary of Defense (Acquisition, Technology, and Logistics). The committee believes that these procedures should provide for the solicitation of component, subsystem, or system-level technologies that, if incorporated in the appropriate defense acquisition program would result in substantial improvements in the program and could be transitioned rapidly into a fielded program, a block change, or a spirally developmental increment. The committee expects that the review panel would take a ``best value'' approach that encompasses consideration of such criteria as potential improvement in performance, affordability, manufacturability, and operational capability. Those proposals with merit would be requested to submit a proposal to be reviewed by the government program office and the prime system contractor for the impacted program. The program office-prime contractor team would then conduct an independent review of the merits of the challenge proposal, including whether the challenge proposal is likely to result in improvements in performance, affordability, manufacturability, or operational capability at the component, subsystem, or system level of the applicable acquisition program and whether the challenge proposal could be implemented rapidly in the program through changes in fielded systems, through block changes to the component, subsystem, or system, or through a

spiral development increment. Each challenge proposal determined under a favorable full review and evaluation by the program office and prime contractor to satisfy the criteria outlined above would then be considered by the prime system contractor for incorporation into the acquisition program as a new technology insertion at the component, subsystem, or system level.

The committee believes that the challenge program could provide an excellent avenue for accelerating the introduction of new and innovative technology into defense acquisition programs and that appropriate incentives, such as share-in-saving or other appropriate incentives, should be established to encourage the program office and the prime contractor to adopt successful challenge proposals that meet the criteria outlined above.

Subtitle C--Ballistic Missile Defense

Section 231--Limitation on Obligation of Funds for Procurement of (PAC-3) Missiles Pending Submission of Required Certification

This section would prevent obligation of funds for procurement of PAC-3 pending submission to the congressional defense committees of criteria for the transfer of missile defense programs from the Missile Defense Agency to the military departments, and certification by the Secretary of Defense that those criteria have been met for the PAC-3 program. The criteria and certification are required by sections 224(b)(2) and 224(c), respectively, of title 10, United States Code.

Section 232--Responsibility of Missile Defense Agency for Research, Development, Test, and Evaluation Related to System Improvements of Programs Transferred to Military Departments

This section would amend Section 224(e) of title 10, United States Code to require the Director of the Missile Defense Agency to retain responsibility for research, development, test, and evaluation related to improvements of missile defense systems and system components that have been transferred to the military departments for procurement and fielding.

Section 233--Amendments To Reflect Change in Name of Ballistic Missile Defense Organization to Missile Defense Agency

This section would amend a number of provisions of permanent law to reflect the name change of the ``Ballistic Missile Defense Organization'' or ``BMDO'' to the ``Missile Defense Agency'' or ``MDA''.

TITLE III--OPERATION AND MAINTENANCE

OVERVIEW

The budget request for operation and maintenance represents an increase of $22.7 billion over spending levels authorized and appropriated for fiscal year 2002. Of this increase, $13.8 billion has been included for the Defense Emergency Response Fund (DERF), and $3.3 billion represents the cost for

Department of Defense civilian employees health care and retirement accrual funding. The remaining $5.6 billion, which represents three percent of the operation and maintenance budget request, is allocated to what the Department has termed ``realistic budgeting'' and inflation. As detailed elsewhere in the report, $10.0 billion of the DERF, and the $3.3 billion for the civilian employees accrual funding have not been included in the committee's recommendations.

Although the budget request has been portrayed as the largest increase in defense spending in many years, the reality is that there are little, if any, real increases. The committee is concerned with the Department's ability to achieve acceptable readiness in the military services. The proposed level of funding, coupled with the need to fight a war, and $25.4 billion in unfunded requirements identified by the chiefs of the military departments for fiscal year 2003, suggests that adequate military readiness will be difficult to sustain in the long term. Not only is there concern for sustaining adequate readiness for the duration of the current conflict, but also a looming concern for the inevitable reconstitution of our forces when the war has concluded. Many of the Department's combat weapons systems are long past their initial design lifespan, and there are only a few replacement systems on the drawing boards.

The committee notes the increased attention and recognition of historic under-funding in many of the critical readiness accounts with the application of realistic funding this year. Even this approach of realistic funding, however, may not sustain readiness at acceptable levels. As an example, the budget request includes an increase for ship depot maintenance of $621.2 million. This significant increase will not provide any additional ship repair over previous years, it will merely fund previously programmed ship repair requirements and may negate the annual practice of re-programming and supplemental funding requests. Even with this laudable attempt at realistic funding, the committee notes that the ship repair accounts are only funded at the 95 percent level.

The committee conducted a series of hearings in an effort to obtain a more accurate and detailed assessment of current and near-term readiness from senior DOD civilian and military leaders. As it has been for the past several years, the overwhelming impression left on the committee was of an overextended force struggling to maintain acceptable readiness levels in a wartime environment coupled with domestic terrorism concerns. The committee continues to hear complaints about lack of spare parts, aging equipment, decaying infrastructure, growing equipment and facility backlogs, and the difficulties of conducting quality training and operational deployments with significant personnel shortages. The committee notes that within the fiscal years 01, 02, and 03 DERF accounts, over $4.0 billion has been dedicated for increased force protection requirements. The committee applauds the Department for these much needed security improvements and urges the Department to assign the same level of effort to the other infrastructure needs of the Department.

The committee notes that the Department has made some progress, but must continue to take steps to reduce costs in non-readiness related accounts. At the same time, the Department must provide aggressive oversight over proposals to reduce costs through contracting out and privatization. The

committee is concerned with the apparent differing opinions between the Department and the Office of Management and Budget as to the need for further mandated outsourcing studies. At the same time, the committee is aware that the Department has turned to strategic sourcing as a means to make outsourcing decisions without the need for prolonged studies. The committee is concerned that strategic sourcing may encompass consolidation, restructuring, privatization, and the outright termination of existing services, which may produce short-term savings, but may prove to be more costly in the future and may have an adverse impact on readiness. The committee fully supports well developed and justified programs that will reduce costs and prove over time to enhance readiness; however, at a time when military readiness is critical for the successful prosecution of the war effort, the committee does not believe the Department should conduct uncoordinated new programs.

Consistent with past practice, the committee has identified spending that does not directly support readiness and has reprioritized it into areas that will. In making decisions on how best to apply resources to address readiness problems, the committee relied heavily on testimony received during extensive oversight hearings and on the unfunded priorities identified by the service chiefs.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

ITEMS OF SPECIAL INTEREST

Budget Request Adjustments

The committee recommends the following adjustments to the fiscal year 2003 budget request:

Department of the Army Adjustments:s of dollars]	
AIT/RFID Maintenance	+9.0
AIT/RFID Prepositioned Stocks	+8.0
Army Aviation Warfighting Simulation Center	+4.0
Army Cold Weather Clothing (ECWCS)	+8.0
Army Depot Apprenticeship Program	+10.0
Army National Guard Cold Weather Clothing (ECWCS)	+4.0
Army National Guard Modular Sleep System	+10.0
Army Reserve Modular Sleep System	+6.0
Army Reserve Cold Weather Clothing (ECWCS)	+4.0
Army Reserve Military Technicians	+8.0
Azur Blue Cannon Bore Cleaning System	+2.2
BA-4 BRAC Preparation Funds	-24.1
BA-4 Global Command Support System	-5.0
Controlled Humidity Preservation	+20.0
Corrosion Prevention and Control Program	+12.0
Electronic Maintenance and Point to Point Wiring	+6.0
Hydration on the Move (CamelBak)	+4.1
M-Gators	+4.0
Training Range Modernizations	+32.0
Transfers to H.R. 4547	-14.4
USARSO Leasing Increases	-2.55
Department of the Navy Adjustments:	
AV-8B Engine Life Maintenance Program	+2.0
BA-3 IMET Funding	-4.93
BA-3 IMET Funding, USMC	-1.33
Corrosion Control Program ATC Glass	+2.0

Hydration on the Move CamelBak	+1.0
LHA Stability Improvement Alterations	+57.0
Navy Aviation Depot Apprenticeship Program	+6.0
Navy Shipyard Depot Apprenticeship Program	+6.0
Stainless Steel Sanitary Spaces	+15.0
Navy Transfer to H.R. 4547	-5.3
Naval Sea Cadets	+1.0
USMC Facility Restoration and Modernization	+31.0
USMC Transfers to H.R. 4547	-11.5
Uniting through Reading	+0.1
Department of the Air Force Adjustments:	
Aging Propulsion Systems Life Extension	+7.0
Air Force Logistics System/L-SMART	+2.5
Air National Guard Cold Weather Clothing (ECWCS)	+4.0
B-1B Pivot Shear Replacement	+80.0
BA-4 BRAC Preparation Funds	-16.5
Combat Air Patrol Flying Hours	-300.0
Hydration on the Move (CamelBak)	+1.0
Office, Secretary of Defense Adjustments:	
Impact Aid	+35.0
Defense-wide Activities Adjustments:	
CSRS/FEHBP Accrual Funding transfer out	-2,276.3
Defense Human Resources Activity	-20.0
Defense Information Systems Agency	-37.0
DERF transfer to other accounts	-6,213.3
Foreign Currency Account	-522.4
Joint Chiefs of Staff Exercise Program	-10.0
Overseas Contingency Operations Transfer Fund	-50.0
Washington Headquarters Service	-10.0
TRICARE Prime Remote	+6.0
Marshall Island Diabetes Reversal/Wellness Program	+2.0
National Guard Challenge	+2.5
National Guard Youth Foundation	+2.5

Excess Foreign Currencies Reductions

Since the submission of the budget request, the U.S. dollar has increased in value compared to various foreign currencies. As a result, the committee believes that the budget request is overstated. Therefore, the committee recommends a reduction in this account of $522.4 million to be apportioned to the military services by the Department of Defense.

Joint Chiefs of Staff Training Exercises

The committee is concerned with the increasing pace of operations throughout the military services and the proposed Joint Chiefs of Staff (JCS) training exercises program. The budget request includes an increase of $21.8 million for JCS training exercises. The committee believes that requirements for these additional training exercises will be leviedagainst units that are already overextended with the execution of the war on terrorism, other world-wide operational deployments, home station training exercises, and training exercises at the services' major combat training centers. The committee questions whether the benefit of additional JCS exercises, at this time, is worth the price paid by units already suffering the effects of high operational tempo. Therefore, the committee recommends a reduction of $10.0 million for the JCS training exercises program.

Budget Request Display Issues

Accrual Accounting for Civil Service Retirement and Health Programs

The budget request proposed, for the first time, to include $3.3 billion for the costs of the Civil Service Retirement System (CSRS) and the Federal Employees Health Benefits (FEHB) program for future retirees on an accrual basis in the accounts that pay the salaries of current civilian employees. Currently, these accrual accounts are funded by the Office of Management and Budget and are paid from a general account of the U.S. Treasury. Specific legislation is required to accomplish this change in these mandatory accounts. The Congress has not acted on the required legislation and, therefore, the committee recommends the continuation of the current practice of funding these accounts. The following represents the total budget request for CSRS and FEHB that have not been included in the committee's recommendation:

[In millions of dollars]

Operation and Maintenance--Army	612.382
Operation and Maintenance--Navy	324.278
Operation and Maintenance--Marine Corps	47.210
Operation and Maintenance--Air Force	531.055
Operation and Maintenance--Defense-Wide	346.046
Operation and Maintenance--Army Reserve	43.220
Operation and Maintenance--Navy Reserve	6.227
Operation and Maintenance--Air Force Reserve	55.365
Operation and Maintenance--Army National Guard	87.255
Operation and Maintenance--Air National Guard	88.416
Office of the Inspector General	8.275
Court of Military Appeals	0.311
RDT&E--Army	98.161
RDT&E--Navy	5.565
RDT&E--Air Force	36.249
RDT&E--Defense-Wide	14.688
Military Construction--Army	26.083
Military Construction--Navy	10.470
Working Capital Fund--Army	109.042
Working Capital Fund--Navy	373.228
Working Capital Fund--Air Force	122.365
Working Capital Fund--Defense Commissary Agency	27.589
Working Capital Fund--Defense-Wide	206.879
Family Housing--Army	3.267
Family Housing--Defense Logistics Agency	0.037
Defense Health Program	126.230
Total	3,309.893

Defense Emergency Response Fund

The budget request for operation and maintenance contained, for the first time, a single entry for a transfer account entitled the Defense Emergency Response Fund (DERF), which is intended to be used to support the efforts of the Department of Defense (DOD) to respond to, or protect against, acts or

threatened acts of terrorism against the United States. Of the requested $20.1 billion for the DERF, $10.0 billion is designated as incremental funding for ongoing operations in the War on Terrorism. The remaining $10.1 billion contained in the DERF transfer account is intended for enhancements and new initiatives identified to assist the Department in force protection, munitions, military construction, security and communications requirements, continuity of operations requirements, and for additional flying hours to support combat air patrols within the United States.

In accordance with the Budget Resolution for Fiscal Year 2003, (H.Con. Res. 353), the $10.0 billion designated as incremental funding for ongoing operations in the war on terrorism has not been included in the committee's recommendation.

The committee is concerned that maintaining a single transfer account for the additional items needed by the military services to increase security, and continue operations of the war on terrorism, will be difficult to manage and, of greater concern, will be difficult to audit. The committee notes that the Department provided detailed DERF justification materials based on the traditional appropriation account formats. Using this data, the committee has distributed all of the remaining DERF transfer account into the specific services' accounts by budget activities and sub-activities groups. The following shows the distribution of the DERF transfer account to the traditional appropriations accounts:

Operation and Maintenance	$ 3,847,048,000
Procurement	3,382,433,000
Research and Development	2,198,235,000
Military Construction	594,384,000
Military Personnel	32,900,000
Total	10,055,000,000

Information Technology (IT) Issues

Overview

The Assistant Secretary of Defense for Command, Control, Communications and Intelligence [ASD(C3I)] is a single position with various roles and responsibilities, one of those roles being the Department of Defense's (DOD) Chief Information Officer (CIO).Under title 10, United States Code, the DOD CIO is responsible for reviewing budget requests; ensuring interoperability; ensuring federal and Department of Defense standards are prescribed; and eliminating duplicative information technology and national security systems. The committee recognizes these are difficult and challenging responsibilities, yet these tasks are vital if DOD is to succeed in management reform and transformation.

The committee is aware of several dominant problems regarding the purchase of information technology systems. These problems include the inability to aggressively control and manage user requirements; failure to integrate information technology reviews with budget and financial decisions; difficulty in properly using performance based contracts; and promotion or endorsement of program managers who do not have

the varied skills necessary to run a successful information technology program.

Requirements

Information technology systems have the ability to improve dramatically the Department's numerous administrative processes. The committee believes that too often tremendous resources are wasted on systems that do not meet the initial requirement for which the systems were intended. Without proper oversight and aggressive leadership, management reform will suffer and cases, such as described below, will prevail.

The committee recognizes that requirements setting and management are particularly difficult for those IT systems that are intended to be joint or defense wide. Evidence suggests that these IT systems cannot move beyond the requirements phase without strong leadership making difficult trade-offs among the various requirements. Without leadership, joint or defense wide systems duplicate military or agency unique systems rather than replace those systems. Equally, a joint or defense-wide system often migrates into a more unique system as the various agencies and military services adapt the system to their individual requirements. One of the more glaring examples of failure to minimize requirement growth is the Standard Procurement System (SPS), a system touted as moving the procurement world into paperless contracting.

This system was stunted by the services' and agencies' insurmountable requirements and lack of Department leadership to arrest unnecessary requirements growth. The services and agencies complained that their unique requirements were not being met and independently changed the system to fit their own needs. The committee is aware of other problems with SPS, but believes requirements growth was one of the more significant problems. The Department committed over $320.0 million to this system prior to Congress bringing SPS to a halt last year.

Budget Reviews

The committee believes that the Department of Defense has not articulated or successfully integrated the CIO's responsibilities with budgeting and financial decisions. The committee believes the opportunity for such integration presents itself with the Department's recent commitment to a financial management modernization program.

The Under Secretary of Defense, Comptroller, is committed to leadership and strong oversight over this program--which includes the development, funding, and financing of the information technology systems under the modernization program. The committee believes the Comptroller's interest in information technology should be captured and the Comptroller should have greater responsibility and oversight over all information technology systems within the Department of Defense. The committee believes that the need to integrate the CIO's responsibilities with the Comptroller's responsibilities is well within the foundation principles of the Clinger-Cohen Act of 1996 (Public Law 104-106).

Performance-based contracting

A major concern for the committee is the way in which the

Department uses performance-based contracts, or task orders, for IT services. The committee believes in the concept of payment for performance. When the Department chooses a performance based service contract for an IT system, the Department should design the contract in a way that ties contractor payment with performance. The committee believes that a performance metric, and thus payment, should be more than a delivery schedule. Payment should also include an affirmative evaluation of whether the service or product does in fact meet all of the contract objectives. Failure to incentivize the contractor to perform as originally agreed in the contract is a practice inconsistent with good management and good business practice.

Program management

A successful IT program manager needs a strong and varied set of skills and knowledge. Not only does the program manager need acquisition experience, it is equally important to have technical and functional knowledge. The technical experience is important in evaluating the vendor product, understanding vendor progress, and recognizing technical difficulties ahead. Functional knowledge is a key to evaluating user requirements, recognizing the necessary degree of business re-engineering, and anticipating user concerns. These three skills can be difficult to find in one program manager. The committee believes, however, that at a minimum, the senior program management team must incorporate all three varied skills.

Defense Messaging System (DMS)

This system was originally intended to replace the automatic digital network (AUTODIN), a messaging system that DOD uses to transmit messages ranging from unclassified to top secret, including sensitive compartmented information. Seven years after the original DMS contract was awarded, and the expenditure of $647.0 million, the AUTODIN is still not in operation because, in part, top secret and sensitive compartmented information cannot be transmitted with DMS. The committee believes this is just one of several examples where after general requirements for an IT system have been established, the Department has failed to provide the necessary leadership to manage and move the system in a positive and successful direction. The committee strongly believes that without proper oversight and aggressive leadership in this area, management reform will suffer and cases, such as demonstrated above, will prevail.

Defense Integrated Military Human Resources Systems

The Department of Defense is attempting to develop and implement the Defense Integrated Military Human Resources System (DIMHRS), a single personnel and pay system that will support all military personnel. The committee is concerned with the Department's continued disparate efforts in the development of DIMHRS. Information technology systems of this magnitude and importance require uniform, rigid, and continuous oversight. The committee believes that such an oversight management structure is not in place.

In the budget request for fiscal year 2003, the committee

received three different budget exhibits from the three organizations that play a significant role in development of DIMHRS. None of the three organizations were aware of the other submissions, or could discuss information or data contained in the other's submissions. The program manager and program executive office could not even explain the purpose or work of all four prime contractors working for the program manager. The committee notes there are over 12 prime contracts under this initiative.

The committee has seen total confusion, a lack of communication, and complete mistrust between the personnel community and the pay community. The two sides do not support each other's funding requirements, user requirements, or testing procedures. This system will fail unless the Secretary of Defense takes immediate steps to vastly improve the management structure of DIMHRS. The committee directs the Secretary of Defense to obligate no funds appropriated for fiscal year 2003 for DIMHRS until a report is submitted to the Senate Committee on Armed Services and the House Committee on Armed Services. The report shall include: a statement of the roles and responsibilities assigned to the Defense Human Resources Activity, the Defense Finance and Accounting Service, and the Department of the Navy; all funds appropriated and obligated, by appropriation, for DIMHRS since its inception; a list of each prime contractor and the work to be performed under the contract; a description of the pay and personnel module that will be used in DIMHRS and a description of the testing each module underwent and a statement whether the module can meet user requirements.

Global Command Support System--Army

In 1997, the Army initiated actions that would transform the Army's information technology (IT) support systems. This included replacing 16 legacy IT systems with five modules. After spending over $320.0 million on this system to date, nothing has been fielded and no legacy systems have been turned off. In fact, the Army is still attempting to implement the first, and admittedly easiest, module. The committee is troubled by the amount of money and time needed for initial fielding of the first and easiest module, and is equally concerned with the Army's decision to start development of the second module, even before there is an Army decision about whether the second module will be a commercial off the shelf product or a government developed product. In light of these concerns, the committee recommendation includes a reduction of $5.0 million for the Global Command Support System.

Supply Maintenance Aviation Reengineering Team

The Supply Maintenance Aviation Reengineering Team is one of four enterprise resource planning initiatives within the Department of the Navy. Although the objectives of this plan have commendable goals, the committee is concerned with the Navy's acquisition plan for this initiative. The Navy has awarded a performance based contract for this initiative; however, at the same time, the Navy is still developing performance measurements, quantifying mission improvements, resource savings and mission benefits. In addition, the Navy has informed the committee that it is still waiting for the

contractor to document critical aspects of the project. The committee urges the Navy to re-evaluate this initiative.

Warfighters Simulation System

The Warfighter Simulation system, initiated by the Department of the Army in 1994, is intended to allow Army units world wide to train in their local command posts using their assigned organizational equipment. The committee understands that no formal cost benefit or return on investment analysis was ever performed for this system. In April 2001, the system experienced a ``schedule breach''. At that time, the milestone decision authority for this system directed that a revised acquisition program baseline be developed and cost position established. To date, neither is complete. Therefore, the committee directs the Secretary of the Army to not obligate any funds for fiscal year 2003 for the Warfighter Simulation System until the military decision authority reviews the revised acquisition program baseline and cost position and determines it is appropriate to move forward with this program.

Wireless Priority Service

The budget request includes $101.0 million in the Defense Emergency Response Fund, and $73.0 million in the operation and maintenance request for the Defense Information Systems Agency to initiate and implement a priority wireless service whereby government officials can achieve priority access when using cellular phones. Following White House guidance, the committee understands that the Department hopes to have priority access nationwide by December, 2003. However, the committee does not believe that the Department has developed a realistic implementation plan, and has not seen evidence that the Department can obligate $73.0 million in the first quarter of fiscal year 2003. Therefore, the committee recommends a reduction of $37.0 million for the Defense Information Systems Agency.

Environmental Issues

Through a series of hearings, fact-finding trips and in-depth briefings, the committee has received a growing number of reports from the Department of Defense and the military services that mandatory compliance with federal environmental laws is having an increasingly adverse impact on their ability to fully utilize training ranges that are critical to maintaining military readiness. The committee is concerned thatmaintaining military readiness is not only necessary to insure national security, but especially critical for the successful prosecution of the War on Terrorism.

During the past several months, the committee has had numerous meetings with representatives from the Department, the military services, federal environmental regulators, state regulatory organizations and representatives of the nonprofit environmental community to consider their common and competing concerns regarding the impact on military readiness and national security caused by compliance with various federal environmental laws. In addition to meetings in Washington, D.C., the committee has visited numerous military facilities throughout the country to examine the positive effects of

compliance with environmental laws and regulations, as well as the adverse impact environmental compliance is creating in other geographic areas, particularly in the context of encroachment upon existing and available land which can be used for military training and testing.

The committee is of the opinion that it is essential that all federal agencies, including the Department, be required to comply with all federal environmental laws, including the Endangered Species Act (Public Law 93-205), the Marine Mammal Protection Act (Public Law 92-522), the Migratory Bird Treaty Act (Public Law 93-300), the Clean Air Act (Public Law 88-206), and the Clean Water Act (Public Law 92-500), to name a few. However, due to its unique training and operational missions, the Department often faces unique challenges in balancing its obligations to comply with these environmental laws and sustaining military readiness. The ever increasing limitations and restrictions on lands and waters which are currently set aside for military training exercises, as well as restrictions on the times and conditions under which military training exercises can be conducted, are some examples of these environmental encroachment challenges.

For example, the Navy spends approximately $2.4 million each year and is forced to close its shore bombardment range off the California coast at San Clemente Island four days each week during the breeding season due to the presence of a bird called the loggerhead shrike, an endangered species that inhabits the island. When the shrike was initially listed as an endangered species on San Clemente Island, the population was estimated to include only 13 birds. Today the population has grown to approximately 160 birds, of which approximately 70 birds are in the wild. The rest are housed in the captive breeding programs on San Clemente Island or at the San Diego Zoo, all at the expense of the Navy. To achieve this environmental success, the Navy has found it necessary to reduce one of the island's two firing ranges in size by 90 percent and the other by 50 percent during the fire season. Although the shrike population has increased dramatically, current laws establish no goal at which restrictions on the Navy's activities will be relaxed.

Similarly, at Fort Hood, Texas, one of the Army's premier training installations, of approximately 200,000 training acres, 66,000 acres, or 33 percent, of the training land is committed to protect the habitat of two endangered species. The presence of cultural artifacts restricts an additional 11 percent of Fort Hood's training area, and 128,000 acres have restrictions on digging, affecting 64 percent of the training area. Combined with additional restrictions of smoke and noise, a total of 84 percent of Fort Hood's available training area is currently subject to some kind of limitation. The committee notes that some type of encroachment problem exists at nearly every military installation.

The Migratory Bird Treaty Act is an important environmental statute that was enacted in 1918 to control the mass slaughter of birds for commercial purposes. Under the statute, a federal agency can obtain a permit to ``take'' migratory birds intentionally, such as clearing large flocks of Canadian Geese from a landing field or golf course. However, a federal court recently ruled that the Navy had violated the Migratory Bird Treaty Act by accidentally taking migratory birds while conducting training at one of its facilities in Guam without a

permit to take migratory birds. The court recognized a paradox in that the statute prohibits the issuance of a permit to authorize unintentional takings during military readiness activity. The committee recommends a provision that would amend the Migratory Bird Treaty Act to correct this paradox.

After several weeks of requesting that the Department communicate its environmental proposals to Congress, the Department delivered its proposed legislative language to the committee three business days prior to the Readiness Subcommittee markup. Among the requests received from the Department for relief of environmental encroachment was a proposal addressing encroachment of the Navy's operational activities by creating a new definition of ``harassment'' under the Marine Mammal Protection Act.

The committee recognizes the need to balance important federal environmental laws against the need to safeguard the Navy's ability to maximize its readiness capabilities. The committee declined to adopt a provision addressing the encroachment challenges created by the current language in the Marine Mammal Protection Act due to the lack of a meaningful period during which the committee had to examine the long-term environmental impact of this legislative provision. The committee recognizes that modifications to the Marine Mammal Protection Act may be required to address the Navy's concerns and intends to continue its examination of this matter in order to derive the correct legislative solution to this issue.

It is not the intent of the committee to weaken or repeal any of the existing federal environmental laws. The committee remains committed to fully funding the environmental programs of the Department. This commitment is demonstrated through annual authorizations to the Department and the military services of approximately $4 billion for environmental programs. The committee is similarly committed to preserving the invaluable natural resources that occupy the lands and seas upon which the military services operate, including authorization of important research and development projects with partners throughout the government and environmental community.

The committee recommends several legislative provisions to promote a statutory balance between the need to preserve and protect our invaluable natural resources and the equally important imperative to ensure national security

Morale, Welfare, and Recreation Issues

Appropriated Fund Support for Morale, Welfare, and Recreation Programs

The committee has long supported robust appropriated fund support to Morale, Welfare, and Recreation (MWR) programs of the Department of Defense and the military services. At the same time, the committee believes that the Department should conduct efficient, self-supporting business activities that both provide a benefit and some measureof income. The committee has discovered, however, that the tragic events of September 11, 2001, and the resultant tightened security on military bases have had a devastating impact on many installation MWR programs. Many business activities suffered significant financial losses as customers had difficulty accessing base facilities and a substantial number of personnel deployed. In testimony before the committee, Department of

Defense officials stated that the Department was reviewing a proposal to provide some measure of financial relief for affected programs. The committee commends the Secretary of Defense for this initiative and urges him to follow through and provide needed funds to these important programs.

Defense Commissary Agency Funding and Staffing

The committee believes that the commissary benefit is one of the most important non-pay benefits provided to military families. The committee has learned in repeated family testimony and installation visits that the commissary store is a key element of a cohesive military community, especially in times of crisis and major deployments. The committee is aware that the Defense Commissary Agency (DECA) has embarked on an aggressive cost cutting campaign that will eliminate 2,650 civilian positions over a three-year period. While the committee believes that all Defense agencies should be operated at maximum efficiency, the committee has heard testimony that these cuts may have gone too far, to the point of jeopardizing service to the customer. The Secretary of Defense, in testimony before the committee on February 6, 2002, committed to maintain the present level of savings and customer service in commissary stores, and the committee fully supports that objective. There is dispute, however, on whether that commitment is being fulfilled. To answer that question and help the committee and the Department preserve this important benefit, the committee believes that an independent agency should be tasked to determine whether an adequate level of funding and staffing will be maintained.

Accordingly, the committee directs the Comptroller General to review the DECA budget, staffing plan, and customer satisfaction survey methodology to determine the adequacy of the customer service survey methodology and whether current levels of savings and customer service can be maintained. The Comptroller General shall report his findings to the Senate Committee on Armed Services and the House Committee on Armed Services not later than March 1, 2003. The committee further directs the Secretary of Defense to moderate the pace of these proposed personnel reductions until the results of the Comptroller General review are available.

Force Protection for Morale, Welfare, and Recreation Activities

The committee is aware that the Department of Defense is reviewing force protection standards for military installations. This review includes overall base security, facility stand off distances from installation perimeters, parking security, building engineering upgrades and the like. The committee believes that Morale, Welfare, and Recreation (MWR) activities of all types should be included in this review. The committee is aware of instances where major resale and other MWR activities are located outside the perimeter of a military installation. The committee affirms its long held view that the protection of Department of Defense assets and facilities, including MWR activities, wherever they may be located, is a command responsibility that must be resourced with appropriated funds.

Support of Privatized Housing Areas

The committee supports the military services' efforts to improve military family housing through privatization initiatives. The committee has also acted to preserve the virtual monopoly of the military resale system on installations by prohibiting such projects from including facilities that would compete with military commissaries, exchanges, or other Morale, Welfare, and Recreation (MWR) programs. The committee provided that protection because it believes that military communities are best served by military resale activities. In order to continue to receive such protection, the military services' resale and MWR programs have an obligation to aggressively support privatized housing with needed programs such as shoppettes, child care centers, and other necessary facilities, especially if such housing is isolated from the parent installation.

Other Issues

Automatic Identification Technology/Radio Frequency Identification

The committee believes that equipment maintenance is a critical requirement to achieving readiness. The Department of the Army is developing depot level maintenance programs to re-capitalize equipment and mitigate the impact of aging combat equipment. The key to the maintenance process of these programs, is the ability to track and manage critical parts within the repair cycle process. Currently, the ability to accurately see the location of items in the repair cycle is limited. Many items undergoing repair are often lost, misrouted, or misplaced requiring procurement of a replacement part, or work being deferred until the part can be found. Either action results in production delays and increased repair costs.

The committee is aware of a promising automatic identification technology that would enable the tracking and management of critical parts and equipment known as Radio Frequency Identification (RF/ID) for maintenance. In January 2001, the Army successfully concluded a pilot program using RF/ID to continuously track and monitor critical and essential repair parts of selected major aviation components undergoing maintenance at their aviation depot. In addition, the committee believes that every opportunity to obtain and employ technologies that will aid in Total Asset Visibility (TAV) of all materiel in storage, transit, and from manufacturer or vendor, to depots, through ports, afloat on the high seas, and in land based storage sites. This is particularly important to optimize the processes associated with the storage and shipment of pre-positioned stocks, sets, kits, and outfits stored throughout the globe to support contingency requirements.

Because these new technologies have the potential to improve readiness, the committee recommends the addition of $8.6 million for Maintenance RF/ID, and $7.9 million for Pre-Positioned Stocks RF/ID. Procurement requirements for these systems are discussed elsewhere in the report.

Cold Weather Clothing

The committee is aware that within the active and reserve

components, there is a need for additional funding for the Extended Cold Weather Clothing System (ECWCS), which is designed to provide protection during cold and wet weather. As an example, many military units operating in harsh weather environments, including Afghanistan, continue to provide individuals with obsolete cold weather clothing that was designed and fabricated with 1970's fabric technology and construction techniques. These critical protective items, now approaching 25 years in the inventory, represent the oldest and most inefficient items of clothing in use by soldiers in the field. Faced with the dilemma of wearing the outmoded cold-weather gear and being uncomfortable, many soldiers rely on personal outdoor wear to keep warm purchased from commercial sources at their own expense. The committee believes that individual mobility, protection and comfort is a significant contributor to the combat readiness of the individual war-fighter and would significantly improve their quality of life. Therefore, the committee recommends an increase of funding for ECWCS as follows:

[In millions of dollars]

Army	8.0
Army Reserve	4.0
Army National Guard	4.0
Air National Guard	4.0

Commercial Technologies for Maintenance Activities

The committee continues to believe that the Commercial Technologies for Maintenance Activities (CTMA) program, created by the Department of Defense (DOD) in 1998 and designed to bring the most modern and advanced manufacturing capabilities used from commercial industry in DOD maintenance depots and related maintenance activities, is of great value as a technology resource and will have a positive effect on the efficiency and effectiveness of DOD industrial activities. The CTMA program is in direct support of section 361 of the National Defense Authorization Act for Fiscal Year 1998 (Public Law 105-85) that required DOD to re-engineer industrial processes and adopt best-business practices at their depot-level activities. Although DOD initially funded the CTMA program in fiscal years 1998 and 1999 to carry out the mandate of Section 361, it has failed to keep CTMA in its budget despite the strong support of the program by Congress and the depot activities of the Department. Therefore, the committee recommends the addition of $20.0 million for the Defense Logistics Agency to continue the CTMA program at depot-level activities that will lower operations and sustainment costs. The committee believes the addition of these funds will allow depot-level activities to participate in manufacturing technology demonstration projects in collaboration with more than 220 of the leading U.S. manufacturers and urges the Department of Defense to include funding for the CTMA program in future budget requests.

Industrial Mobilization Capacity/Unutilized Plant Capacity

Industrial Mobilization Capacity (IMC)/Unutilized Plant Capacity (UPC) funding at Department of the Army arsenals is

required to compensate the arsenals for the costs of that capability that is maintained only for mobilization. If the arsenals were a private business, they would get rid of this mobilization capacity and associated costs. The arsenals, however, have been directed to retain this mobilization capacity. Absent direct IMC/UPC funding the arsenals would have to include these mandated mobilization costs in their overhead rates. These inflated overhead rates would greatly hamper the arsenals as they compete for work from outside the Army as well as drive up production costs. The practical implication of not fully funding IMC/UPC has been costly to the arsenals. The Congress has expressed its concern about the Army's lack of support of IMC/UPC for the past several years, including a requirement in the National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398) to fully budget for IMC/UPC. The committee is aware that the budget request includes $24.8 million for IMC/UPC for Rock Island Arsenal and $25.2 million for IMC/UPC for Watervliet Arsenal. The committee congratulates the Secretary of the Army for finally fully budgeting for this critical requirement and expects the secretary to use the funding only for IMC/UPC needs at the Army's production arsenals.

Fuel Savings Technology

The United States uses more petroleum each year than the next five largest consuming nations combined. Military fuel consumption for aircraft, ships, ground vehicles and facilities makes the department of Defense the single largest consumer of petroleum in America. Ten years after the end of the Cold War, over 70 percent of the tonnage required to deploy Army combat units is fuel. Naval forces depend each day on millions of gallons of fuel to operate around the globe. The Air Force is the largest Department consumer, and spends approximately 85 percent of its fuel budget to deliver, by airborne tankers, just 6 percent of its annual jet fuel usage. Due to unpredictable changes in fuel costs, the projected loss in the Department's fuel account in fiscal years 2002 and 2003 is expected to be approximately $1.2 billion.

The committee believes the Department should consider new technologies to reduce the amount of required fuel. A report issued by the Defense Science Board Task Force in January 2001 titled: ``More Capable Warfighting Through Reduced Fuel Burden'', stated ``High payoff, fuel-efficient technologies are available now to improve warfighting effectiveness in current weapon systems through retrofit and by new systems acquisition''. One of these new technologies to reduce fuel usage is a bolt-on fuel catalyst that treats fuel prior to ignition and has shown remarkable reductions not only in fuel usage, but also in engine emissions.

The committee is aware that a fuel catalyst system, designed for diesel engines, has been tested over a 14 month period by the Marine Corps at Camp Pendleton, California with results showing an average 38.7 percent fuel economy and a 44.8 percent reduction in certain engine emissions. This same technology was also tested by the Navy Facilities Engineering Service Center onboard a Navy vessel that resulted in a 39 to 50 percent reduction in exhaust pollution and a 21 percent reduction in fuel consumption.This new technology would increase fuel efficiency resulting in substantial cost savings on fuel,

would extend vehicle range, and would reduce the attendant logistical cost to supply fuel. The committee understands the cost of this new technology can be amortized in as little as six months through fuel savings alone.

Given the magnitude of potential fuel savings and emissions reductions, the committee does not understand why the Department has not taken advantage of this technology. The committee urges the Secretary of Defense to take immediate steps for the application of this new technology as soon as practicable.

Energy Savings Performance Contracts

Authority for the Department of Defense to enter into Energy Savings Performance Contracts (ESPC) is contained in section 8287 of title 42, United States Code, and Executive Order 13123. Based on this authority, the Department of the Air Force has entered into numerous ESPCs. Under current Air Force policy, a single contractor is awarded an ESPC for each of the five regions, which make up the continental United States. The committee believes there could be instances where an installation is interested in entering into an ESPC, but the capabilities of the contractor assigned to that region do not meet the installation's requirements. The committee, therefore, requests the Secretary of the Air Force to re-evaluate its current policy of dividing the country into regions and entering into only one ESPC per region.

Long Term Depot Strategy

The committee is concerned that the Air Force has not yet completed a long-term depot strategy. Over the past few years, the committee has expressed a need for the Air Force to develop a strategy that provides a roadmap for how the air logistics centers will be used and supported in the future. While the committee is pleased that the Air Force has made significant progress in developing such a strategy, the committee is concerned that the strategy has not yet been finalized and looks forward to receiving, as soon as possible, a completed long-term depot strategy that will identify:

(1) Future weapon systems and how they will be supported in the depots,

(2) The plans for future investments in infrastructure and technology to ensure that the depots are fully equipped and resourced to support critical weapon systems, and

(3) The parameters of public-private partnerships to ensure effective and efficient support of weapon systems for the Air Force.

National Defense Sealift Fund Issues

The budget request contained $388.8 million for one T-AKE vessel in the National Defense Sealift Fund. The T-AKE is a Department of the Navy cargo and ammunition ship that provides at-sea replenishment. Twelve T-AKE ships are planned for procurement between fiscal years 2000 and 2007.

The committee notes that the previous future years defense program (FYDP) submitted to Congress for fiscal year 2001 included two T-AKE ships in fiscal year 2004 but the FYDP for

fiscal year 2003 includes only one ship in this year, and understands that costs for T-AKE ships in fiscal year 2004 and later years are based on the option that the Navy would procure two T-AKE ships in fiscal year 2004.

Since the committee understands that fixed-price contracts have been awarded under the assumption that the Department of the Navy would provide funding for two ships in fiscal year 2004 and to deviate from that assumption would increase unit costs, it encourages the Navy to return to a funding profile that would exercise the option to procure two T-AKE ships in fiscal year 2004.

LEGISLATIVE PROVISIONS

Subtitle A--Authorization of Appropriations

Section 301--Operation and Maintenance Funding

This section would authorize $129.8 billion in operations and maintenance funding for the Armed Forces and other activities and agencies of the Department of Defense.

Section 302--Working Capital Funds

This section would authorize $2.4 billion for Working Capital Funds of the Department of Defense.

Section 303--Armed Forces Retirement Home

This section would authorize $69.9 million from the Armed Forces Retirement Trust Fund for the operation of the Armed Forces Retirement Home, including the Armed Forces Retirement Home--Washington, and the Armed Forces Retirement Home--Gulfport.

Subtitle B--Environmental Issues

Section 311--Incidental Taking of Migratory Birds During Military Readiness Activity

This section would amend section 704 of title 16, United States Code, to give the Department of Defense statutory authority under the Migratory Bird Treaty Act, P.L. 93-300, to obtain a permit for incidental taking of birds during authorized military readiness activity.

Section 312--Military Readiness and the Conservation of Protected Species

This section would amend section 1533 of title 16, United States Code, (Public Law 93-205), to amend the Endangered Species Act of 1973 to prohibit furtherdesignations of critical habitat for endangered species in areas for which an Integrated Natural Resources Management Plan has been prepared under section 101 of the Sikes Act, (Public Law 86-797). This section would also require regulatory agencies to consider national security concerns in addition to economic impact prior to designating future areas of critical

habitat. This section would not annul existing critical habitat designations, but it would permit the Secretary of the Interior to exercise discretion to revise existing critical habitat designations on military installations. No existing critical habitat can be revised, however, if such action would result in the extinction of an endangered or threatened species.

Section 313--Single Point of Contact for Policy and Budgeting Issues Regarding Unexploded Ordnance, Discarded Military Munitions, and Munitions Constituents

This section would require the Secretary of Defense to establish a single point of contact in the Department of Defense for policy and budgeting issues involving the characterization, remediation, and management of explosive and related risks with respect to unexploded ordnance, discarded military munitions, and munitions constituents at defense sites that pose a threat to human health or safety. The section would also permit the Secretary to establish an independent advisory and review panel to report annually to Congress on progress made by the Department of Defense regarding unexploded ordnance.

Subtitle C--Commissaries and Nonappropriated Fund Instrumentalities

Section 321--Authority for Each Military Department To Provide Base Operating Support to Fisher Houses

This section would amend section 2493 of title 10, United States Code, to authorize the secretary of a military department to provide appropriated fund support to Fisher Houses associated with the health care facilities of that military department. Currently, only the Secretary of the Navy may provide such support. This provision would expand that authority to the Secretaries of the Army and Air Force.

Section 322--Use of Commissary Stores and MWR Retail Facilities by Members of National Guard Serving in National Emergency

This section would amend section 1063a of title 10, United States Code, to authorize members of the national guard who are ordered to non-federal service in response to a federally declared national emergency to use commissary and exchange stores. Many members of the national guard have been called to service in their states to help secure the homeland in the War on Terrorism, and the committee believes that they should be authorized commissary and exchange privileges.

Section 323--Uniform Funding and Management of Morale, Welfare, and Recreation Programs

This section would authorize the Secretary of Defense to permit installation commanders to manage funds appropriated for installation Morale, Welfare, and Recreation (MWR) programs under the procedures used for nonappropriated funds. In effect, the installation commander would be allowed to pool appropriated and nonappropriated MWR funds into a single nonappropriated fund account, resulting in greater flexibility and a more streamlined financial accounting system. The

Department of Defense conducted a successful test of this concept, and the committee believes adoption of this initiative throughout the Department will increase the efficiency of MWR programs operated at the installation level.

Subtitle D--Workplace and Depot Issues

Section 331--Notification Requirements in Connection With Required Studies for Conversion of Commercial or Industrial Type Functions to Contractor Performance

This provision would require the Secretary of Defense to notify Congress when the public sector maintains performance of a commercial function after competing against the private sector to determine which workforce could perform the work in the most efficient and effective manner.

Section 332--Waiver Authority Regarding Prohibition on Contracts for Performance of Security-Guard Functions

This section would provide a waiver to section 2465(a) of title 10, United States Code, which currently prohibits the contracting out of security guard functions of the Department of Defense. The waiver authority would allow the Secretary of Defense or the secretary of a military department to contract for security guard functions if these functions are or will be performed by members of the armed forces, and at locations where security-guard functions are now required since September 11, 2001.

Section 333--Exclusion of Certain Expenditures From Percentage Limitation on Contracting for Performance of Depot-Level Maintenance and Repair Workloads

Currently, section 2474(f) of title 10, United States Code, excludes, until the year 2005, all work performed by non-federal personnel at Department of Defense maintenance and repair depots from the percentage limitations (50/50) on contracting for depot-level maintenance by the private sector. This provision would remove the date limitation. The committee believes that the date limitation impedes the ability of both the public and the private sectors to fully achieve the benefits of public-private partnerships.

Section 334--Repeal of Obsolete Provision Regarding Depot-Level Maintenance and Repair Workloads That Were Performed at Closed or Realigned Military Installations

This provision would repeal section 2469a of title 10, United States Code, that addressed depot-level maintenance and repair workloads that were performed at installations closed or realigned under the Defense Base Closure and Realignment Act of1990 (Public Law 101-510). All applicable installations have completed closure or realignment actions and, therefore, section 2469a is no longer necessary.

Section 335--Clarification of Required Core Logistics Capabilities

This provision would amend section 2464(a)(3) of title 10,

United States Code to change the definition of core logistics to include acquisition logistics, supply management, system engineering, maintenance, and modification management.

Subtitle E--Defense Dependents' Education

Section 341--Assistance to Local Educational Agencies That Benefit Dependents of Members of the Armed Forces and Department of Defense Civilian Employees

This section would authorize $30.0 million for educational assistance to local education agencies where the standard for the minimum level of education within the state could not be maintained because of the large number of military connected students. The committee's commitment to military children has provided much needed boosts to the education of military children around the country. Even so, the committee notes that the Department of Education impact aid program provides supplementary funds to eligible school districts nationwide, and believes that the Department of Education bears the principal responsibility for providing support for the educational needs of the nation's children.

Section 342--Availability of Quarters Allowance for Unaccompanied Defense Department Teacher Required To Reside on Overseas Military Installation

This section would amend section 905 of title 20, United States Code, to provide a method for the Department of Defense Education Activity (DODEA) to reimburse the Department of the Navy for the costs associated with making excess family housing available to unaccompanied DODEA teachers assigned to Guantanamo Bay Naval Station, Cuba. The provision would also provide DODEA with a needed incentive to attract and retain qualified educators to accept employment at Guantanamo Bay.

Section 343--Provision of Summer School Programs for Students Who Attend Defense Dependents' Education System

This section would amend section 921 of title 20, United States Code, to clarify that the Secretary of Defense may provide optional summer school programs in the defense dependents' education system at no cost to those students who would normally be entitled to a free public education.

Subtitle F--Information Technology

Section 351--Navy-Marine Corps Intranet Contract

This provision would authorize the Department of the Navy to expand the duration of the current contract for Navy Marine Corps Intranet services from the current five years to seven years. The committee believes that this extension is necessary for the continued success of this program.

The National Defense Authorization Act for Fiscal Year 2001 (P.L. 106-398) authorized a phased implementation for the Navy-Marine Corps Intranet. Under this approach, the first phase consisted of implementing and testing the first 15 percent of

the total number of seats to be provided under the contract. Although the Navy agreed that this approach was reasonable, the following year the Navy sought legislative relief. In response, Congress granted Navy the authority to order 250,000 seats, over half the program, before the operational testing of the original 15 percent was complete. The National Defense Authorization Act for Fiscal Year 2002 (P.L. 107-107) granted this authority. The Department of the Navy has recently notified the committee that it needs authority to lengthen the duration of the original contract. The committee recognizes the enormous infrastructure the contractor has built and implemented in order for the Navy-Marine Corps Intranet to be successful. The committee believes it is appropriate for the contractor to have a longer period of time to recoup its investment costs.

The committee, however, continues to have significant concerns over this program. At this time, the primary concerns are cost and funding. The budget request for NMCI is $1.4 billion. This funding request, however, does not include the costs for maintaining legacy systems, being connected to the SIPRNET, or to fund a transition office. The committee is concerned these unfunded requirements for fiscal year 2003 will exceed $600.0 million.

Section 352--Annual Submission of Information on National Security and Information Technology Capital Assets

This provision would codify information and data the Department of Defense must supply Congress on information technology systems. In the past, the committee has received information technology documents that describe the various information technology initiatives and provide budget data on these initiatives. These documents, however, are too often inaccurate, misleading, and incomplete. The Department must provide the committee accurate and precise information and data on information technology systems. The committee will rely on the documents, submitted pursuant to this provision, when making recommendations. It is not the committee's intention, however, to eliminate data or information the Office of Management and Budget or the Department of Defense may internally request on information technology and national security systems.

Section 353--Implementation of Policy Regarding Certain Commercial Off-the-Shelf Information Technology Products

This provision would require the Secretary of Defense to ensure effective implementation, throughout the military services and defense agencies, of the federal government's policy to purchase only those commercial off-the-shelf informationassurance and information assurance-enable information technology products that have been evaluated and validated in accordance with specified criteria, schemes, or programs.

Section 354--Installation and Connection Policy and Procedures Regarding Defense Switch Network

This provision would require the Secretary of Defense to establish a clear, uniform, and enforceable policy, applicable to all military and defense agencies, regarding the testing and

certification requirements that must be satisfied before a telecom switch can be connected to the Defense Switch Network.

The committee understands that there is a current policy in place, but believes the current policy is not well defined and does not have clear requirements for certifying and connecting telecom switches. The Department of Defense must apply the new policy consistently, or risk vendor re-evaluating the Department as a customer.

Subtitle G--Other Matters

Section 361--Distribution of Monthly Reports on Allocation of Funds Within Operation and Maintenance Budget Subactivities

This provision would amend section 228 of title 10, United States Code, to clarify that the report required by section 228, concerning the allocation of funds within the various operation and maintenance accounts of the Department of Defense, be provided to the congressional defense committees.

Section 362--Minimum Deduction From Pay of Certain Members of the Armed Forces to Support Armed Forces Retirement Home

This provision would amend section 1007(i) of title 37, United States Code, to require that the minimum amount to be collected monthly from all active duty enlisted and warrant officer personnel for the support of the Armed Forces Retirement Home be no less than $1. The committee notes that the current rate of deduction, $.50 cents, was established in 1977 and; although Congress authorized the Department of Defense to increase the monthly deduction to $1 in section 371 of the National Defense Authorization Act for Fiscal Year 1995 (Public Law 103-337), the Department has not acted on this authority. The committee further notes that had the Department increased the monthly deduction to the authorized level of $1 in 1995, the Armed Forces Retirement Home Trust Fund would have received, approximately, an additional $55.0 million thereby maintaining the stability of the Trust Fund.

Section 363--Condition on Conversion of Defense Security Service to a Working Capital Funded Entity

This provision would prohibit the Department of Defense from converting the Defense Security Service (DSS) to a working capital fund (WCF) entity until the Secretary of Defense certifies to the Senate Committee on Armed Services and the House Committee on Armed Services that the financial tools and systems are in place to support DSS as a WCF.

Section 364--Continuation of Arsenal Support Program Initiative

This section would amend Section 343 of the National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398) to authorize the Secretary of the Army to extend the Arsenal Support Initiative Program through fiscal year 2004. It would also require the Secretary of the Army to provide a report to the congressional defense committees by July 1, 2003, on the benefits of this program for Army manufacturing arsenals and to the Army and the success as of that date in achieving

the goals of the program.

Section 365--Training Range Sustainment Plan, Global Status of Resources and Training System, and Training Range Inventory

This section would require the Secretary of Defense to develop a comprehensive plan for addressing problems created by limitations on the use of military lands, marine areas, and airspace reserved, withdrawn, or designated for training and testing activities by the Department. The section would also require the Secretary of Defense to report to Congress on plans of the Department to improve the Global Status of Resources and Training System to better reflect the extent that military units are achieving training requirements and the impact of encroachment and other factors negatively affecting military readiness. In addition, the section would require the Secretary of Defense to develop and maintain a training range data bank for each of the military services.

Section 366--Amendments to Certain Education and Nutrition Laws Relating to Acquisition and Improvement of Military Housing

This section would amend section 8003(b)(2) of the Elementary and Secondary Education Act of 1965, (section 7703(b)(2) of title 20, United States Code), to prevent changes in the daily attendance, caused by the privatization of family housing on military installations, from affecting payments under the impact aid program. The section would also amend section 9(b)(3) of the Richard B. Russell National School Lunch Act (section 1758(b)(3) of title 42 United States Code), to exclude payments to military personnel for privatized military housing from affecting the eligibility of students for free or reduced price school lunches.

TITLE IV--MILITARY PERSONNEL AUTHORIZATIONS

OVERVIEW

The committee's military personnel recommendations directly reflect its considerations of the impact that the war on terrorism is having on service members and their families. Following the September 11, 2001 attack on America, the nation's military forces, already stressed by years of high operations tempo and under-resourcing, responded magnificently to a range of challenges, and many new missions. Notwithstanding that magnificent response, the committee believes that the wartime operations have both masked and exacerbated the same debilitating stresses of high operations and personnel tempos that existed before the global war on terrorism. While fully supporting the efforts of the Secretary of Defense to reduce operational and mission requirements, the committee recognizes that the war on terrorism will be a long-term effort and that some growth in active manpower is prudent at this time. Therefore, the committee's recommendation would increase active duty end strength by 12,600 above fiscal year 2002 levels, the largest single-year growth in active strength since 1985-1986, and provide an additional $550.0 million to support the increase.

The committee also understands that service in uniform, whether in peace or war, often inflicts disabling injuries on

military personnel. Heretofore, disabled military retirees were prohibited by law from receiving both their full military retired pay and their disability payments from the Department of Veterans Affairs (VA). The committee's recommendation would end this injustice by authorizing the most severely disabled military retirees, those rated 60 percent and above, to receive both their full retired pay and their full VA disability payments by 2007.

Building on its continuing multi-year effort to improve pay and benefits, the committee continues to believe that fully funded and flexible compensation programs are essential to successful recruiting and retention. Accordingly, the committee would provide a pay raise that combines both across-the-board and targeted increases for mid-grade noncommissioned officers and officers, and a new, more flexible approach to managing the retention of critical health care providers. Furthermore, the committee's recommendation would reduce out-of-pocket housing expenses from the current 11.3 percent to 7.5 percent in fiscal year 2003 and sustain the commitment to eliminate out-of-pocket expenses by fiscal year 2005.

Responding to the Secretary of Defense's desire for increased freedom to manage, the committee remains committed to providing military and civilian personnel managers within the Department of Defense the flexible authorities needed to promote efficient, effective, equitable, and timely management practices. Accordingly, the committee would include more flexible legislative initiatives for promotion, retirement, education programs, leave management, medical deferment of separation or retirement, support for veterans' funerals, privately-owned vehicle storage, and recruit candidate testing.

Finally, in the area of health care, the committee continues to seek better implementation of the TRICARE For Life program and to improve existing programs. To this end, the committee's recommendations focus on several limited benefit changes, necessary improvements to TRICARE's management and business practices, the future of the managed care support contracts and optimization efforts.

LEGISLATIVE PROVISIONS

Subtitle A--Active Forces

Section 401-End Strengths for Active Forces

This section would authorize the following end strengths for active duty personnel of the armed forces as of September 30, 2003.

Service	FY 2002 authorized	FY 2003 Request	FY 2003 Committee recommendation	Change from FY 2002 authorized	Change from FY 2003 request

Army	480,000	480,000	484,800	4,800	4,800
Navy	376,000	375,700	379,457	3,757	3,457
USMC	172,600	175,000	175,000	0	2,400
Air Force	358,800	359,000	360,795	1,795	1,995
DOD Total	1,387,400	1,389,700	1,400,052	10,352	12,652

The committee's strength recommendation approves the 1.4 percent growth for the Marine Corps requested by the Secretary of Defense, and also provides for one percent increases for the Army and Navy, and a one-half of one percent increase for the Air Force that are in addition to the budget request. The committee's concerns about the inadequacy of active component manning levels extend back for at least five years prior to the commencement of the worldwide war on terrorism on September 11, 2001. Since that date, new military force requirements have emerged and the operations tempo has increased. In only one case--the increased Marine Corps end strength--did the budget request recognize these new realities. For the other services, the net end strength requested in the budget was just below the fiscal year 2002 authorized levels. While the committee fully supports the efforts of the Secretary of Defense to require the military services to comprehensively review their total force manpower requirements, the committee also believes that some increases in end strength are prudent now, that the recommended increases are within the discretionary end strength growth permitted by current law, and that the recommended increases can be achieved by each of the military services. To support the additional end strength, the committee recommends increasing by $550.0 million the total amount authorized for the military personnel accounts of the Army, Navy and Air Force.

Section 402--Revision in Permanent End Strength Minimum Levels

This section would amend section 691 of title 10, United States Code, by establishing end strength floors for the active forces at the fiscal year 2003 strength levels recommended by the committee in section 401.

Section 403--Authority for Military Department Secretaries To Increase Active-Duty End Strengths by Up to One Percent

This section would authorize the secretaries of the military departments to increase the authorized active duty end strength of their respective military service by up to one percent. The increase allowed to the secretaries of the military departments would be within the overall two percent increase in end strength that current law now permits the Secretary of Defense to authorize. The committee recommends

this expanded authority for the secretaries of the military departments to allow them flexibility to enhance manning and readiness in essential units or critical specialties or ratings, and to assist them in managing dynamic strength fluctuations occurring in the military services as a result of new requirements, hard-to-predict recruiting and retention variables, and variables induced by the movement of reserve component personnel on and off active duty.

Section 404--General and Flag Officer Management

This section would increase by one the limit on the number of United States Marine Corps three- and four-star general and flag officers authorized to be on active duty, thereby permitting the commanding general, II Marine Expeditionary Force, to serve as a lieutenant general. This section would also exempt the senior military assistant to the Secretary of Defense from counting against the limits on three- and four-star general and flag officers that apply to that officer's specific military service. In addition, the section would also require that the chief of the Army Veterinary Corps serve in the grade of brigadier general. This section would become effective upon Congressional receipt of a report, using current requirements and data, that complies fully with section 1213, of the National Defense Authorization Act for Fiscal Year 1997 (Public Law 104-201).

Section 405--Extension of Certain Authorities Relating to Management of Numbers of General and Flag Officers in Certain Grades

This section would extend to December 31, 2004, three expiring authorities relating to general and flag officer management. Those authorities provide for: the process by which the Secretary of Defense and Chairman of the Joint Chiefs of Staff fill vacant senior joint four-star general and flag officer positions; the exemption of the senior joint four-star general and flag officers appointed by that process from the general and flag officer limits that apply to the military services; and, the process by which the Chairman of the Joint Chiefs of Staff designates and fills 12 general and flag officer positions on the joint staff and 10 reserve component general and flag positions on the staffs of the commanders of the unified and specified commands.

Subtitle B--Reserve Forces

Section 411--End Strengths for Selected Reserve

This section would authorize the following end strengths for the selected reserve personnel, including the end strength for reserves on active duty in support of the reserves, as of September 30, 2003:

	FY 2003	Change from FY 2002

	Service	authorized		Committee	FY 2003	FY 2002	Request	recommendation	request	authorized
Army National Guard	350,000	350,000	350,000	0	0					
Army Reserve	205,000	205,000	205,000	0	0					
Naval Reserve	87,000	87,800	87,800	0	800					
Marine Corps Reserve	39,558	39,558	39,558	0	0					
Air National Guard	108,400	106,600	106,600	0	-1,800					
Air Force Reserve	74,700	75,600	75,600	0	900					
DOD Total	864,658	864,558	864,558	0	-100					
Coast Guard Reserve	8,000	9,000	9,000	0	1,000					

Section 412--End Strengths for Reserves on Active Duty in Support of the Reserves

This section would authorize the following end strengths for reserves on active duty in support of the reserves as of September 30, 2003:

	FY 2002	FY 2003	Change from	Committee	FY 2003	FY 2002	Request	recommendation	request	authorized
Army National Guard	23,698	23,768	24,562	794	864					
Army Reserve	13,406	13,588	14,070	482	664					
Naval Reserve	14,811	14,572	14,572	0	-239					
Marine Corps Reserve	2,261	2,261	2,261	0	0					
Air National Guard	11,591	11,697	11,697	0	106					
Air Force Reserve	1,437	1,498	1,498	0	61					

DOD Total.....	67,204	67,384	68,660	1,276	1,456	

The committee believes that full time manning is a crucial component of readiness in the reserve components and for the last several years has supported continued overall growth in full-time manning. In that vein, the committee's recommendation for fiscal year 2003 would provide for a 2.2 percent growth over the previous year's end strength for reserves on active duty in support of the reserves.

Section 413--End Strengths for Military Technicians (Dual Status)

This section would authorize the following end strengths for military technicians (dual status) as of September 30, 2003:

Service	FY 2002 authorized	Request	FY 2003 request	Change from FY 2002 authorized	Change from FY 2003 request	Committee recommendation (floor)
Army National Guard	23,615	23,615	24,102	487	487	
Army Reserve.....	6,249	6,349	6,599	250	350	
Air National Guard.....	22,422	22,495	22,495	0	73	
Air Force Reserve.....	9,818	9,911	9,911	0	93	
DOD Total.....	62,104	62,370	63,107	737	1003	

The committee's recommendation would provide for a 1.6 percent growth in the strength of military technicians above the levels authorized in fiscal year 2002.

Section 414--Fiscal Year 2003 Limitation on Non-Dual Status Technicians

This section would establish the following limits on the numbers of non-dual status technicians as of September 30, 2003:

Service	FY 2002 limit	Request	FY 2003 (limit) request	Change from FY 2002 limit	Committee recommendation
Army National Guard	1,600	1,600	1,600	0	0
Army Reserve	1,095	995	995	0	-100
Air National Guard	350	350	350	0	0
Air Force Reserve	90	0	90	90	0
DOD Total	3,135	2,945	3,035	90	-100

The committee's recommended increase in the number of Air Force Reserve non-dual status technicians results from revised data provided by that component subsequent to the committee's receipt of the budget request. The committee notes that the Army Reserve and the Air Force Reserve are required by section 10217 of title 10, United States Code, to reduce the total number of non-dual status technicians in both components to no more than 175 by September 30, 2007, and the committee urges both components to coordinate their efforts to reach that objective.

Subtitle C--Authorization of Appropriations

Section 421--Authorization of Appropriations for Military Personnel

This section would authorize $93,725.028 million to be appropriated for military personnel. This authorization of appropriations reflects both reductions and increases to the budget request that are itemized below.

[Dollars in millions]

	Military personnel accounts	O&M accounts
Recommended Increases		
Active End Strength:		
Army	247.00	.....
Navy	201.00	.....
Air Force	102.00	.....

RC End Strength:		
Army National Guard AGRs	28.40	.....
Army Reserve AGRs	11.50	.....
Army National Guard Military Technicians	.....	11.30
Army Reserve Military Technicians	.....	8.00
Defense Health Program:		
TRICARE Prime Remote	.....	6.00
Marshall Island diabetes program	.....	2.0
Other Programs:		
Military personnel funding in Defense Emergency Response Fund	32.90	.....
Naval Sea Cadets	.....	1.00
National Guard Challenge	.....	2.50
National Guard Youth Foundation	.....	2.50
Uniting Through Reading	.....	0.13
Total Recommended Additions	622.80	33.43
Recommended Reductions		
Effect of FY 2002 NDAA legislation on accrual payment to Uniformed Services Retiree Health Care Fund	810.00	.....
Savings from not adopting DOD legislative proposals	29.20	.....
Savings from repeal of Special Stipend for Severely Disabled	33.43	.....
Transfer funding for wartime-related pays to H.R. 4547	320.80	.....
Total Recommended Reductions	1,193.43	

TITLE V--MILITARY PERSONNEL POLICY

OVERVIEW

The committee remains committed to providing military and civilian personnel managers within the Department of Defense the flexible authorities needed to promote efficient, effective, equitable, and timely management practices. Accordingly, the committee would include more flexible legislative initiatives for promotion, retirement, education programs, leave management, medical deferment of separation or retirement, support for veterans' funerals, privately-owned vehicle storage, and recruit candidate testing.

ITEMS OF SPECIAL INTEREST

Absentee Voting for Military Members

Section 1604 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107) requires the Secretary of Defense to conduct during the November 2002 general election a statistically valid demonstration project under which uniformed voters may cast their absentee ballot through an electronic voting system. The committee is aware that the Secretary of Defense has exercised the discretionary authority included in section 1604 to delay the electronic voting demonstration

project until the general election in November 2004. The committee urges the Secretary of Defense to continue to investigate the potential to participate in, and provide funding for, smaller scale tests during the November 2002 election as preparation for the major effort envisioned for the November 2004 election. The committee is aware of existing initiatives that would benefit from the support of the Department of Defense and would provide such an interim step opportunity during the November 2002 election.

Compensation and Benefits for Reserve Component Members

The committee recognizes that the current level of reserve component participation and responsibility in military operations changed dramatically during the last decade of the twentieth century. Today the reserve components represent a significant portion of the capability of the total force and are an essential element in the full spectrum of worldwide military operations. Since 1996, the reserve components have contributed between 12 and 13 million full time equivalent days in direct support of DOD missions, a ten-fold increase over a 1989 benchmark period. In addition, the current national military strategy calls for a significant number of military occupational specialties and skills to reside solely in the reserve components. The recent war on terrorism has required the call-up of over 85,000 reservists to active duty, and the current operational tempo gives no indication that there will be significant reductions in the near future. This increase in operations tempo of reserve forces raises questions about compensation and benefits of particular concern to the citizen-soldier.

Accordingly, the committee directs the Comptroller General of the United States to review the terms and elements of reserve compensation, benefit, and personnel support programs, including the retirement system. The review should address the effectiveness and adequacy of compensation and benefit programs, income protection for reservists called to active duty, family support programs, health care access, and other programs of interest to reservists serving on active duty. The review should assess the need for these programs to be improved and, if appropriate, offer recommendations for achieving needed improvements. The review should also include a comparison of these programs to similar programs conducted for the benefit of active duty forces to determine if the reserve programs are fair and equitable given the increased contributions by reserve forces to the defense of the nation.

Additionally, the review should include an examination of the differences in benefits and protections provided to reservists who are called to serve under different authorities to include: title 10, United States Code; title 32, United States Code; and state active duty. The review should assess the need for benefits and protections to be made consistent regardless of the authority under which reservists are called to serve and, if appropriate, offer recommendations for achieving that objective.

The committee directs the Comptroller General to report his findings and recommendations to the Senate Committee on Armed Services and the House Committee on Armed Services by March 31, 2003.

Consideration of Innovative Readiness Training Initiatives

The committee recognizes the success of the Department of Defense Civil Military Innovative Readiness Training Program, which is authorized by section 2012 of title 10, United States Code. This program provides military unit and individual support and services to non-Department of Defense organizations in a manner that accomplishes unit and individual training requirements. The committee urges the Secretary of Defense to consider training opportunities that provide a benefit to our nation's youth and support the President's education priorities. The committee recommends the secretary to consider applications from local schools, particularly those in rural and urban areas, for support of training initiatives to establish computer networks in schools.

Review and Report on Increased Participation of U.S. Navy Officers in Intermediary and Senior War Colleges

The committee is concerned about the challenges facing the Navy in providing its officers with appropriate and timely opportunities for professional military education. Therefore, the committee directs the Secretary of the Navy to review the plans and progress achieved to increase participation of active and reserve Navy officers in intermediate and senior war colleges. The review should include an assessment of the attendance objective for each level, as well as actions being taken to achieve the objectives. Specific attention should be given to responses that may require enabling congressional action. The Secretary of the Navy shall provide the results of the review to the Senate Committee on Armed Services and the House Committee on Armed Services by April 18, 2003.

Uniting Through Reading

The committee is pleased to note the success of the Navy's Uniting Through Reading program. Uniting Through Reading improves literacy and strengthens the quality of life for Navy and Marine Corps families separated during deployments. This popular family support program is currently available to all ships preparing for deployment, and is being extended to the Naval Construction Forces (Seabees), Marine Expeditionary Units, the Naval Reserve Forces, individual deployers, and deployed, shore-based squadrons. Uniting Through Reading helps maintain the emotional bond between children and parents during extended periods of separation. The committee recommends an additional $130,000 for this important program.

LEGISLATIVE PROVISIONS

Subtitle A--General Personnel Management Authorities

Section 501--Increase in Number of Deputy Commandants of the Marine Corps

This section would increase the authorized number of deputy commandants at Headquarters, United States Marine Corps, from five to six. This authorization would permit the commander,

Marine Corps Combat Developments Command, to be designated a deputy commandant, but would not increase the number of three-star Marine Corps general officers on active duty because the commander, Marine Corps Combat Developments Command, already holds that rank.

Section 502--Extension of Good-of-the-Service Waiver Authority for Officers Appointed to a Reserve Chief or Guard Director Position

This section would extend to December 31, 2004, the authority of the Secretary of Defense to waive the requirement for significant joint experience as a qualification for appointment as the chief of the Army, Navy, Air Force, or Marine Corps reserve or as director of the Army or Air National Guard. The committee recommends the extension because it understands that the requirement for significant joint experience was established just two years ago with the enactment of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398), and that the Department and service secretaries will require a period of time for future candidates for appointment as chiefs of the reserve and national guard components to acquire that joint experience. However, the committee also believes that unless the Secretary of Defense acts aggressively, it could be many years before senior reserve component officers will gain the requisite experience. Therefore, this section would also require the Secretary of Defense to report to Congress regarding the steps that he, together with the Chairman of the Joint Chiefs and the secretaries of the military departments, will take to ensure that no further extensions of this waiver authority will be required after 2004.

Subtitle B--Reserve Component Management

Section 511--Reviews of National Guard Strength Accounting and Management and Other Issues

This section, like section 512, is a result of the committee's continued concerns about the national guard's unit strength management, senior officer selection and oversight, and whistleblower protections. This section would require both the Comptroller General and the Secretary of Defense to conduct reviews and to provide the committee assessments of:

(1) The effectiveness of the Department of Defense's continuing effort to improve unit strength management in the Army National Guard;

(2) The effectiveness of the federal recognition process for senior national guard officers;

(3) The nature and extent of administrative and judicial actions taken in cases of substantiated misconduct by senior national guard officers;

(4) The effectiveness of federal protections for whistleblowers and the national guard and the nature and extent of corrective actions taken against those in the national guard who retaliate against whistleblowers; and

(5) The differing Army and Air Force policies for taking adverse administrative actions against national guard general officers serving in a state status.

Section 512--Courts-Martial for the National Guard When Not in Federal Service

This section would amend title 32 United States Code, to update and streamline the administration of military justice in the national guard when it is not in a federal status. Furthermore, reflecting the committee's support for the 1998 recommendation of the Department of Defense Panel to Study Military Justice in the National Guard, this section would require the Secretary of Defense to develop a model state Uniform Code of Military Justice, as well as a model state Manual for Courts-Martial, and undertake an effort to present these two models for consideration and possible adoption by all the states and territories. As noted in the panel's report, such an effort would promote the modernization and uniformity of the administration of military justice in the national guard while in state status.

Section 513--Matching Funds Requirements Under National Guard Youth Challenge Program

This section would revise the Department of Defense cost share for each state's National Guard Challenge Program from 60 percent to 75 percent.

Subtitle C--Reserve Component Officer Personnel Policy

Section 521--Exemption from Active Status Strength Limitation for Reserve Component General and Flag Officers Serving on Active Duty in Certain Joint Duty Assignments Designated by the Chairman of the Joint Chiefs of Staff

This section would exempt the 10 reserve component general and flag officers who are serving on active duty on the joint staffs of the commanders of the unified and specified commands from counting against the numbers of reserve component general and flag officers authorized by section 12004 of title 10, United States Code. These 10 reserve component general and flag officers, the so-called ``Chairman's ten'' because the Chairman of the Joint Chiefs of Staff designates the joint staff positions they fill on active duty, already are exempted by section 526 of title 10, United States Code, from counting against active duty general and flag officer limits. The proposed exemption from reserve component general and flag officer authorizations would enable the reserve components not on active duty to fill 10 more general and flag officer mobilization positions. The authority for this exemption would expire on December 31, 2004.

Section 522--Eligibility for Consideration for Promotion to Grade of Major General for Certain Reserve Component Brigadier Generals Who do Not Otherwise Qualify for Consideration for Promotion Under the One-Year Rule

Section 14301 of title 10, United States Code, precludes promotion eligibility for reserve officers who are serving on the reserve active-status list or the active-duty list (or combination of both lists) for less than one year as of the

convening of the promotion board. This section would permit reserve brigadier generals of the Army and Air Force to be eligible for promotion with less than one year on the reserve active-status list or the active-duty list (or combination of both lists) when the following three factors apply to the officer:

(1) The officer had been transferred from an inactive status to the active status list during the one-year period preceding the date of the convening of the promotion board.

(2) The officer had been in an inactive status for less than one year immediately before the officer's most recent transfer to an active status.

(3) The officer had continuously served for at least one year on the reserve active status list, the active duty list (or a combination of both lists) before the officer's most recent transfer to an inactive status.

Section 523--Retention of Promotion Eligibility for Reserve Component General and Flag Officers Transferred to an Inactive Status

Section 14317 of title 10, United States Code, requires that reserve officers forfeit their status as a selectee for promotion when they are transferred to inactive status. They may be promoted upon return to active status, but only if recommended for promotion by a subsequent promotion board. This section would permit reserve officers selected for promotion to major general and rear admiral to retain their promotion eligibility and, if otherwise qualified, be promoted to the higher grade upon returning to an active status from an inactive status.

Section 524--Authority for Limited Extension of Medical Deferment of Mandatory Retirement or Separation for Reserve Officers

This section would authorize the secretaries of the military departments to defer mandatory retirement or separation of reserve officers undergoing hospitalization or medical observation when such hospitalization or medical observation is part of an evaluation to determine the officer's eligibility for disability retirement or separation. The secretary of the military department would be authorized to extend the retirement or separation for 30 days after completion of the evaluation requiring hospitalization or medical observation.

Subtitle D--Education and Training

Section 531--Authority for Phased Increase to 4,400 in Authorized Strengths for the Service Academies

This section would permit the secretaries of the military departments, beginning with classes entering the service academies during the 2003-2004 academic year, to increase the end strengths for cadets or midshipmen at their respective service academies, in annual increments of up to 100, from the current limit of 4,000 to 4,400. In addition, this section would specify that the annual increase in service academy end strength could not exceed the increase achieved during the preceding year in enrollments in the senior Reserve Officers

Training Program (ROTC) of that service. This section also urges the secretaries of the military departments to ensure that by the 2006-2007 academic year the corresponding increase in enrollments in the senior ROTC program are all scholarship participants. The committee recommends a linkage between end strengths at the service academies and senior ROTC enrollments because it firmly believes that the long-term effectiveness of the officer corps of the military services will be enhanced by growth in both commissioning sources.

Section 532--Enhancement of Reserve Component Delayed Training Program

This section would authorize members who enlist in the reserve delayed training program to remain in that program for one year, a full three months longer than authorized in current law. The one-year duration would be consistent with the active duty delayed entry program.

Subtitle E--Decorations and Awards

Section 541--Waiver of Time Limitations for Award of Certain Decorations to Certain Persons

This section would waive the statutory time limitations for the award of the Distinguished Flying Cross to individuals recommended for award of the Distinguished Flying Cross by the service secretary concerned.

Section 542--Option To Convert Award of Armed Forces Expeditionary Medal Awarded for Operation Frequent Wind to Vietnam Service Medal

This section would authorize participants in Operation Frequent Wind, the evacuation of Vietnam conducted on April 29 and 30, 1975, to return the award of the Armed Forces Expeditionary Medal and to receive the Vietnam Service Medal in its place.

Subtitle F--Administrative Matters

Section 551--Staffing and Funding of the Defense Prisoner of War/ Missing Personnel Office

This section would require the Secretary of Defense to increase the military and civilian manning levels, as well the annual funding, for the Defense Prisoner of War/Missing in Action Office (DPMO) in fiscal year 2004 and subsequent years to enable the DPMO to adequately perform its full range of missions. This section would also prohibit the secretary in fiscal year 2003 from reducing the assigned military and civilian personnel and funding below the levels requested in the budget. The committee makes this recommendation because it believes the DPMO plays a crucial role in the fulfillment of the national commitment to provide a full accounting for the prisoners of war and missing in action of the nation's wars. The committee is disappointed that the secretary did not heed the committee's direction in the committee report on H.R. 2586 (H. Rept. 107-194), to increase DPMO resources. The committee also understands that the DPMO faces a potential reduction of

15 percent or more in fiscal year 2003 as part of the secretary's plan to reduce the size of headquarters. The committee believes such a reduction in DPMO to be imprudent.

Section 552--Three-Year Freeze on Reductions of Personnel of Agencies Responsible for Review and Correction of Military Records

The committee considers the review boards agencies, and specifically the boards for correction of military records, within each military department as representing congressional interests in safeguarding fairness and equity for all service members. The committee views these boards differently from other headquarters functions and becomes concerned when announced management decisions to reduce manpower levels within the boards threaten their efficiency and effectiveness.

Accordingly, this section would preclude the secretaries of the military departments from reducing the number of military and civilian personnel assigned to duty within the boards through fiscal year 2005 until 90 days after the secretary of the military department concerned submits a report that describes the proposed reduction, provides the rationale for the reduction, and specifies the number of personnel that will be assigned to the board after the reduction is complete.

Section 553--Department of Defense Support for Persons Participating in Military Funeral Honors Details

This section would authorize the Secretary of Defense to prescribe a flat-rate daily stipend for military retirees and others who are not service members or government employees participating in funeral honors details. The stipend would be paid in lieu of separate payments for transportation and miscellaneous expenses.

Section 554--Authority for Use of Volunteers as Proctors for Administration of Armed Services Vocational Aptitude Battery Test

This section would authorize the secretaries concerned to accept the voluntary services of educators and other individuals to assist recruiters in administering the Armed Services Vocational Aptitude Battery to high school students.

Section 555--Annual Report on Status of Female Members of the Armed Forces

This provision would require the Secretary of Defense to submit an annual report to the Senate Committee on Armed Services and the House Committee on Armed Services on the status of female members of the armed forces regarding assignments and assignments policies, deployment, promotion and retention rates, and sexual harassment.

Subtitle G--Benefits

Section 561--Voluntary Leave Sharing Program for Members of the Armed Forces

This section would authorize a service member to transfer accrued leave to another member when the recipient is likely to

require a prolonged absence from duty due to a medical condition of a family member or other hardship condition. The commander of the recipient and the commander of the contributor would be required to approve such transfer of leave.

Section 562--Enhanced Flexibility in Medical Loan Repayment Program

This section would repeal the bar against providing loan repayment benefits to participants in the armed forces health professions scholarship and financial assistance program and would remove the limit on the total benefit that may be paid.

Section 563--Expansion of Overseas Tour Extension Benefits

Section 705 of title 10, United States Code, authorizes members who have been granted leave and transportation benefits in connection with an extension of an overseas tour to travel to the nearest port of entry within the 48 contiguous states and return. This section would authorize members who have been granted leave and transportation benefits in connection with an extension of an overseas tour to travel to an alternative location within the 48 contiguous states, so long as the cost does not exceed the cost of transportation to the nearest port of entry.

Section 564--Vehicle Storage in Lieu of Transportation When Member Is Ordered to a Nonforeign Duty Station Outside Continental United States

This section would authorize members to store a privately-owned vehicle when the member is ordered to a duty station in a nonforeign area outside the continental United States and the shipment of a vehicle is prohibited or contingent upon completion of extensive modification.

Subtitle H--Military Justice Matters

Section 571--Right of Convicted Accused to Request Sentencing by Military Judge

This section would amend chapter 47 of title 10, United States Code, to permit the sentencing phase of trial in courts-martial to be conducted by a military judge sitting alone, rather than by court members.

Under the present courts-martial process, a military judge alone may not sentence an accused if the accused elects to be tried by court members. Such a result, however, has disadvantages. Sentencing trials involving members may be more lengthy and complicated than judge-alone proceedings, costing the government time and expense and keeping court members away from their regular duties for extended periods. Moreover, military judges generally have as sound a sense of community and disciplinary norms and mores as court members because they typically preside over many cases at a single installation.

This section would permit a separate choice of forum decision to be made following announcement of findings of guilt or innocence by the court but before evidence on sentencing is received. A request for sentencing by judge-alone could be made orally on the record or in writing. Consistent with article 18 of the Uniform Code of Military Justice, section 818 of title

10, United States Code, and Rule for Courts-Martial 201(f)(1)(C), judge-alone sentencing would not be permitted in capital cases.

This section would apply to offenses committed after January 1, 2003. The committee notes that Congress considered a similar provision last year but deferred legislative action pending receipt of a report from the Secretary of Defense on this issue. The report was due March 1, 2002, but has not been received. The committee has been provided no explanation for the failure to timely provide this report. The committee anticipates receipt of the report in time to permit full consideration of this issue before the effective date of this provision.

Section 572--Report on Desirability and Feasibility of Consolidating Separate Courses of Basic Instruction for Judge Advocates

This section would require the Secretary of Defense to study the feasibility and desirability of consolidating the separate Army, Navy and Air Force courses on basic instruction for judge advocates into a single course to be conducted at a single location. Recent deployments of American military personnel have demonstrated increased interoperability requirements, as well as the likelihood that joint military operations will be more common in the future. Given this reality, questions must be asked about whether cost savings in training activities can be achieved and whether common courses of instruction among the services in certain disciplines leading to better interoperability in joint operations make sense.

In the context of the services' judge advocate officer corps, the legal subjects officers should learn in order to be successful military attorneys are not service-specific. For example, the provisions of the Uniform Code of Military Justice and courts-martial practices are substantially the same for all the services, as are the majority of laws pertaining to claims, civil law and legal assistance. Moreover, overhead and infrastructure cost savings could be achieved by consolidating the physical facilities of the three service judge advocate schools into a single location. Service-unique instruction or acculturation could easily be provided as an adjunct to a generic legal course of instruction. The result of this consolidation could be well-trained legal officers who could perform better in joint operational environments and whose training costs are less than those of officers who attend the separate courses of instruction provided at present. The committee requires the secretary to report on his findings to the Senate Committee on Armed Services and the House Committee on Armed Services by February 28, 2003.

TITLE VI--COMPENSATION AND OTHER PERSONNEL BENEFITS

OVERVIEW

The committee continues to believe that fully funded and flexible compensation programs are essential to successful recruiting and retention. Accordingly, the committee would include a pay raise that combines both across-the-board and targeted increases for mid-grade noncommissioned officers and officers, increases to wartime pays and benefits and a new more

flexible approach to managing the retention of critical health care providers.

The committee remains committed to achieving for disabled military retirees concurrent receipt of military retired pay and disability compensation from the Department of Veterans Affairs (VA). The committee is pleased that the Concurrent Resolution on the Budget--Fiscal Year 2003 (H. Con. Res. 353), adopted in the House includes an allocation of $5.8 billion over 5 years in mandatory spending to fund full concurrent receipt during fiscal year 2007 for disabled retirees rated by the VA as 60 percent disabled and above. Accordingly, the committee would include a provision that achieves full concurrent receipt of military retired pay and VA disability compensation during fiscal year 2008 for military retirees rated by the VA as 60 percent disabled and above.

ITEMS OF SPECIAL INTEREST

Integrating Basic Allowance for Subsistence into Basic Pay

The committee has grown increasingly concerned that similarly situated deployed service members receive disparate treatment regarding receipt of basic allowance for subsistence (BAS). Based on the type of deployment and service-unique policies, some service members receive their full BAS while others serving at the same duty location receive only a portion of their BAS. While the committee remains committed to resolving such inequities, this concern has prompted the committee to question the larger issue of whether BAS continues to be a useful management tool. It occurs to the committee that the services would benefit from eliminating the administrative burden and structure associated with managing BAS and integrating the value of the allowance into basic pay for all personnel. While such a strategy would raise the issue of how to deal with the increase in the tax burden for individuals, the committee notes that the increase in personal taxes would be counterbalanced by an increase in the value of retired pay for those that remain for a full career. The committee is aware that the Seventh Quadrennial Review of Military Compensation recognized the benefits of simplifying military pay systems and made a recommendation that included the elimination of BAS.

Accordingly, the committee directs the Secretary of Defense to study this issue, examine the cost implications, develop implementation strategies, and determine the Department of Defense position. The committee directs the Secretary of Defense to report the findings of his review to the Senate Committee on Armed Services and the House Committee on Armed Services by March 31, 2003.

Montgomery G.I. Bill for Members of the Selected Reserve

The committee has received complaints that the benefits of the Montgomery G.I. Bill for members of the selected reserve have not kept pace with the benefits provided under the Montgomery G.I. Bill for members serving on active duty. The committee recognizes that there are necessary differences between the programs and that benefit levels will be different due to the different purposes of the programs. However, the committee believes that some of the existing differences

between the programs are not justified and have resulted from administrative oversight or neglect. Accordingly, the committee directs the Secretary of Defense to study the differences between the two programs and report the findings and recommendations of his review to the Senate Committee on Armed Services and the House Committee on Armed Services by March 31, 2003.

Reducing the Gap Between Military and Private Sector Pay Increases

The committee believes that eliminating the gap in pay raise rates between the military and the private sector is fundamental to an effective compensation strategy and an essential prerequisite to successful recruiting and retention. While a variety of other allowances, special pays, and bonuses must be constantly monitored and adjusted when required, basic pay is the foundation upon which the other elements of compensation are based and it must keep pace with private sector pay raises.

Section 602 of the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65) requires that military pay raises exceed the private sector rate by one-half of one percent during fiscal years 2001 through 2006. The committee recognizes that, depending on the pay raises planned for the defense budgets through fiscal year 2006, the pay gap will likely not be eliminated during fiscal year 2006. The committee is inclined to extend beyond fiscal year 2006 the period of time that military pay raises are required to exceed the private sector pay raise rates. While such an action would signal military forces and their leaders that the committee is committed to restoring and maintaining parity between military and private sector pay raises, it may also prematurely set a goal that will ultimately be unnecessary.

Accordingly, the committee directs the Secretary of Defense to report the details of his long-term plan for military pay raises and his estimate as to when the gap in pay raise rates between the military and the private sector will be eliminated. The committee directs the Secretary of Defense to provide the report to the Senate Committee on Armed Services and the House Committee on Armed Services by March 31, 2003.

Use of the Critical Skills Retention Bonus for Linguists

The committee urges the secretaries of the military departments to fully utilize the flexibility provided in the critical skills retention bonus to address the need to retain qualified foreign language speakers. The war on terrorism has highlighted the need to attract and retain foreign language speakers, including, but not limited to, critical languages such as Arabic, Korean, Mandarin Chinese, Persian-Farsi, and Russian. For example, a January 2002 report by the General Accounting Office (GAO) indicated thatthe Army had a requirement for 608 Korean linguists, but was only able to fill 480 positions. This shortfall did not result because of inadequate training levels. The Defense Language Institute has graduated 693 Korean linguists over the previous 5 years, or 114 percent of the Army's total requirement. The committee believes that more needs to be done to retain skilled linguists to take advantage of the higher productivity inherent with more experienced and proficient linguists. The committee believes that the critical skill retention bonus offers the means to

achieve the needed improvement in the retention of military linguists.

LEGISLATIVE PROVISIONS

Subtitle A--Pay and Allowances

Section 601--Increase in Basic Pay for Fiscal Year 2003

This section would increase basic pay a minimum of 4.1 percent for all members of the uniformed services. In addition, the section would provide additional increases to mid-grade and senior noncommissioned officers, and mid-grade officers to maintain incentives to serve throughout the enlisted career and to increase incentives to retain junior officers and highly skilled enlisted members.

This raise would continue to fulfill Congress' commitment to increasing pay for the uniformed services. The combined across-the-board and targeted raise would be the equivalent of a 4.7 percent across-the-board raise and would reduce the pay gap between military and private sector pay increases over time from 7.5 percent to 6.4 percent.

Section 602--Expansion of Basic Allowance for Housing Low-Cost or No-Cost Moves Authority to Members Assigned to Duty Outside United States

This section would authorize the secretary concerned to pay members assigned overseas who complete low-cost or no-cost moves to continue to receive basic allowance for housing (BAH) based on the BAH rate for the member's previous duty location if the secretary determines that it would be inequitable to pay the member the BAH rate for the member's new duty location. The provision would bring the treatment of BAH rates for low-cost or no-cost moves in an overseas area in line with the treatment of BAH for similar moves inside the United States.

Subtitle B--Bonuses and Special and Incentive Pays

Section 611--One-Year Extension of Certain Bonus and Special Pay Authorities for Reserve Forces

This section would extend the authority for the selected reserve reenlistment bonus, the selected reserve enlistment bonus, special pay for enlisted members of the selected reserve assigned to certain high priority units, the selected reserve affiliation bonus, the ready reserve enlistment and reenlistment bonus, and the prior service enlistment bonus until December 31, 2003.

Section 612--One-Year Extension of Certain Bonus and Special Pay Authorities for Certain Health Care Professionals

This section would extend the authority for the nurse officer candidate accession program, the accession bonus for registered nurses, the incentive special pay for nurse anesthetists, the special pay for selected reserve health care professionals in critically short wartime specialties, and the accession bonus for dental officers until December 31, 2003.

The provision would also extend the authority for repayment of educational loans for certain health professionals who serve in the selected reserve until January 1, 2004.

Section 613--One-Year Extension of Special Pay and Bonus Authorities for Nuclear Officers

This section would extend the authority for the special pay for nuclear-qualified officers extending the period of active service, nuclear career accession bonus, and the nuclear career annual incentive bonus until December 31, 2003.

Section 614--One-Year Extension of Other Bonus and Special Pay Authorities

This section would extend the authority for the aviation officer retention bonus, the reenlistment bonus for active members, the enlistment bonus for active members, the retention bonus for members with critical military skills, and the accession bonus for new officers in critical skills until December 31, 2003.

Section 615--Minimum Levels of Hardship Duty Pay for Duty on the Ground in Antarctica or on Arctic Icepack

This section would specify a hardship duty pay rate of not less than $240 per month for duty performed by service members on the ground in Antarctica or on the Arctic icepack. The provision would specify that the monthly rate be prorated and paid for each day of qualified service.

Section 616--Increase in Maximum Rates for Prior Service Enlistment Bonus

This section would increase the rates paid to reservists with critical skills under the prior service enlistment bonus from $5,000 to $8,000 in the case of a member who enlists for six years, from $2,500 to $4,000 in the case of a member who enlists for three years, and from $2,000 to $3,500 in the case of a member who received a prior bonus for a three year enlistment and who reenlists or extends for an additional three years.

Section 617--Retention Incentives for Health Care Providers Qualified in a Critical Military Skill

The committee recognizes that, in some cases, the legislative authorities for health care provider special and incentive pays and bonuses have not been updated for a decade andhave lost their value to attract and retain quality practitioners. The committee understands that the Department of Defense is studying health care provider compensation and that a new structure for these incentives will be forthcoming. In an effort to facilitate the ultimate implementation of the new pay and bonus structure, the committee elects to adopt a more flexible legislative authority for this purpose that preserves through an annual report the capability of Congress to provide oversight. Accordingly, this section would amend the critical skill retention bonus to provide exceptions to the limits on bonus amounts and years of service for bonuses paid to health care providers.

Subtitle C--Travel and Transportation Allowances

Section 631--Extension of Leave Travel Deferral Period for Members Performing Consecutive Overseas Tours of Duty

This section would authorize members who have been granted travel and transportation benefits in connection with a consecutive overseas tour to defer those benefits for the full duration of the additional tour of duty. If the member is unable to undertake the travel before the completion of the additional tour because of duty in connection with a contingency operation, the provision would authorize the member to defer the travel and transportation for a year after the contingency operation duty ends.

Subtitle D--Retired Pay and Survivors Benefits

Section 641--Phase-in of Full Concurrent Receipt of Military Retired Pay and Veterans Disability Compensation for Military Retirees with Disabilities Rated at 60 Percent or Higher

The committee is opposed to reducing retired pay due to members of the uniformed services to offset the receipt of compensation for service-connected disabilities paid by the Department of Veterans Affairs (VA). The committee believes that retirees are entitled to receive both the retired pay for which they contributed years of faithful service and the VA compensation for a service-connected disability intended to recognize a lifelong limitation on earning potential. The committee intends to continue to promote concurrent receipt for all eligible retirees and is committed to adopt the legislative changes needed to achieve advances in concurrent receipt to the extent that funding for this purpose is made available in future concurrent budget resolutions.

Accordingly, and consistent with the Concurrent Resolution on the Budget--Fiscal Year 2003 (H. Con. Res. 353) adopted in the House, this section would authorize retirement-qualified members of the uniformed services with disabilities rated as 60 percent and above to receive during the fifth year of a 5-year transition program, full VA disability compensation without a reduction in retired pay. In the case of a member who receives a disability retirement, the section would allow the retired pay to be reduced, but only to the extent that the member's retired pay exceeds the amount of retired pay to which the member would have been entitled based solely on the member's years of service.

The transition program would provide the following amounts to disabled retirees during fiscal year 2003:

(1) Members rated 100 percent disabled would receive $750 per month.

(2) Members rated 90 percent disabled would receive $500 per month.

(3) Members rated 80 percent disabled would receive $250 per month.

(4) Members rated 70 percent disabled would receive $250 per month.

(5) Members rated 60 percent disabled would receive $125

per month.

The transition program during fiscal years 2004, 2005, and 2006 would reduce for each retiree the difference between the amount of retired pay received the previous year and full concurrent receipt by 23 percent, 30 percent, and 64 percent, respectively. During fiscal year 2007, all retirees with disability rating of 60 percent and above would receive their entire retired pay and VA disability compensation.

Section 642--Change in Service Requirements for Eligibility for Retired Pay for Non-Regular Service

This section would reduce the number of years of continuous reserve component service required immediately before qualifying for non-regular retired pay from eight to six.

Section 643--Elimination of Possible Inversion in Retired Pay Cost-of-Living Adjustment for Initial COLA Computation

This section would limit partial-year retired pay cost-of-living adjustments (COLAs) in the first year of retirement to be no greater than the COLA paid to retirees who were retired for the entire year.

Section 644--Technical Revisions to So-Called ``Forgotten Widows'' Annuity Program

This section would make technical and administrative changes to section 644 of the National Defense Authorization Act for Fiscal Year 1998 (Public Law 105-85) that addressed annuities for certain military surviving spouses.

Subtitle E--Reserve Component Montgomery GI Bill

Section 651--Extension of Montgomery G.I. Bill-Selected Reserve Eligibility Period

This section would extend the eligibility window for educational assistance for members of the selected reserve through the Montgomery G.I. Bill from 10 to 14 years from the date of first eligibility.

Subtitle F--Other Matters

Section 661--Addition of Definition of Continental United States in Title 37

This section would amend section 101 of title 37, United States Code, to include the definition of continental United States as the 48 contiguous states and the District of Columbia and amend other sections of title 37, United States Code, to reflect the addition of the definition.

TITLE VII--HEALTH CARE MATTERS

OVERVIEW

Enactment of the National Defense Authorization Act of

Fiscal Year 2002 (Public Law 107-107) limited changes to TRICARE in fiscal year 2002 to necessary improvements intended to facilitate better implementation of TRICARE For Life or to improve existing programs. The committee commends the Secretary of Defense for the Department's efforts to ensure smooth implementation of the new benefits for Medicare-eligible military retirees and their eligible beneficiaries and other improvements to TRICARE. With this in mind, the committee has focused this year's legislation on several limited benefit changes, necessary improvements to TRICARE's management and business practices, the future of the managed care support contracts, and optimization efforts.

The committee was encouraged that the defense health program budget request relied on more realistic cost and budgeting assumptions. The commitment to fully fund the defense health program (DHP) is commendable. However, the committee continues to urge the Department of Defense (DOD) to more fully optimize the military treatment facilities. Although the direct care system of military treatment facilities has received an increase in the budget request, a sustained period of under-investment in optimization, maintenance, and repair of these facilities has eroded the capacity of the military hospitals and clinics of the direct care system. The committee is concerned that current funding for the direct care system continues to undermine optimization efforts, forcing some patients into the private sector. On balance, this phenomenon drives up the cost of the defense health program and limits the resources available for treating patients in the direct care system. The committee expects to be kept informed of the efforts to allocate defense health resources in a manner that will maximize the effectiveness of the entire DHP.

For the past several years, the committee has focused its efforts to reduce the high cost of TRICARE claims processing. In testimony this year, the committee again heard from providers and managed care support contractors that DOD's unique claims processing system costs continue to far exceed those of equivalent civilian systems for processing claims. The testimony suggested that impediments to a cost-effective, provider and beneficiary friendly system for TRICARE claims processing continue to exist. Hearing testimony also suggested that the committee needs to better understand the nature, reasons, and extent of trends in the TRICARE network provider instability, and the effectiveness of DOD's and TRICARE managed care support contractors' efforts to measure and mitigate such turbulence. The committee was encouraged by testimony from DOD health officials that they would examine the policies and practices associated with the managed care support contractors, and the committee urges the Department to move forward and examine and formulate plans to address these issues. However, the committee is concerned about the long-term impact of these issues on the program and requires the Comptroller General to also study these areas.

The committee recognizes that DOD is negotiating extension periods to existing managed care support contracts even as it considers how to structure the next generation of TRICARE contracts. Much remains to be known of the Department's plans to redesign the contracts and possible initiatives to carve out specific contract areas such as marketing and pharmacy services. The committee notes DOD's intent to include suitable best business practices found in the health care industry and

to incorporate mechanisms that share risk between TRICARE's partners--the Department of Defense and the managed care support contractors. The successful implementation of the new contracts should also keep in mind the potential impact on the beneficiaries. The committee urges the Department to continue to ensure all stakeholders are included. The committee expects to be kept fully informed as the Department approaches its final design of new contract vehicles.

The committee continues to be pleased with the nature and extent of DOD's engagement with the private non-governmental associations representing the interests of the beneficiaries of the military health care system during its deliberations on the design of next generation contracts and implementation of TRICARE programs. The committee encourages DOD to continue to reach out to beneficiaries of the military health care system and other key stakeholders including DOD's managed care support contractors. The Department should consider broadening and enhancing this outreach to include other health care organizations and providers in more routine consultations regarding benefit design and delivery, industry best practices, management initiatives, and beneficiary and provider communications and consultation. Such outreach could provide valuable insight regarding provider and beneficiary incentives and satisfaction.

ITEMS OF SPECIAL INTEREST

Claims Processing for Under-65 Medicare-Eligible Beneficiaries

The committee is aware that Medicare-eligible beneficiaries under the age of 65 are not currently able to have their health care claims filed electronically because the Department has not yet resolved cross-over claims issues. Until the Department remedies this shortcoming, under-65 Medicare-eligible beneficiaries are unable to fully participate in TRICARE For Life (TFL) and, in essence are denied participation in the program because they must pay their fees upfront. For many, this is not a viable option. Until this cross-over claims issue is resolved, these beneficiaries are effectively denied the ready access to Medicare providers they are entitled to under the TFL program. The committee directs the Secretary of Defense to expeditiously resolve this barrier to TFL participation and submit a report to the Senate Committee on Armed Services and the House Committee on Armed Services by March 31, 2003, on actions taken to resolve claims processing problems for under-65 Medicare-eligible beneficiaries.

Defense Enrollment and Eligibility Enrollment Reporting System Improvements

The committee is concerned about the accuracy and timeliness of the current process to update information in the Defense Enrollment and Eligibility Reporting System (DEERS). In particular, there appears to be some delay in entering updates when changes occur in the sponsor's military status, demographics, or duty station. The DEERS database determines the eligibility and benefit program of service members. If there are delays in accurately processing and transmitting personnel changes to DEERSby the military services, then

beneficiaries are denied health care, or health care is delayed. The committee believes the Department should set a goal of near real-time updates with 100% accuracy. The committee directs the Secretary of Defense, to assess the ability of the military services to update information in DEERS in a more timely and accurate manner, and, if necessary, implement a plan to make the improvements the secretary believes are necessary. The secretary's report to the Senate Committee on Armed Services and the House Committee on Armed Services would be required by September 30, 2003.

Force Health Protection

The committee remains strongly committed to ensuring that the force health protection of our troops continues to remain a high priority for the Department of Defense (DOD) and the military services. The committee is pleased to note the implementation of new clinical guidelines for use by DOD and the Department of Veterans Affairs' (VA) physicians in caring for the unique needs of military personnel and their families. However, as utilization of the active, guard and reserve components continues to increase to meet the growing demand for deployments around the world, force health protection remains at the forefront of our ability to meet these requirements. The Department was tasked with developing a system that can be used to track military personnel who are deployed, monitor in-theatre medical requirements, and conduct post-deployment assessments to ensure that DOD and the military services know where and when our men and women are deployed, the environment in which they are deployed, any medical requirements they are subject to while in theatre, and any post-deployment health developments. These issues were raised as a result of the Persian Gulf War. In view of the continuing and increasing deployments around the world, we need to ensure that we are doing everything possible to protect the health of our troops. The committee recently requested that the General Accounting Office examine the DOD-VA medical surveillance system. In view of this, the committee urges that the Secretary of Defense take this opportunity to review the entire spectrum of force health protection issues in order to ensure that a collaborative, focused and adequately resourced effort is underway, and that appropriate medical surveillance policies and procedures are in place throughout the DOD and the military services.

Military Health Care System Information Management

The committee remains interested in developments by the Department of Defense (DOD) to improve its health care information management systems. The committee, therefore, is concerned that the Department has yet to provide the interim report requested in the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107) to conduct a comprehensive study of DOD medical data systems that will facilitate management, clinical treatment, system performance evaluations, costs, manpower and enrollment. The establishment of a comprehensive medical data system is vital to the Department on a number of levels, including improving benefits and services to military personnel, retirees and their families, increasing resource sharing activities between the Department and the Department of Veterans Affairs or other federal agencies and private organizations, improving resource

management and reducing barriers to ensure medical readiness. The committee urges the Department to provide adequate resources to ensure that the development and implementation of these information management systems moves forward in a timely manner.

TRICARE Access Standards for Appointments

The committee is aware of the many advantages available to beneficiaries under TRICARE Prime, including the access standards for the wait time for appointments. The committee is concerned that these standards may not be uniformly met by all managed care support contractors and military treatment facilities, thereby impacting their ability to adequately address the health care needs of TRICARE Prime enrollees. The Department needs to ensure that beneficiaries calling for appointments receive them within the required access standards.

The committee recommends that the Secretary of Defense review and improve current processes to ensure that military treatment facilities inform the managed care support contractors of available appointments.

Waiver of TRICARE Senior Pharmacy Deductible for Beneficiaries in Nursing Homes

The committee is concerned that TRICARE beneficiaries who are patients in nursing homes are currently subject to the annual deductible for using out-of-network pharmacy services. Because TRICARE considers the pharmacy services used by nursing homes in most states to be out-of-network pharmacies, the committee believes the Department could resolve this inequity by waiving the annual deductible for patients in nursing homes. This non-network pharmacy deductible policy is aimed at creating an incentive for beneficiaries to use the National Mail Order Pharmacy or network pharmacies. However, the policy unintentionally penalizes beneficiaries in nursing homes. The committee directs the Secretary of Defense to implement such policies and regulations or recommend any legislative changes that may be necessary to waive the deductible for these patients, and report to the Senate Committee on Armed Services and the House Committee on Armed Services by March 31, 2003, on actions taken.

LEGISLATIVE PROVISIONS

Subtitle A--Health Care Program Improvements

Section 701--Elimination of Requirement for TRICARE Preauthorization of Inpatient Mental Health Care for Medicare-Eligible Beneficiaries

This section would eliminate the redundant TRICARE preauthorization requirement for specific cases in which Medicare has already authorized such care and Medicare is the primary payer. This provision would take effect on October 1, 2004.

Section 702--Expansion of TRICARE Prime Remote for Certain Dependents

This section would extend the TRICARE Prime Remote benefit to active duty family members who are not authorized to accompany the member to the member's permanent duty station. This benefit would apply in cases when the dependent continues to reside at the location of the former duty assignment and that location is more than 50 miles, or approximately 1 hour of driving time, from the nearest military medical treatment facility adequate to provide the needed care; or when there is no reasonable expectation the member will return to the location of the former duty assignment and the dependent moves to a location that is more than 50 miles, or approximately 1 hour of driving time, from the nearest military medical treatment facility adequate to provide the needed care. This provision would take effect on October 1, 2002.

Section 703--Enabling Dependents of Certain Members Who Died While on Active Duty to Enroll in the TRICARE Dental Program

This section would amend section 1076a(k)(2) of title 10, United States Code, to permit the dependents of members who die while serving on active duty tours of more than 30 days to enroll in the TRICARE Dental Program under that section regardless of the dependent's dental plan enrollment status on the date of the member's death. Many dependents outside the continental United States temporarily discontinue participation in the premium sharing dental plan under section 1076 because they receive their dental care in DOD dental facilities. In cases where the member dies while assigned overseas, their dependents' nonparticipation disadvantages their future eligibility. This section would authorize these dependents to participate in the dental plan in the same manner as other dependents of members who die while on active duty.

Section 704--Improvements Regarding the Department of Defense Medicare-Eligible Retiree Health Care Fund

This section would align the normal cost contribution funding for the Department of Defense (DOD) Medicare-eligible retiree health care fund with the military personnel accounts since the payments into the fund are related to post-retirement health benefits associated with military service, this change would treat accrual funding for health benefits for Medicare-eligible beneficiaries in a manner consistent with funding for retirement pension costs under chapter 74 of title 10, United States Code.

This section would mandate participation in the Uniformed Services Retiree Health Care Fund by non-DOD uniformed services. The National Defense Authorization Act of 2002 (Public Law 107-107), made participation in the fund discretionary for the Coast Guard, the commissioned corps of the Public Health Service, and the commissioned corps of the National Oceanic and Atmospheric Administration. The committee views the President's request to require such participation by the secretaries of the federal departments administering non-DOD uniformed services without prejudice and has included such a provision.

Section 705--Certification of Institutional and Non-Institutional Providers Under the TRICARE Program

This section would amend section 1079 of title 10, United States Code, to require the Secretary of Defense to prescribe regulations to allow, to the extent practicable, providers authorized under title XVIII of the Social Security Act, section 1395 et seg. of title 42, United States Code, to be deemed TRICARE providers in addition to their current certification as TRICARE For Life (TFL) providers. This provision would allow the acceptance of Medicare certification as the basis of TRICARE provider authorization. Moreover, this provision reduces administrative requirements associated with the credentialing of Medicare providers so that they may treat TRICARE patients in addition to TFL patients. This provision will take effect on October 1, 2003.

Section 706--Technical Correction Regarding Transitional Health Care

The transitional health care benefit for certain involuntarily separated members made permanent in the National Defense Authorization Act of Fiscal Year 2002 (Public Law 107-107), inadvertently failed to include the dependents of the service members. This technical correction ensures transitional health care benefits for the dependents of the service members entitled to such benefit.

Subtitle B--Reports

Section 711--Comptroller General Report on TRICARE Claims Processing

This section would require the Comptroller General to evaluate the continuing impediments to a cost-effective, provider and beneficiary friendly system for TRICARE claims processing. The committee has long had an interest in claims processing reform, including a range of reforms directed in the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65). Recently the committee heard testimony from providers and industry that DOD's unique claims processing system features individual claim costs far exceeding those of equivalent civilian systems for processing claims. Moreover, the requirements associated with DOD's claims processing system may discourage some providers from participation in the TRICARE program, thus creating an impediment to beneficiary access. The committee is concerned that these issues were among those that led to the reforms in the National Defense Authorization Act of 2000 (Public Law 106-65). The committee is also concerned that on balance, the additional cost and administrative burdens associated with this unique claims processing system may serve as a hindrance to more efficient beneficiary care and satisfaction, as well as improved provider participation. The study mandated under this section would pay special attention to:

(1) The extent of progress implementing improvements in claims processing particularly the application of best industry practices;

(2) The extent of progress in simplifying claims processing procedures and eliminating or reducing the reliance on and complexity of, the Health Care Service Record;

(3) The suitability of a Medicare-compatible claims processing system with regard to the data requirements

necessary to administer TRICARE and related information systems; and

(4) The extent to which the TRICARE claims processing system impedes provider participation and beneficiary access, and provide recommendations for improvements.

The Comptroller General's report of findings and recommendations to the Senate Committee on Armed Services and the House Committee on Armed Services would be required by March 31, 2003.

Section 712--Comptroller General Report on Provision of Care Under the TRICARE Program

This section would require the Comptroller General to evaluate the nature, reasons, and extent of trends in TRICARE network provider turbulence, and the effectiveness of DOD's and TRICARE support managed care contractors' efforts to measure and mitigate such turbulence. The committee has heard testimony that provider network instability exists in certain geographic areas, that such instability may be associated with the administrative requirements, preauthorization procedures and the reimbursement rates of the TRICARE program, that the measurement of past and future trends may be instructive, that DOD's existing authority to adjust reimbursement rates to address provider network adequacy in certain areas is largely unused, and that the administrative requirements of the TRICARE program merits review. The study mandated under this section would pay special attention to:

(1) The adequacy of provider/network stability measurement tools and their current use by DOD and/or managed care support contractors to assess network adequacy/stability;

(2) The relationship of reimbursement rates and TRICARE administration requirements, (including preauthorization requirements) to provider/network turbulence;

(3) The current extent of the problem and likely future trends with and without intervention using existing authority;

(4) DOD's and TRICARE managed care support contractors' use of existing authority to apply higher reimbursement rates in specific geographic areas;

(5) Recommendations for improvements needed in measurement tools or their application; and

(6) Recommendations for specific fiscally prudent measures that could mitigate negative trends or improve provider/network stability.

The Comptroller General's report of findings and recommendations to the Senate Committee on Armed Services and the House Committee on Armed Services would be required by March 31, 2003.

Section 713--Repeal of Report Requirement

This section would repeal the reporting requirement specified in section 712 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398). The committee notes that the reporting requirement has been superceded by the TRICARE For Life program and obviated by decisions by the Department of Defense and the Department of

Health and Human Services not to pursue the Medicare subvention demonstration project.

TITLE VIII--ACQUISITION POLICY, ACQUISITION MANAGEMENT, AND RELATED MATTERS

ITEMS OF SPECIAL INTEREST

Acquisition Program Management

The Department of Defense acquisition programs continue to experience significant cost increases and schedule delays. No military service is exempt from this problem. Examples of major acquisition programs with significant cost increases and schedule delays include:

(1) Army--CH-47 helicopter upgrade and Comanche helicopter.

(2) Navy--Virginia class submarine and LPD-17.

(3) Air Force--Space based infrared system and advanced extremely high frequency communications satellite.

(4) Marine Corps--UH-1/Cobra helicopter upgrades.

(5) Special Operations Command--Advanced seal delivery system.

The continued prevalence and the pervasive nature of unscheduled cost growths and schedule delays lead the committee to conclude that the Department of Defense is not yet practicing the improvements espoused to be included in the new Department of Defense Directive 5000 series and Department of Defense Instruction 5000 series.

Each military service has a program or programs that have exceeded the Nunn-McCurdy limits, which necessitates review by the Secretary of Defense, program re-base-lining, and re-certification to Congress.

It is well recognized that cost growth and time delays are often associated with poor program structure and unsatisfactory program management, often involving both government and contractors. Examples of poor management include:

(1) Contractors submitting low cost estimates--an action inconsistent with best business practices.

(2) The Department failing to sufficiently analyze the scope of work, estimate costs accurately, establish affordable requirements and avoid requirement creep, resulting in increased system development and procurement cost.

(3) Both the Department and contractors establish high performing program management teams, but then disband the teams as other projects reach high profile.

(4) Discontinuity in program management.

(5) Allowing too many programs to progress to SDD/EMD, without sufficient funding available to adequately fund programs in the out years.

The committee believes that the issue is not to re-write Department of Defense Directive 5000 series again, but rather to properly baseline programs, beginning with the mission needs statement and operational requirements specification. Programs must be based on realistic cost estimates, which are fully funded. Program operational requirements must be complete and remain stable. The joint requirements oversight council (JROC)

must guard against requirements creep and ensure compliance with applicable Department of Defense acquisition regulations, including JROC validation and approval.

The committee also believes that in order to manage acquisition properly, DOD must have and use a modern financial control system, as is discussed elsewhere in this report.

Defense Logistics Agency's Best Value Contracting

The committee is aware of concerns over how the Defense Logistics Agency (DLA) is implementing best value contracting in the acquisition of select items. DLA is responsible for acquiring and managing over 13,000 different items that outfit military troops and civilian customers with uniforms, helmets, body armor, chemical protective suite, footwear, tents, and other related items. DLA is one of the Department of Defense's principal buyers of goods and services, yet DLA's buying practices have often come into question. The committee understands the difficult task facing DLA and other defense acquisition organizations in balancing the imperative to ensure the best possible value for the military customer while also providing for the broad participation of qualified private sector suppliers. To better understand how DLA is performing in executing this goal, the committee directs the Comptroller General to conduct a review on whether DLA is properly implementing applicable statutory and regulatory guidance for best value purchases. In particular, the review should examine DLA's use of past performance as an evaluation factor in the selection of suppliers and the impact this practice is having on the imperative to maintain an adequate domestic supplier base for key items of supply. The report shall be provided to the House Armed Services Committee no later than March 1, 2003.

Report on Small Business Concerns Owned and Controlled by Women

The committee directs the Secretary of Defense to report whether the Department of Defense has met its annual goal of awarding procurement contracts to small business concerns owned or controlled by women from fiscal years 1998--2002. To the extent the Department of Defense has not met its goals the Secretary of Defense shall include in the report actions taken to try to meet its goal. This report shall be provided to the House Committee on Armed Services no later than February 15, 2003.

LEGISLATIVE PROVISIONS

Section 801--Plan for Acquisition Management Professional Exchange Pilot Program

This section would require the Secretary of Defense to develop a pilot program for the exchange of personnel between Department of Defense acquisition management community and the private sector. The committee believes such an exchange program would improve knowledge and foster understanding between the two communities with the ultimate benefit of the Department acquiring better quality products and services.

Section 802--Evaluation of Training, Knowledge, and Resources Regarding

Negotiation of Intellectual Property Arrangements

This section would require the Secretary of Defense to evaluate the adequacy of training, education and resources within the acquisition community on the negotiation of intellectual property. This section would require the Secretary of Defense to report the results of the evaluation in a report to the Senate Committee on Armed Services and the House Committee on Armed Services. The report shall also include any actions that should be taken to meet the Department's needs, and the number of legal personnel within the Department of Defense (DOD) who are trained in the negotiation of intellectual property arrangements.

The committee is concerned that DOD does not have the resources to adequately negotiate intellectual property rights with the private sector. The committee notes that in 1995 DOD updated the Defense Federal Acquisition Regulations pertaining to rights in technical data and computer software. The updates resulted from the work of a Government-Industry Technical Advisory Committee, established by the National Defense Authorization Act for Fiscal Years 1992 and 1993 (Public Law 102-190). The committee is concerned that the flexibility and commercially-friendly intellectual property terms and conditions contained in these regulations are not understood, and are thus underutilized within DOD.

Section 803--Limitation Period for Task and Delivery Order Contracts

This section would amend sections 2304a and 2304b of title 10, United States Code, by proscribing the period of time for which these contracts can be awarded, and by more clearly characterizing advisory and service task order contracts as a type of task and delivery order contract. The committee believes it is appropriate to limit contract duration in order to better promote the use of competition. The committee also believes that all task and delivery order contracts should be treated as congruently as is possible and appropriate.

Section 804--One-Year Extension of Program Applying Simplified Procedure to Certain Commercial items; Report

This section would amend section 4202 of the Clinger-Cohen Act of 1996 (divisions D and E of Public Law 104-106) by extending for one more year the authority for the Secretary of Defense to use simplified acquisition procedures for the purchase of commercial items not greater then $5.0 million. The section would also require the Secretary of Defense to report to Congress, no later than January 15, 2003, whether authority under the pilot program should be made permanent. The report should also address the benefits and usefulness of this pilot program.

Section 805--Authority to Make Inflation Adjustment to Simplified Acquisition Threshold

This section would provide the Administrator of the Office of Federal Procurement Policy with the authority to adjust the simplified acquisition threshold every five years to account for inflation.

Section 806--Improvement of Personnel Management Policies and Procedures Applicable to the Civilian Acquisition Workforce

This section would require the Secretary of Defense to develop an implementation plan for improving the personnel management policies and procedures for the Department of Defense acquisition workforce based on the demonstration project authorized by section 4308 of the National Defense Authorization Act for Fiscal Year 1996 (Public Law 104-106). The section would additionally require the Secretary of Defense to provide a report to Congress by February 15, 2003, containing the implementation plan and any areas within the implementation plan needing legislative relief.

The committee supports the ongoing Department of Defense (DOD) Civilian Acquisition Workforce Personnel Demonstration Project, which is designed to determine the effectiveness of initiatives to increase organizational efficiencies, enhance retention rates and rewards for performance, and increase quality of the workforce and the products it acquires. The committee is concerned with the delay in commencing the demonstration project and believes that the Secretary of Defense must ensure that lessons learned from the first three years of the demonstration project are incorporated into the Department's overall acquisition management, organizational structure, and personnel systems.

Section 807--Modification of Scope of Ball and Roller Bearings Covered for Purposes of Procurement Limitation

This section would amend section 2534 of title 10, United States Code, by expanding the definition of ball and roller bearings to include unconventional or hybrid ball and roller bearings, cam follower bearings, ball screws and other derivatives of ball and roller bearings. This section would not extend the time period for which the procurement limitation is in place.

Section 808--Rapid Acquisition and Deployment Procedures

This section would require the Secretary of Defense to develop rapid procedures for the acquisition and the deployment of items a commander of a unified combatant command urgently requires. The procedures would require the Chairman of the Joint Chiefs of Staff, the Secretary of Defense, the secretary of the military service, as well as the Director, Operational Test & Evaluation to work together in an expedited manner in order to deliver to the commander of a unified combatant command the item urgently needed to react to an enemy or to provide safety.

Section 809--Quick-Reaction Special Projects Acquisition Team

This section would require the Secretary of Defense to establish a special projects acquisition team to examine and address issues affecting expeditious procurements. The special projects acquisition team shall specifically address industrial base issues, lengthy acquisition procedures due to acquisition regulations, environmental issues, small business concerns, and the purchase of products made in the United States.

Section 810--Report on Development of Anti-Cyberterrorism Technology

This section would require the Secretary of Defense to submit a report to Congress by February 1, 2003, on Department of Defense efforts to enter into contracts with private entities to develop anti-cyberterrorism technology.

Section 811--Contracting with Federal Prison Industries

This section would require the Secretary of Defense to acquire a product or service from Federal Prison Industries in accordance with chapter 137 of title 10, United States Code. This provision would also require the Secretary of Defense to assure that Federal Prison Industries, Inc. does not provide contractor services if an inmate were to have access to certain information.

TITLE IX--DEPARTMENT OF DEFENSE ORGANIZATION AND MANAGEMENT

ITEM OF SPECIAL INTEREST

Regional Centers for Security Studies

The committee has been concerned that the Department of Defense's regional centers for security studies, and some of its staff, have not accurately represented the views and policies of the United States government with regard to foreign affairs and national security matters. As such, the committee was inclined this year to propose legislative provisions that would seek to redress this problem. However, the committee is reassured by recent reports that senior officials in the Department of Defense are reviewing how the regional centers are organized, managed, and staffed, as well as studying a number of ways to ensure coherence with regard to policy matters and positions. As a result, the committee has withheld action this year regarding this matter, but looks forward to receiving the results of the Department's assessment, and its plans, if any, for subsequent action.

LEGISLATIVE PROVISIONS

Section 901--Change in Title of Secretary of the Navy to the Secretary of the Navy and Marine Corps

This section would redesignate the title of the Secretary of the Navy to the Secretary of the Navy and Marine Corps.

Section 902--Report on Implementation of United States Northern Command

This section would require the Secretary of Defense to submit to the Committees on Armed Services of the Senate and House of Representatives a report by September 1, 2002, containing an implementation plan for the United States Northern Command that addresses organizational, legal, diplomatic, budgetary, and personnel matters associated with the establishment of the command.

Section 903--National Defense Mission of Coast Guard to be Included in

Future Quadrennial Defense Reviews

This section would amend section 118(d) of title 10, United States Code, to require the Secretary of Defense to include the national defense mission of the U.S. Coast Guard when conducting the Quadrennial Defense Review. The committee recognizes that the U.S. Coast Guard currently performs a range of national security missions, and anticipates that in the future the U.S. Coast Guard will increasingly be integrated with the other military services in the conduct of deployments and joint operations. Accordingly, the committee believes the Secretary of Defense should assess and include the capabilities of the U.S. Coast Guard as part of the Quadrennial Defense Review process.

Section 904--Change in Year for Submission of Quadrennial Defense Review

This section would amend section 118(a) of title 10, United States Code, to move the submission of the Quadrennial Defense Review (QDR) to the second year after a year divisible by four.

The committee notes the importance of the QDR to the Department's planning guidance and other important decisions. While the committee believes the QDR allows a new Administration the opportunity to lay out a blueprint for its future defense plan and activities, it also recognizes that the complexity of preparing the QDR can be compounded by the lengthy confirmation process for Presidential appointees. The committee feels that moving the submission of the QDR back a year will give senior civilian Department of Defense leadership more time to conduct the type of critical review of all aspects of the Department's operations envisioned by the statute.

Section 905--Report on Effect of Operations Other Than War on Combat Readiness of the Armed Forces

This section would require a report on the impact of operations other than war on the combat readiness of the United States Armed Forces. These operations include humanitarian operations, counter-drug operations, peace operations (including peace monitoring activities and observer missions), and nation assistance, which is defined as the assistance provided to a host nation to promote stability, develop sustainability, and establish institutions responsive to the needs of the people. In order to better account for, understand, and highlight the impact of these operations on the Department of Defense, and to assist Congress in assessing these costs and benefits relative to the nation's foreign policy and national security interests, the committee directs the Secretary of Defense to prepare and submit to the Committees on Armed Services of the Senate and House a detailed report on the pecuniary and non-pecuniary costs and benefits of these operations.

Section 906--Conforming Amendment to Reflect Disestablishment of Department of Defense Consequence Management Program Integration Office

This section would amend section 12310(c) of title 10, United States Code, to conform to an internal Department of Defense reorganization involving the Consequence Management

Program Integration Office.

TITLE X--GENERAL PROVISIONS

ITEMS OF SPECIAL INTEREST

Chartering of Special Purpose Vessels

Each year the Department of the Navy charters a number of special purpose vessels in order to meet both its ongoing and emergency requirements. These vessels generally include salvage ships, oceanographic survey and research vessels, cable laying ships, and other vessels not traditionally used in special purpose roles. The committee notes that despite the Navy's desire to increase competition for these charters, there have been several instances where only one contractor submitted bids for these charters. In some cases, the method of procurement or the type of contract proposed for the charter may have served to inadvertently eliminate a class of vessels that are capable of performing these functions but are not technically classified or cataloged as being able to perform the mission.

In view of this and the committee's desire to increase competition in these programs, the committee directs the Secretary of the Navy to prepare a report that will address the following matters:

(1) Identification of barriers, including legal, regulatory, administrative, or acquisition procedures, that may exist with respect to the use of U.S.-flag vessels or that otherwise may decrease competition;

(2) A market survey which identifies vessels capable of performing the required activities;

(3) The need for increased use of innovative contracting methods, including greater use of performance based contracts;

(4) Identification of methods for increasing the use of U.S.-flag vessels in such special purpose activities;

(5) Any proposals for legislation or administrative steps that the Secretary considers necessary to increase competition and use of U.S.-flag vessels.

The report shall be submitted to the Senate Committee on Armed Services and to the House Committee on Armed Services not later than February 1, 2003.

Counter-Drug Activities

Overview

The budget request for counter-drug activities maintained a steady-state level of effort as compared with prior years. The committee continues to support a robust counter-drug program and is cognizant of the linkages between terrorist organizations and the international narcotics trade. In that regard, the committee is concerned with the lack of targeting of opium storage facilities in Afghanistan that were identified early in the conduct of Operation Enduring Freedom. The committee understands that U.S. Central Command deemed that opium in any form did not constitute a credible military

target. However, as well established, the ruling Taliban maintained close ties to the narcotics trade in Afghanistan and used illicit narcotics trafficking profits to bolster their regime. Accordingly, the committee believes the Department of Defense should review and revise its policy in this regard to ensure that such targets are properly prosecuted in Afghanistan and any future conflicts.

The committee is also aware that the U.S. Southern Command Forward Operating Locations (FOLs) in El Salvador, Ecuador, and Curacao are all nearing full operational capability. The committee remains fully supportive of this important effort but is concerned that recent statements by senior Ecuadorian officials may restrict the use of the airfield at Manta, Ecuador. The committee believes that U.S. aircraft based at Manta should be available to conduct search and rescue and humanitarian relief operations. Accordingly, the committee urges the Administration to engage the government of Ecuador to seek approval for use of the Manta FOL for these specific purposes.

The budget request contained $848.9 million for drug interdiction and counter-drug activities, in addition to $149.8 million for operational tempo which is included within the operating budgets of the military services.

The committee recommends an authorization for fiscal year 2003 Department of Defense counter-drug activities as follows:

[In thousands of dollars]

FY03 Drug Interdiction & Counter-Drug Request	$848,900
Educate America's Youth	27,100
Increase Safety of Citizens	81,800
Reduce Health & Social Costs	82,500
Shield America's Frontiers	335,700
Break Drug Sources of Supply	321,800
Recommended Decreases:	
DEA Support	1,300
Riverine Training Deployments	1,000
Tethered Aerostat Radar System	5,000
Transit Zone Maritime Patrol Aircraft	3,000
Recommended Increases:	
Mexico Information Analysis Center	1,500
National Guard C-26 Aircraft	2,100
Southwest Border Fence	6,700
Recommendation	$848,900

Items of Special Interest

DEA support

The budget request contained $6.2 million for Department of Defense support to federal law enforcement, namely the Drug Enforcement Agency (DEA) for data processing and analysis. While the committee fully supports the underlying merit of the classified program, the committee strongly believes the Drug Enforcement Agency (DEA) must assume responsibility for adequately funding the program requirements. Accordingly, the committee recommends a decrease of $1.3 million for this activity.

Mexico information analysis center

The budget request contained $790,000 for the Mexico Information Analysis Center (IAC). The committee is aware that the IAC provides tactically actionable intelligence in support of U.S. and Mexican counter-narcotics efforts and has contributed to significant gains in this area. Accordingly, the committee recommends an increase of $1.5 million for this successful program.

National Guard C-26 aircraft

The budget request did not contain funds to complete the upgrade of counter-narcotics National Guard C-26 aircraft with Electro-Optical (EO) digital cameras. The committee is aware that of the current fleet of 11 aircraft, only 10 C-26s are outfitted with an EO camera. The committee understands the requirement for the National Guard is to complete the standardization and additionally procure two EO camera spares. The committee supports this program and recommends $2.1 million for this purpose.

Riverine training deployments

The budget request contained $4.1 million for worldwide riverine deployments. The committee supports this activity but is aware that deployments of this nature are frequently postponed or delayed. Accordingly, the committee recommends a decrease of $1.0 million for this program.

Southwest border fence

The Southwest border continues to be a heavily utilized drug trafficking corridor into the United States. The committee has been supportive of fence and road-building activities in this area and continues to support this effort. Accordingly, the committee recommends an increase of $6.7 million for this purpose.

Tethered aerostat radar system

The budget request contained $40.7 million for the Tethered Aerostat Radar System (TARS) which includes $13.3 million for procurement of equipment as compared to $3.4 million in fiscal year 2002. The committee is concerned with the relative size of this increase and, therefore, recommends a decrease of $5.0 million in the TARS program.

Transit zone maritime patrol aircraft

The budget request contained $9.0 million for Transit Zone Maritime Patrol Aircraft, a new contractor lease program to assist in maritime surveillance. The committee understands the basis for this initiative but is concerned that the total budget request is not fully executable in fiscal year 2003. Accordingly, the committee recommends a decrease of $3.0 million for this program.

Principles of Federal Appropriation

The General Accounting Office wrote a comprehensive text on the body of law governing federal appropriations, ``Principles of Federal Appropriations Law,'' in 1982, with a second version published in 1991. This committee considers this text to be a useful resource in deciphering federal appropriations law. As material in this publication is subject to change by statute or through decision-making process, the committee requests that the General Accounting Office update this text.

Security Requirements for Contractor Employees

The committee is concerned with the level of access contractor employees have to military facilities and installations within the United States. In today's environment it is appropriate for any and all security risks to be examined, and to the extent necessary precautions taken. The committee, therefore, directs the Secretary of Defense to evaluate the security risk that may be associated with contractor employee's access to military facilities and installations, and to report to the House Committee on Armed Services and the Senate Committee on Armed Services, no later than February 1, 2003, the results of the evaluation. The evaluation shall include: A determination whether the Department of Defense should require contractors to conduct background investigations on contractor employees; if background checks are appropriate, to describe the type of background checks that should be implemented and the cost of these background checks.

Strategic Force Structure Plan

The most recent Nuclear Posture Review (NPR), submitted to Congress by the Department of Defense on January 8, 2002, is a broad policy document. Despite setting levels for active forward deployed strategic weapons of 3800 in fiscal year 2007 and 1700-2200 in fiscal year 2012, it contains no comprehensive description of the baseline force structure required to execute the national defense strategy that supports those levels. A force structure plan, including the number of warheads by type in both active (deployed, ``responsive'' and spares) and inactive status, the number and type of each associated weapons system, and the number and type of each associated delivery platform, is the point of departure for making intelligent decisions regarding weapons complex infrastructure recapitalization, as well as investments in stockpile life extension programs. Such a plan would also provide a framework for Department of Defense investments in weapons systems and delivery vehicles.

Accordingly, Section 1014 requires the Secretaries of Defense and Energy to jointly prepare a baseline nuclear force structure plan for the period covered by the NPR, and a budget plan to support that force structure. It requires, in addition, submission of a report on the force structure and supporting budget plans to the congressional defense committees by January 1, 2003.

The committee recognizes and endorses the Administration's efforts to reach an agreement with the Russian Federation on future strategic force levels. The committee does not intend, in this regard, to hinder or limit the President's options in carrying outthe foreign policy of the United States.

Consequently, the committee has allowed an extension of the due date of the report to Congress should the President determine that deferment is in the national security interests of the United States.

U.S. Strategic Deterrent

The committee believes that a flexible, reliable, and robust nuclear deterrent is critical to the national security of the United States. Capable and credible strategic forces are essential to deterring enemies and potential adversaries, defending our friends and allies, promoting global stability, and ensuring that the United States can protect and advance its interests abroad.

Given these vitally important goals and interests, juxtaposed against a strategic environment that is as uncertain, dangerous, and complex as ever in history, the committee has outlined in a Sense of Congress provision the purposes and need for the United States to maintain a reliable, flexible and robust strategic deterrent. The key to achieving such a posture is revitalization of the nation's nuclear weapons industry, and the retention and training of skilled nuclear and weapons technicians, scientists, and engineers.

Finally, the committee firmly believes that improvements and changes to the nation's strategic deterrent should be made in accordance with the national defense strategy, the Nuclear Posture Review, and the global strategic environment.

LEGISLATIVE PROVISIONS

Subtitle A--Financial Matters

Section 1001--Transfer Authority

This section would provide fiscal year 2003 transfer authority to the Department of Defense for amounts up to $2.0 billion.

Section 1002--Authorization of Supplemental Appropriations for Fiscal Year 2002

This section would authorize amounts enacted in the Emergency Supplemental Act, 2002 (Division B of Public Law 107-117) for the Department of Defense and for the national security activities of the Department of Energy.

This section would also authorize those defense items appropriated pursuant to any fiscal year 2002 emergency supplemental appropriations legislation enacted during the second session of the 107th Congress.

This section would further limit the obligation of emergency supplemental funds to the Department of Defense until the Secretary submits a report to the congressional defense committees detailing the appropriation accounts to which the funds have been transferred and the purpose for which the transferred amounts are to be used.

Section 1003--Uniform Standards Throughout Department of Defense for Exposure of Personnel to Pecuniary Liability for Loss of Government Property

This section would extend the authority for imposition of pecuniary liability for government property that is lost, damaged or destroyed to military members of the Navy and Marine Corps, and to all civilian employees of the Department of Defense. Currently, only military members and civilian employees of the Departments of the Army and the Air Force are subject to this liability. This section would also extend the authority to deduct the amount of the pecuniary liability from the pay of a member of the Navy and Marine Corps. Currently, the authority to deduct the liability applies only to members of the Army and Air Force.

Section 1004--Accountable Officials In the Department of Defense

This section would establish pecuniary liability for those Department of Defense officials who submit illegal, improper, or incorrect data or information to an official who could rely on that data to make payment on a voucher. This provision provides the Department the ability to enforce responsibilities assigned to personnel in the management of purchase cards, as well as other areas where personnel are required to review and submit data that the Department will rely on to make payments.

Section 1005--Improvements in Purchase Card Management

This section would amend section 2784 of title 10, United States Code, by enhancing the Secretary of Defense's responsibilities for management and oversight of the Department of Defense's purchase card program. Recent reports, including the Department of Defense's March 2002 Inspector General Report demonstrate that additional managerial steps are needed to prevent negligence, misuse, or abuse of the purchase card. This section would add those safeguards necessary to improve internal controls over this program.

Section 1006--Authority to Transfer Funds Within a Major Acquisition Program from Procurement to RDT&E

This section would amend Chapter 131 of title 10, United States Code, to provide the Secretary of Defense limited authority to transfer funds from Procurement to Research, Development, Test, and Evaluation (RDT&E), for the same acquisition program when that program's development effort cannot transition to procurement as planned.

This transfer authority is limited to a total of $250.0 million for any fiscal year and $20.0 million per acquisition program per fiscal year. This authority also specifically prohibits the use of transferred amounts for new starts.

Section 1007--Development and Procurement of Financial and Nonfinancial Management Systems

This section would require: (1) the Secretary of Defense to submit a report to the congressional defense committees providing the goals and objectives of the department'sfinancial management modernization plan; and (2) the approval of the Under Secretary of Defense, Comptroller, prior to the expenditure of funds by any department or agency within the Department of Defense for new or upgraded financial management and non-financial feeder systems.

On July 19, 2001, the Secretary of Defense established the Financial Management Modernization Program and directed the program management office to ``develop a DOD-wide blueprint--an Enterprise Architecture--that prescribes how the Department's financial and non-financial feeder systems and business processes will interact.'' The National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107) authorized $100.0 million for the Financial Management Modernization Program in PE 65016D8Z. The fiscal year 2003 budget request was $96.3 million.

The committee believes that this program is one of the most important developmental programs within the Department. The committee also believes that the major impediment to implementing a viable financial management program within the Department will be overcoming the cultural and bureaucratic resistance to change.

Consequently the committee believes that strict control over expenditures for new and upgraded financial and non-financial feeder systems is required and that until the architecture is established for the new system that no agency or department within DOD should be permitted to commit funds for new, upgraded or interim financial management systems without the explicit approval of the Comptroller. In addition, implementation of the objective system under prescribed milestones must be mandatory.

This can only be accomplished if the responsible agency, the Department's comptroller, is given total authority for all funds authorized for obligation for financial management and feeder systems within the Department.

Subtitle B--Reports

Section 1011--After-Action Reports on the Conduct of Military Operations Conducted as Part of Operation Enduring Freedom

This section would require the Secretary of Defense, in consultation with the Chairman of the Joint Chiefs of Staff, the Commander-in-Chief of United States Central Command, and the Director of Central Intelligence, to submit to the Senate Committee on Armed Services, the House Committee on Armed Services, the Senate Select Committee on Intelligence, and the House Permanent Select Committee on Intelligence two reports on the conduct of military operations conducted as part of Operation Enduring Freedom. The first report, an interim report, would be required not later than June 15, 2003, and the final report not later than 180 days after the cessation of hostilities associated with Operation Enduring Freedom.

The committee is aware that the campaign in Afghanistan demonstrated new war fighting doctrine and concepts and believes an appropriate record must be established as soon as possible to assist in the conduct of future military operations. Therefore, the committee supports a requirement for the Secretary of Defense to produce two reports to address the accomplishments and shortcomings of the overall military operation, including personnel, readiness, basing, air and sea lift, joint operations, and equipment matters. The committee notes that after-action reports of Operation Desert Storm and Operation Allied Force can serve as a guide for the Department in this regard. The committee is particularly concerned with

the factors that promoted or inhibited the timely insertion of Special Operations Forces (SOF) personnel and assets into the theater of operations, their operational utility and effectiveness once in Afghanistan, and the scope and adequacy of logistical and operational support provided to both SOF and Central Intelligence Agency personnel.

Section 1012--Report on Biological Weapons Defense and Counter-Proliferation

This section would require a report on the Department's biological weapons defense, nonproliferation, and counter-proliferation programs. Given the anthrax letter attacks of 2001, efforts by the al Qaeda terrorist organization to acquire dangerous pathogens, and continuing reports by the intelligence community that several rogue states and other countries have active biological warfare programs, the committee is concerned about the United States' ability to halt, defend against, and counter these present and emerging threats.

As a result, the committee directs the Secretary of Defense to provide a report to the Senate Committee on Armed Services and the House Committee on Armed Services on the Department's programs and initiatives to defend against and counter the development, production, and proliferation of biological weapons agents, technology, and expertise to terrorist groups and other states. The purpose of this report is to inform Congress of the legal (including U.S. and international law), policy, resource, and other impediments to the Department's biological warfare defense, nonproliferation, and counter-proliferation initiatives, activities, and programs.

Section 1013--Requirement That Department of Defense Reports to Congress Be Accompanied by Electronic Version

This section would amend section 480(a) of title 10, United States Code, to require the Department of Defense to submit to Congress electronic versions of all unclassified required reports, to include certifications, notifications, or other written communications.

The committee is concerned that the Department of Defense failed to comply with section 1042 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107) which required the Department of Defense to provide electronic reports only upon request from Congress. Accordingly, the committee reaffirms its view that this requirement is consistent with the Department's intention to make greater use of electronic media and will facilitate broader dissemination of, and wider access to, official DOD information.

Section 1014--Strategic Force Structure Plan for Nuclear Weapons and Delivery Systems

This section would require the Secretaries of Defense and Energy to jointly prepare a baseline nuclear force structure plan for the period covered by, and consistent with, the Nuclear Posture Review submitted to Congress on January 8, 2002. The planwould include the warheads, weapon systems, and delivery vehicles required to execute the national defense strategy, as well as the infrastructure, modernization and life extension plans, and other elements of the defense program of the United States necessary to

sustain that force structure. The section would also require a budget plan to support that force structure. The section would require submission of a report on the force structure and supporting budget plan to the congressional defense committees by January 1, 2003, but would permit the President to defer submission of the report to a date certain should the President determine that it is in the national security interest of the United States to submit the report on a later date.

Section 1015--Report on Establishment of a Joint National Training Complex and Joint Opposing Forces

This section would require the Secretary of Defense to submit a report to the Senate Committee on Armed Services and the House Committee on Armed Services not later than six months after the date of enactment that outlines a plan to develop and operate a joint national training complex capable of supporting field exercises and experimentation at the operational level of war across a broad spectrum of adversary capabilities.

The committee notes that the Department of Defense currently lacks the infrastructure to support joint high-fidelity field exercises and experiments and is aware that the National Defense Panel recommended in 1997 that the Department establish a Joint National Training Complex to fully support joint transformation initiatives. Accordingly, the committee believes that the Department must assess the benefits of establishing a Joint National Training Complex in order to enhance future joint warfighting.

Section 1016--Repeal of Various Reports Required of the Department of Defense

This section would repeal a number of reporting requirements contained in title 10, United States Code, and annual National Defense Authorization Acts.

Section 1017--Report on the Role of the Department of Defense in Supporting Homeland Security

This section would require the Secretary of Defense to submit to the congressional defense committees a report by December 31, 2002, on Department of Defense responsibilities, missions, and plans for military support of homeland security, with particular focus on defense against biological agents.

Section 1018--Study of Short-term and Long-term Effects of Nuclear Earth Penetrator Weapon

This section would direct the Secretary of Defense to request a report by the National Academy of Sciences (NAS), which will be submitted to the Congress with the Secretary's comments as appropriate, on the short- and long-term effects on a civilian population and/or U.S. military personnel in the proximity of the target area, as a result of:

(1) The use of an earth-penetrating nuclear weapon, to include the effects on the target area itself;

(2) The use of an above-ground nuclear detonation to destroy hard or deeply-buried targets in the target area;

(3) The use of an advanced conventional weapon to

destroy an adversary's weapons of mass destruction storage or production facilities in the target area.

Section 1019--Study of Short-term and Long-term Effects of Nuclear-tipped Ballistic Missile Interceptor

This section would direct the Secretary of Defense to request a report by the National Academy of Sciences (NAS), which will be submitted to the Congress with the Secretary's comments as appropriate, on the short- and long-term effects of:

(1) The use of a nuclear-tipped ballistic missile interceptor in the outer atmosphere on the civilian population and U.S. military personnel in proximity to the target area;

(2) A nuclear weapon detonated above a major U.S. city on the population of that city and on the nation as a whole.

Subtitle C--Other Matters

Section 1021--Sense of Congress on Maintenance of a Reliable, Flexible, and Robust Strategic Deterrent

This section would express the Sense of Congress regarding the purposes and need for the United States to maintain a reliable, flexible and robust strategic deterrent in accordance with the national defense strategy, the Nuclear Posture Review, and the global strategic environment.

Section 1022--Time for Transmittal of Annual Defense Authorization Legislative Proposal

This section would require the Secretary of Defense to transmit to Congress the annual defense authorization request for a fiscal year within 30 days of the date the President transmits to Congress the budget for that fiscal year. In this section ``defense authorization request'' is defined as a legislative proposal submitted to Congress for enactment and includes the authorization of appropriations for that fiscal year as required by section 114 of title 10, United States Code, personnel strengths for that fiscal year as required by section 115 of title 10, United States Code, and any other matter that is proposed by the Secretary of Defense for enactment as part of the annual defense authorization bill for that fiscal year.

Section 1023--Technical and Clerical Amendments

This section would make a number of technical and clerical amendments to existing law of a non-substantive basis.

Section 1024--War Risk Insurance for Vessels in Support of NATO-Approved Operations

This section would authorize the Secretary of Transportation to provide war risk insurance to a commercial vessel that is supporting a shared logistics military operation approved by the North Atlantic Council. This section would also authorize the Secretary of Transportation, with the concurrence of the Secretary of State, to seek from another nation a

commitment to indemnify the United States for any amounts paid by the United States for claims against such insurance.

Section 1025--Conveyance, Navy Drydock, Portland, Oregon

This section would authorize the Secretary of the Navy to sell Navy Drydock No. YFD-69, located in Portland, Oregon, to Portland Shipyard, LLC at an amount equal to the fair market value at the time of the conveyance, as determined by the Secretary.

Section 1026--Additional Weapons of Mass Destruction Civil Support Teams

This section would express the sense of the Congress that the Secretary of Defense should establish 23 additional Weapons of Mass Destruction Civil Support Teams, raising the total to 55, and provide at least one team be established in each state and territory.

TITLE XI--DEPARTMENT OF DEFENSE CIVILIAN PERSONNEL

LEGISLATIVE PROVISIONS

Section 1101--Eligibility of Department of Defense Nonappropriated Fund Employees For Long-Term Care Insurance

This section would amend sections 9001 and 9002 of title 5, United States Code, to permit nonappropriated fund employees of the Department of Defense to participate in the employee-funded Federal Long Term Care Insurance program.

Section 1102--Extension of Department of Defense Authority to Make Lump-Sum Severance Payments

This section would amend section 5595 of title 5, United States Code, to extend the lump-sum severance payment authority to employees of the Department of Defense who are involuntarily separated from September 30, 2003, to September 30, 2006. This section would also direct that the President report to Congress within twelve months whether this new authority should be made permanent or extended to other federal agencies.

Section 1103--Common Occupational and Health Standards for Differential Payments as a Consequence of Exposure To Asbestos

This section would amend sections 5343 and 5545 of title 5, United States Code, to establish a common standard for payment of hazardous duty differential pay for reason of exposure to asbestos for prevailing rate and general schedule federal employees.

Section 1104--Continuation of Federal Employee Health Benefits Program Eligibility

This section would amend section 8905a of title 5, United States Code, to extend eligibility for health benefits to Federal employees separated before October 1, 2006, or February 1, 2007, if specific notice of separation is given to the

employee before October 1, 2006.

Section 1105--Triennial Full-Scale Federal Wage System Wage Surveys

This section would amend section 5343 of title 5, United States Code, to change the full-scale federal wage system wage survey cycle conducted by the Office of Personnel Management from two to three years.

TITLE XII--MATTERS RELATING TO OTHER NATIONS

LEGISLATIVE PROVISIONS

Section 1201--Support of United Nations-Sponsored Efforts to Inspect and Monitor Iraqi Weapons Activities

This section would extend the authority under section 1505 of the Weapons of Mass Destruction Control Act of 1992, section 5859a of title 22, United States Code, for the Department of Defense to expend up to $15.0 million in fiscal year 2003 in support of the United Nations efforts to account for Iraqi weapons of mass destruction items, facilities, and capabilities.

Section 1202--Strengthening the Defense of Taiwan

This section would strengthen the self-defense capability of Taiwan and promote regional stability. The Taiwan Relations Act of 1979 (Public Law 96-8) states that ``the United States will make available to Taiwan such defense articles and defense services in such quantity as may be necessary to enable Taiwan to maintain a sufficient self-defense capability.'' This law further stipulates that the President and Congress shall determine the nature and quantity of such defense articles and services based solely upon their judgment of the needs of Taiwan. While the committee is generally satisfied with the Administration's actual and proposed sales of defense articles to Taiwan, China's missile buildup and arms acquisitions have heightened concern about Taiwan's ability to defend itself. The committee is concerned that if the balance of power in the Taiwan Strait continues to shift in China's favor, China may be tempted to seize Taiwan by force.

The United States has stated, through policy and law, that it desires a peaceful resolution to the differences between China and Taiwan. In 2000, the Department released a report that stated, ``As long as Taiwan has a capable defense, the environment will be more conducive to peaceful dialogue, and thus the whole region will be more stable.''

Given these reports and assessments, the committee believes that Taiwan's self-defense capability could be enhanced, and regional stability promoted, through the conduct of operational training and exchanges of senior officers between the armed forces of the United States and the armed forces of Taiwan. This training would cover a broad range of military matters, to include improving civil-military relations. The committee believes that weapons sales alone do not guarantee capability. Rather, these systems are only as effective as the military personnel trained to operate, integrate, and employ them.

The committee is confident that the preparation and

implementation of a comprehensive training plan by the Department, for the conduct of training between the armed forces of the United States and the armed forces of Taiwan, will help Taiwan maintain a sufficient self-defense capability, deter aggression, promote dialogue, and enhance regional stability.

This section would also require that the Secretary of Defense submit the joint training and exchange plan, at least 30 days before implementation, to the Congress,specifically the Committees on Armed Services of the House of Representatives and the Senate, the Committee on International Relations in the House of Representatives, and the Committee on Foreign Relations in the Senate.

Section 1203--Administrative Services and Support for Foreign Liaison Officers

This section would amend Title 10, United States Code, by making clear that the Secretary of Defense and the secretaries of the military departments may pay for, or provide without cost, administrative services and support to foreign liaison officers performing duties at military facilities in the United States. Through the Department of Defense Foreign Liaison Officer Program, military representatives of foreign governments are temporarily assigned to components or commands of U.S. armed forces. The administrative services and support that could be provided under this section include base or installation operation support services, office space, utilities, copying services, fire and police protection, and computer support. This section would not authorize the Secretary to provide pay and allowances and other similar benefits for foreign liaison officers. The U.S. government would also not cover, among other things, the following costs associated with foreign liaison officers stationed in the United States: pay and allowances; travel by the officers and their dependents; movement of the household effects of the officers or their dependents; preparation and shipment of the remains and funeral expenses associated with the death of an officer or the officer's dependents; formal and informal training of the officers; and expenses in connection with the return of an officer whose assignment has been terminated or expired, along with his dependents.

This provision was requested by the Department of Defense. However, given the committee's concern that this authority could evolve over time to cover costs and activities that would be unauthorized under this provision (as outlined above), a report shall be required before this authority is either reauthorized or expires on September 30, 2005.

Section 1204--Additional Countries Covered by Loan Guarantee Program

This section would amend section 2540(b) of title 10, United States Code, to expand the list of countries eligible under the Defense Export Loan Guarantee Program to include countries that are determined by the Secretary of Defense, in consultation with the Secretary of State, to be important to the United States' efforts to combat drug trafficking organizations or foreign terrorist organizations.

The committee continues to believe that the Defense Export Loan Guarantee Program can serve as an alternative to U.S. foreign assistance programs, and can support legitimate foreign

defense equipment requirements. However, the committee is concerned that many nations, such as Colombia, that are combating drug trafficking organizations or foreign terrorist organizations do not currently qualify for the Defense Export Loan Guarantee Program. Therefore, the committee believes that it is in the interest of the United States to expand the list of nations eligible to participate in the program.

Section 1205--Limitation on Funding for Joint Data Exchange Center in Moscow

This section would prohibit the obligation or expenditure of more than 50 percent of fiscal year 2003 funds for activities associated with the Joint Data Exchange Center in Moscow, Russia, until 30 days after the Secretary of Defense submits to the Senate Committee on Armed Services, the House Committee on Armed Services, the Senate Committee on Foreign Relations, and the House Committee on International Relations the agreement required by section 1231 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398) and an agreement exempting the United States from Russian taxes and liability.

The committee remains concerned by Russia's apparent unwillingness to move forward with this project by agreeing to the same kinds of tax and liability exemptions that apply to other U.S.-Russia cooperative programs. The committee urges the Department of Defense to reach agreement with Russia on such exemptions, or risk continued congressional support for this endeavor.

Section 1206--Limitation on Number of Military Personnel in Colombia

This section would restrict funds available to the Department of Defense to support or maintain more than 500 U.S. military personnel in Colombia at any time. The amendment would provide exemptions from the limitation for military personnel assigned to the U.S. Embassy in Colombia as an attache, part of the security assistance office or the Marine Corps security contingent, participating in natural disaster relief efforts, involved in non-operational transit through Colombia, engaged in rescuing or retrieving U.S. military or governmental personnel, or participating in a ship port call. The provision would also provide the Secretary of Defense the authority to waive the military personnel limitation should the Secretary determine that such a waiver is in the national security interests of the United States.

TITLE XIII--COOPERATIVE THREAT REDUCTION WITH STATES OF THE FORMER SOVIET UNION

OVERVIEW

The budget request contained $416.7 million for cooperative threat reduction (CTR) activities, representing a 3.4 percent increase from the $403 million appropriated for fiscal year 2002. The request included $239.9 million to dismantle former Soviet Union (FSU) weapons of mass destruction (WMD) and associated infrastructure; $94.4 million to consolidate and secure FSU WMD and related technology and materials; $8.8 million to increase transparency and encourage higher standards

of conduct; $58.9 million to support defense and military cooperation with the objective of preventing proliferation; and $14.7 million for other program support, including administrative and management costs. Finally, from these program categories, $55.0 million would go toward preventing the proliferation of biological weapons.

The committee recommends the budget request with modifications.

The committee has traditionally supported the overriding goal of the CTR program: to reduce the threat to the United States posed by the former Soviet Union's residual weapons of mass destruction and their delivery systems. Nevertheless, in recent years the committee has raised numerous concerns, including: the expansion in the program's scope; the Department's willingness--especially in the absence of prior congressional consultation--to absorb project costs that Russia, in particular, has not funded; the difficulty in determining whether assistance provided is accomplishing intended objectives; the lack of appropriate access and transparency agreements; the challenge of ensuring that assistance provided is not directly or indirectly facilitating the process of arms modernization; possible duplication and redundancies in similar projects executed by multiple federal agencies; fraud, waste, and mismanagement in the program; and whether CTR activities are more appropriately funded outside the Department of Defense.

This year, the committee faces a much more daunting problem. Current law stipulates that United States assistance for CTR projects may not be provided to any independent state of the former Soviet Union for any year unless the President certifies to Congress for that year that the proposed recipient state is committed to a number of conditions that are in the national interest of the United States. The President currently has no authority to waive this certification or any of these conditions.

These conditions and certification were mandated given the amount of financial assistance being provided to these countries, and the obvious need for reciprocal financial and political commitment by recipient countries to the goals and objectives of these threat reduction programs. Granting the President unlimited waiver authority for the annual certification, or any of the conditions that compose it, would most certainly weaken the President's ability to insist that recipient countries fully support, participate in, and share the fundamental goals of the Cooperative Threat Reduction Act (Public Law 103-160). However, completely suspending these programs would itself be contrary to U.S. interests in ensuring the nonproliferation of weapons of mass destruction.

The Administration informed Congress in early 2002 that the President cannot certify that Russia is committed to complying with relevant arms control agreements, specifically the Biological and Toxin Weapons Convention (BWC) and the Chemical Weapons Convention (CWC). The purposes of these conventions are to prevent the use of these types of weapons of mass destruction by prohibiting any research, development, production, or stockpiling of these weapons.

The purpose of the United States CTR programs with the states of the former Soviet Union is to similarly prevent the use of weapons of mass destruction, or their acquisition or theft by third parties, by assisting these countries in

reducing their excess stockpiles, production facilities, materials, and delivery systems, among other things. By doing so, presumably the risk of proliferation, theft, and illicit or accidental use--prevention of which are in the national security interests of the United States and its allies--would also be reduced.

If Russia is not committed, let alone not complying with, its obligations under the BWC and CWC, then its illicit activities undermine the purpose and goals of the CTR program. Moreover, noncompliance with its arms control agreements calls into question Russia's fundamental commitment to nonproliferation and demilitarization, its credibility and trustworthiness as a treaty partner, and its strategic intentions and plans toward the United States and other nations.

Given that the President has been forthright about Russia's questionable activities, and has put Moscow on notice regarding its commitment to comply with all relevant arms control agreements, the committee is granting the President limited waiver authority in Section 1308 so as to allow the CTR program in Russia to continue. This waiver authority, however, is limited in both duration and scope, and includes appropriate reporting requirements to ensure that Congress is properly apprised of the nature and extent of this ongoing matter, and why it is important to the United States national security to exercise this waiver authority.

Additionally, the President is required to develop a plan or policy to promote Russian compliance with its relevant arms control agreements. Needless to say, failure by Russia to take immediate action to demonstrate its commitment to the BWC and CWC risks further restrictions on CTR assistance to Russia.

The committee continues to believe that the focus of the CTR program should be the elimination of those weapons that pose the most serious and direct threat to U.S. security--first and foremost, strategic nuclear weapons and associated infrastructure. As such, the committee does not fully support the Administration's budget request for chemical weapons destruction in Russia, particularly when that country is failing to meet its obligations under the CWC.

The committee also notes that the CTR program was originally envisioned as a short-term emergency effort to reduce the threat posed to the United States by the thousands of nuclear weapons and their delivery vehicles left behind after the demise of the Soviet Union. However, the original focus of the CTR program has expanded significantly in scope since its inception. Now, there is an effort to expand the CTR program beyond the FSU. The committee does not believe this is wise given the amount of CTR work still needing to be done in the FSU, and has therefore placed a prohibition on further expansion of the CTR program.

The committee believes that the oversight provided by Congress since the program's inception has served to improve the overall management of the program and to increase its effectiveness. As such, the committee remains troubled that the Departmenthas not complied with the various reporting requirements mandated by law that are designed to enhance congressional visibility and oversight of the CTR program. Accordingly, the committee recommends a provision (sec. 1303) that would prohibit or limit the obligation or expenditure of all fiscal year 2003 CTR funds until the necessary reports are submitted.

The committee expects the Department to consider carefully and fully the concerns the committee has identified with respect to the CTR program as the Department prepares its budget and program request for fiscal year 2004.

ITEMS OF SPECIAL INTEREST

Arms Elimination Projects in Russia

The budget request contained $70.5 million for strategic offensive arms elimination projects in Russia, a 47 percent decrease from the fiscal year 2002 appropriated amount of $133.4 million. The committee recommends the budget request.

Biological Weapons Proliferation Prevention

The budget request contained $55.0 million for biological weapons proliferation prevention activities in the former Soviet Union, a 223 percent increase from the fiscal year 2002 appropriated level of $17.0 million. The committee recommends the budget request.

Although generally supportive of efforts to prevent the proliferation of biological weapons expertise, the committee remains concerned over the lack of transparency with respect to Russia's biological weapons programs, the risk that collaborative research on defensive biotechnology can be applied to offensive weapons purposes, the perpetuation of a knowledge and skills base among Russian scientists that may increase their attractiveness to foreign states seeking to develop biological weapons, the difficulty of verifying that assistance provided is not being diverted to illicit purposes, and the lack of an exit strategy for this activity.

Chemical Weapons Destruction in Russia

The budget request contained $133.6 million for chemical weapons elimination activities in Russia, which represents a 167 percent increase over the fiscal year 2002 appropriated level of $50.0 million. The committee does not fully support this request.

Rather, the committee supports funding this request at $50.0 million, and making the balance of the DOD request--$83.6 million--also available for strategic offensive arms elimination in the former Soviet Union and nuclear weapons transportation and storage security in Russia.

As previously stated, the committee continues to believe that the focus of the CTR program should be the elimination of those weapons that pose the most serious and direct threat to U.S. security: strategic nuclear weapons and associated infrastructure. As such, the committee does not support a budget request that proposes to spend $133.6 million on chemical weapons destruction in Russia, particularly when that country is failing to live up to its obligations under the Chemical Weapons Convention (CWC).

As it stands, Russia has failed to meet any of the time and destruction milestones outlined in the CWC; in fact, Russia is admittedly years behind schedule and shows little sign of making progress in complying with the convention. While Russia may claim economic hardship, and the failure of other

countries--particularly the United States--to help fund the destruction activities outlined in the CWC, the committee notes that Russia's obligations under the CWC are Russia's responsibilities--not others'. Moreover, the Russian government could meet its obligations under the CWC by freeing up funds dedicated to the production of SS-27 ballistic missiles, the development of other offensive arms, and the pursuit of military modernization initiatives.

Finally, the committee is troubled by the fact that Russia has yet to meet all of the necessary conditions, particularly the requirement to provide full and accurate information regarding its chemical weapons stockpile, before CTR funds can be expended on the chemical weapons destruction facility (CWDF). Because Russia has failed to meet these conditions, no CTR funds have been expended on the destruction facility to date. Given the totality of facts, the Committee has decided to flat line this year's budget request for chemical weapons destruction rather than endorse a 167% increase in funding for this project. Additionally, continued Russian reluctance to resolve these issues not only undermines congressional support for the CTR program, it also jeopardizes continued funding for the CWDF project in particular.

Defense and Military Contacts

The budget request contained $18.9 million for defense and military contacts with the states of the former Soviet Union, a slight increase over the fiscal year 2002 appropriated level of $18.3 million. The committee recommends the budget request. Last year, the CTR program funded approximately 500 defense and military contacts with the states of the former Soviet Union. This year's budget request would also support 500 events. However, the committee continues to believe that the utility of these activities is difficult to quantify, yet fully expects the Department to do so as it plans, implements and evaluates these activities. As such, the committee has required a detailed report on this program's activities before more than 50% of fiscal year 2003 CTR funds are obligated or expended.

Fissile Material Storage Facility

The budget request did not contain funding for this activity. The committee notes that Russia continues not to seek assistance to build a second wing at the Mayak storage facility and that sufficient funds remain to complete activity on the first wing. Accordingly, the committee supports the Department's action not to seek additional funds for this activity and recommends a provision (section 1305) that would continue to prohibit CTR funds from being used for the design, planning, or construction of a second wing. The committee notes that Russia has consistently refused to agree to transparency measures that would allow the United States to verify that the fissile material stored at thefacility in Mayak, Russia, is from dismantled nuclear weapons and reiterates its view that the Department should continue to seek an agreement with Russia on this issue.

Nuclear Weapons Storage Security in Russia

The budget request contained $39.9 million for nuclear

weapons storage security in Russia, a 27 percent decrease from the fiscal year 2002 appropriated level of $54.7 million. The committee recommends the budget request, but reiterates the need for the Secretary of Defense to seek an agreement with Russia allowing appropriate U.S. access to nuclear weapons storage sites for which CTR assistance is provided.

Nuclear Weapons Transportation Security

The budget request contained $19.7 million for nuclear weapons transportation security in Russia, a 107 percent increase from the fiscal year 2002 appropriated level of $9.5 million. The committee recommends the budget request. The committee notes that these costs were previously paid by Russia and again urges the Department to seek an agreement that would once again shift the burden of financial responsibility for this activity back to Russia.

Other Assessments and Administrative Support

The budget request contained $14.7 million for other program support, including management and administrative costs, project development, and audits and examinations, an 11 percent increase over the fiscal year 2002 appropriated level of $13.2 million. The committee recommends the budget request.

The committee notes that a portion of these funds has traditionally been applied to new initiatives in the concept development stage. The committee understands that Russia has in the past proposed various initiatives for CTR consideration, including initiatives involving conventional weapons or delivery platforms. The committee believes that the statutory language of section 1303 of the National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398), which prohibits the use of CTR funds for conventional elimination purposes, should be strictly adhered to and that CTR funds should not be expended on concept development studies designed to assess the viability of elimination projects specifically prohibited under the statutory prohibition.

Weapons of Mass Destruction Infrastructure Elimination in Kazakhstan

The budget request contained $9.0 million for weapons of mass destruction infrastructure elimination activities in Kazakhstan, a 50 percent increase over the fiscal year 2002 appropriated level of $6.0 million. This would include funding for activities related to the prevention of fissile and radioactive material proliferation, and the elimination of facilities used to support the deployment and operation of weapons of mass destruction, including infrastructure at former bomber bases. The committee recommends the budget request.

Weapons of Mass Destruction Infrastructure Elimination in Ukraine

The budget request contained $8.8 million for weapons of mass destruction infrastructure elimination activities in Ukraine, a 47 percent increase over the fiscal year 2002 appropriated level of $6.0 million. This would include funding for activities related to the elimination of facilities used to support the deployment and operation of weapons of mass destruction, including facilities for storage and maintenance

of nuclear weapons. The committee recommends the budget request.

Russian Proliferation to Iran

The committee is deeply concerned about continued Russian proliferation to Iran, and the clear threat that this dangerous activity presents to the national security and vital interests of the United States. Needless to say, Russian proliferation to Iran, and to other countries, conflicts with the purpose and goals of the Cooperative Threat Reduction (CTR) program, and could undermine continued congressional support for threat reduction efforts in Russia.

According to the U.S. intelligence community, Russian proliferation to Iran consists primarily of nuclear and missile technology, goods, and know-how, and dual-use items that could contribute to the development of weapons of mass destruction (WMD) and ballistic missiles. This proliferation also includes other WMD technologies and advanced conventional weapons; and Russian entities are also transferring similar items to other countries, including China, Libya, and Syria.

As a result of Russian assistance, the intelligence community estimates that Iran could attempt to launch an intercontinental ballistic missile by 2005, and could possess a nuclear weapon by 2010. Combined, these capabilities would create a new strategic threat to the United States, and an immediate threat to American forces, interests, allies and friends in the region.

Unclassified intelligence reports indicate that Russian proliferation to Iran takes place either covertly, under the guise of peaceful cooperation, or through academic and scientific exchanges that take place in both Russia and Iran. In either case, this matter has been raised by United States officials at the highest levels of the Russian government. Yet, despite U.S. efforts, this activity continues with either the knowledge or acquiescence of senior Russian officials, who support these illicit transfers or are tolerating them for strategic or financial reasons.

To make matters worse, Iran has a longstanding history of providing safe harbor, money, arms and assistance to foreign terrorist organizations. As a result, Iran has been rightly designated a ``state sponsor of terrorism'' by the United States. The most dangerous aspect of Russian proliferation to Iran, therefore, is that weapons of mass destruction technologies or materials might be passed onto foreign terrorist organizations supported by Teheran. It goes without saying that the combination of foreign terrorists organizations and weapons of mass destruction would constitute a grave threat to the national security of the United States, since an attack of this nature would be extremely difficult to prevent, deter, or defend against.

Therefore, it would be fair to state that the ongoing proliferation of WMD technologies, materials, and know-how from Russia to Iran represents a greater, broader,and more likely threat to the national security and vital interests of the United States than the potential proliferation of these same items from Russia.

Russian proliferation to Iran and other countries raises serious questions about Moscow's intentions, commitment to nonproliferation, and desire for improved U.S.-Russian

relations. Thus, the President must make nonproliferation a top priority when dealing with Moscow, and must demonstrate United States resolve and commitment to nonproliferation through clear, firm and coherent policies and strategies that employ the full-range of diplomatic and economic tools at his disposal, both positive and negative, to eliminate this dangerous activity once and for always.

LEGISLATIVE PROVISIONS

Section 1301--Specification of Cooperative Threat Reduction Programs and Funds

This section would specify the kinds of programs to be funded under this title and would make fiscal year 2003 Cooperative Threat Reduction (CTR) funds available for obligation for three years.

Section 1302--Funding Allocations

This section would allocate fiscal year 2003 funding for various CTR purposes and activities.

Section 1303--Prohibition Against Use of Funds Until Submission of Reports

This section would prohibit the obligation or expenditure of fiscal year 2003 CTR funds until 30 days after the annual report required by section 1308 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398), and the update for the multi-year plan required to be submitted for fiscal year 2001, are submitted.

Section 1304--Report on Use of Revenue Generated by Activities Carried Out Under Cooperative Threat Reduction Programs

This section would place a new reporting requirement, as practicable, in the annual report required by section 1308 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398) regarding use of the revenue generated by CTR activities in the states of the former Soviet Union.

Section 1305--Prohibition Against Use of Funds for Second Wing of Fissile Material Storage Facility

This section would prohibit the use of CTR funds for the design, planning, or construction of a second wing for the fissile material storage facility in Mayak, Russia.

Section 1306--Sense of Congress and Report Requirement Regarding Russian Proliferation to Iran

This section would express the Sense of Congress regarding continued Russian proliferation of goods, technology, and know-how that directly or indirectly contribute to Iran's development of weapons of mass destruction and ballistic missiles, and the threat that this illicit activity could pose to United States national security and vital interests.

This section would also require the President to report to the Senate Committee on Armed Services, the House Committee on Armed Services, the Senate Committee on Foreign Relations, and the House Committee on International Relations regarding the scope, nature, and extent of Russian proliferation to Iran, and to other countries of concern; the impact this activity could have on the United States and its national security interests; and the plan, policy, or strategy that the President intends to pursue to halt Russian proliferation.

Section 1307--Prohibition Against Use of Cooperative Threat Reduction Funds Outside the States of the Former Soviet Union

This section would prohibit expanding the CTR program to states outside of the former Soviet Union.

Section 1308--Limited Waiver of Restriction on Use of Funds

This section would provide limited authority for the President to waive the certification requirement of paragraph (d)(5), section 5952 of title 22, United Stated Code--which states that Russia is committed to complying with all relevant arms control agreements--for national security purposes.

This waiver authority is limited in both duration and scope. It includes appropriate reporting requirements to ensure that Congress is properly apprised of the nature and extent of Russia's lack of commitment to all relevant arms control agreements, why it is important to the United States national security to exercise this waiver authority and continue CTR activities with Russia, and the President's plan or policy to promote Russian compliance with its relevant arms control agreements.

The committee notes that while it may be in the national security interest of the United States to continue CTR programs in Russia, it is even more important to the nation's security that Russia comply with all relevant arms control agreements, particularly those involving weapons of mass destruction.

Section 1309--Limitation on Use of Funds Until Submission of Report on Defense and Military Contacts Activities

This section would prohibit the obligation or expenditure of more than 50% of fiscal year 2003 CTR funds for ``Defense and Military Activities'' until the Secretary of Defense submits a report to Congress detailing the activities, operation, and performance of the previous year's events under this program.

TITLE XIV--UTAH TEST AND TRAINING RANGE

OVERVIEW

The Utah Test and Training Range is used for operational training, testing of new systems, and missile motor storage, testing and destruction. The range provides the largest overland safety footprint available in the Department for aircrew training and weapons testing. The continued operation of the Utah Test and Training Range is vital for meeting test and training requirements for the Air Force, allied forces, other national agencies, civilian industry and civilian

academic institutions.

In order to fulfill its mission, the Air Force must maintain overflight capability, including low-altitude overflight, by manned and unmanned aircraft and vehicles as well as the ability to undertake supersonic events. The Air Force must protect established rights-of-way to existing ground instrumentation and communications gear, and the capability to upgrade or add additional equipment as necessary. The Air Force also requires emergency access to certain areas and the ability to control or restrict public access.

In 1990, the Bureau of Land Management recommended that approximately 1.9 million acres in Utah be designated as wilderness, including approximately 200,000 acres within the Utah Test and Training Range. The Wilderness Act of 1964, P.L. 88-577, defines wilderness as lands upon which ``the imprint of man's work [is] substantially unnoticeable'' such that the lands provide ``outstanding opportunities for solitude.'' In recent years, the Department's readiness capabilities have been encroached by threatened litigation wherein parties have asserted that military training activities conducted at or near proposed wilderness areas nationwide are unlawful in instances where the activities interfere with a solitude wilderness experience.

Continued unrestricted access to the special use airspace and lands that comprise the Utah Test and Training Range is a national security priority that is compatible with the protection and proper management of the natural, environmental, cultural and other resources of these lands. This provision would not amend the Wilderness Act, which is silent on the issue of military activities above wilderness areas.

LEGISLATIVE PROVISIONS

Section 1401-Definition of Utah Test and Training Range

This section would define the ``Utah Test and Training Range'' as those portions of the military operating area of the Utah Test and Training Area located solely in the State of Utah, including the Dugway Proving Ground.

Section 1402--Military Operations and Overflights at Utah Test and Training Range

This section would specify that the Wilderness Act would not restrict the ability of the military to conduct overflights or designate new training routes on the Utah Test and Training Range. The section would specify that the Wilderness Act would not require the removal of existing communication, instrumentation or electronic tracking systems, and would permit maintenance of or installation of any such equipment in the future. This section would also instruct the Secretary of the Air Force and the Secretary of Interior to enter into a Memorandum of Understanding to determine procedures and guidelines regarding emergency access, the restriction of public access for safety and security reasons and the temporary placement of communications equipment for training and testing of military activities.

Section 1403--Designation and Management of Lands in Utah Test and

Training Range

This section would specify the Federal lands located in the Utah Test and Training Range that will be designated as wilderness. All areas designated as wilderness would be administered by the Secretary of the Interior subject to the conditions specified in the provision.

Section 1404--Designation of Pilot Range Wilderness

This section would designate specified Federal lands in Box Elder County, Utah, as wilderness known as the Pilot Range Wilderness Area.

Section 1405--Designation of Cedar Mountain Wilderness

This section would designate specified Federal lands in Tooele County, Utah, as wilderness known as the Cedar Mountain Wilderness Area.

DIVISION B--MILITARY CONSTRUCTION AUTHORIZATIONS

PURPOSE

The purpose of Division B is to provide military construction authorizations and related authority in support of the military departments during fiscal year 2003. As approved by the committee, Division B would authorize appropriations in the amount of $9,953,476,000 for construction in support of the active forces, reserve components, defense agencies, and the North Atlantic Treaty Organization (NATO) security infrastructure fund for fiscal year 2003.

MILITARY CONSTRUCTION OVERVIEW

The Department of Defense requested $4,713,916,000 for military construction and $4,220,133,000 for family housing for fiscal year 2003. Within the military construction request, $545,138,000 was requested for implementation of base closure and realignment actions. The committee recommends authorization of $5,702,368,000 for military construction, including $545,138,000 for base closure implementation, and $4,251,108,000 for family housing.

Although the last two military construction budgets will be the highest in several years, the committee remains concerned about the state of our military installations and facilities. Despite these two relatively robust budgets, the situation at installation after installation remains grim, with little hope for the future without a serious commitment to the modernization of the Department's infrastructure. Even the improved funding for sustainment, modernization and restoration does not provide enough resources to keep the condition of these facilities from falling further behind.

The budget request would have funded little more than beddown of new missions and some quality of life projects. While important, these projects do nothing to improve the situation for long neglected current mission requirements, which continue to suffer. To address some of this shortfall, the committee recommends an increase in new budget authority of $1,019,427,000, and carefully reviewed the projects contained

in the budget request. While the committee approved all but a few of the requested projects, the committee withheld approval of seemingly redundant projects overseas and withheld judgment on the value of additional North Atlantic Treaty Organization headquarters.

The committee is pleased that three of the four military services expect to have all military families living in adequate family housing by 2007 through the housing privatization program. The committee has recommended further enhancements to this program in the effort to hasten the day when all military families will live in decent homes.

A tabular summary of the authorizations provided in Division B for fiscal year 2003 follows:

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

TITLE XXI--ARMY

SUMMARY

The budget request contained $1,476,521,000 for Army military construction and $1,405,620,000 for family housing for fiscal year 2003. The committee recommends authorization of $1,521,433,000 for military construction and $1,400,700,000 for family housing for fiscal year 2003.

ITEMS OF SPECIAL INTEREST

Planning and Design

The committee recommends that, within authorized amounts for planning and design, the Secretary of the Army complete planning and design activities for the following project: $1,600,000 for a railhead at Baumholder, Germany.

Unspecified Minor Construction

The committee recommends that, within authorized amounts for unspecified minor construction, the Secretary of the Army execute the following project: $1,050,000 for sewage plant environmental compliance upgrades at White Sands Missile Range, New Mexico.

Water Tanks, Fort Bliss, Texas

The committee authorizes $10,200,000 for phase two of a project to replace elevated water tanks at Fort Bliss, Texas, and recommends authorization of appropriation of $5,200,000. The committee notes that sufficient authorization of appropriations to complete phase two of this project was provided by section 2101 of the Military Construction Authorization Act for Fiscal Year 2002 (division B of Public Law 107-107).

LEGISLATIVE PROVISIONS

Section 2101--Authorized Army Construction and Land Acquisition Projects

This section contains the list of authorized Army construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is intended to be the binding list of the specific projects authorized at each location.

Section 2102--Family Housing

This section would authorize new construction and planning and design of family housing units for the Army for fiscal year 2003.

Section 2103--Improvements to Military Family Housing Units

This section would authorize improvements to existing units of family housing for fiscal year 2003.

Section 2104--Authorization of Appropriations, Army

This section would authorize specific appropriations for each line item contained in the Army's budget for fiscal year 2003. This section also provides an overall limit on the amount the Army may spend on military construction projects.

Section 2105--Modification of Authority to Carry Out Certain Fiscal Year 2002 Projects

This section would amend the table in section 2101 of the Military Construction Authorization Act for Fiscal Year 2002 (division B of Public Law 107-107) to provide for an increase in the amounts authorized for military construction at Fort Carson, Colorado, and Fort Jackson, South Carolina.

TITLE XXII--NAVY

SUMMARY

The budget request contained $895,131,000 for Navy military construction and $1,243,488,000 for family housing for fiscal year 2003. The committee recommends authorization of $1,245,585,000 for military construction and $1,245,404,000 for family housing for fiscal year 2003.

ITEMS OF SPECIAL INTEREST

Electromagnetic Aircraft Launch System Land Based Test Site

The committee commends the Secretary of the Navy for including planning and design funding in the budget request for the Electromagnetic Aircraft Launch System (EMALS) Land Based Test Site at Lakehurst Naval Air Engineering Station, New Jersey. The committee believes this project is a critical component of the CVN-X program and understands that the Secretary of the Navy intends to request full funding for the project in fiscal year 2004. The committee endorses the secretary's plan to fund this project in fiscal year 2004.

North Chicago Department of Veterans Affairs Medical Center And Naval

Hospital, Great Lakes, Illinois

The committee directs the Secretary of the Navy to consult with the Secretary of Veterans Affairs and provide a report of the plan required by the House of Representatives report on National Defense Authorization Act for Fiscal Year 2002 (Report 107-333) to jointly make maximum use of the North Chicago Veterans Affairs Medical Center. The report should be transmitted to the committee by January 30, 2003.

The committee believes that efficiencies are possible if the Department of the Navy and the Department of Veterans' Affairs share a single, modern facility. The committee recognizes the many bureaucratic impediments to such a proposal, among them the reality that construction of medical facilities for the military departments is managed and budgeted by the Department of Defense (DOD). With the understanding that the Secretary of the Navy and the Secretary of Veterans Affairs agree on the design of a new joint facility that will be no more costly to each department than respective single use facilities, the committee encourages the Secretary of the Navy to submit a request to fund the DOD portion of a joint facility to the Secretary of Defense for consideration in the fiscal year 2004 or future medical construction budget requests.

The committee believes that any joint venture undertaken at Great Lakes Naval Hospital and the North Chicago Veterans Affairs Medical Center should meet jointly identified needs in a cost effective manner, be mutually beneficial to the beneficiaries of both departments, and incorporate the best business practices and lessons learned from previous joint ventures. To this end, the Secretary of the Navy, in coordination with the Secretary of Defense, and the Secretary of Veterans Affairs shall consult on further development of compatible budget, reimbursement and accounting systems, andcompatible information technology goals. The consultation shall seek to identify restrictive regulations, policies and regulatory redundancies that inhibit resource sharing, and provide milestone dates to address each identified issue.

Planning and Design

The committee recommends that, within authorized amounts for planning and design, the Secretary of the Navy complete planning and design activities for the following projects: $1,100,000 for a child development center at North Island Naval Air Station, California and $180,000 for a fire station at Whidbey Island Naval Air Station, Washington.

LEGISLATIVE PROVISIONS

Section 2201--Authorized Navy Construction and Land Acquisition Projects

This section contains the list of authorized Navy construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is intended to be the binding list of the specific projects authorized at each location.

Section 2202--Family Housing

This section would authorize new construction and planning and design of family housing units for the Navy for fiscal year 2003.

Section 2203--Improvements to Military Family Housing Units

This section would authorize improvements to existing units of family housing for fiscal year 2003.

Section 2204--Authorization of Appropriations, Navy

This section would authorize specific appropriations for each line item in the Navy's budget for fiscal year 2003. This section also provides an overall limit on the amount the Navy may spend on military construction projects.

Section 2205--Modification of Authority to Carry Out Certain Fiscal Year 2002 Project

This section would amend the table in section 2201 of the Military Construction Authorization Act for Fiscal Year 2002 (division B of Public Law 107-107) to provide for an increase in the amounts authorized for military construction at Naval Station Norfolk, Virginia.

TITLE XXIII--AIR FORCE

SUMMARY

The budget request contained $644,090,000 for Air Force military construction and $1,521,113,000 for family housing for fiscal year 2003. The committee recommends authorization of $929,721,000 for military construction and $1,555,092,000 for family housing for fiscal year 2003.

ITEMS OF SPECIAL INTEREST

C-17 Assault Strips

The committee endorses the decision by the Secretary of the Air Force to base C-17 aircraft at March Air Reserve Base, California, and Travis Air Force Base, California. The committee notes that fully trained C-17 crews must practice combat landings at assault strips located at air bases near their home station. The committee has learned that a facility at Bicycle Lake, Fort Irwin, California, may be able to serve as an assault strip for March Air Reserve Base and Travis Air Force Base crews with some minor improvements. The committee urges the Secretary of the Air Force and the Secretary of the Army to consider upgrading the facility at Fort Irwin for use as an assault strip and urges the Secretary of the Air Force to construct assault strips at locations at appropriate distances from other bases where C-17 aircraft are stationed.

Planning and Design

The committee recommends that, within authorized amounts

for planning and design, the Secretary of the Air Force complete planning and design activities for the following projects: $675,000 for an air traffic control tower at Dover Air Force Base, Delaware, $2,160,000 for the 1st Air Force operations support center at Tyndall Air Force Base, Florida, and $2,430,000 for corrosion control paint facility at Robins Air Force Base, Georgia.

LEGISLATIVE PROVISIONS

Section 2301--Authorized Air Force Construction and Land Acquisition Projects

This section contains the list of authorized Air Force construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is intended to be the binding list of the specific projects authorized at each location.

Section 2302--Family Housing

This section would authorize new construction and planning and design of family housing units for the Air Force for fiscal year 2003.

Section 2303--Improvements to Military Family Housing Units

This section would authorize improvements to existing units of family housing for fiscal year 2003.

Section 2304--Authorization of Appropriations, Air Force

This section would authorize specific appropriations for each line item in the Air Force's budget for fiscal year 2003. This section also would provide an overall limit on the amount the Air Force may spend on military construction projects.

TITLE XXIV--DEFENSE AGENCIES

SUMMARY

The budget request contained $687,535,000 for defense agencies military construction and $47,912,000 for family housing for fiscal year 2003. The committee recommends authorization of $779,896,000 for military construction and $47,912,000 for family housing for fiscal year 2003.

ITEMS OF SPECIAL INTEREST

Planning and Design

The committee recommends that, within authorized amounts for planning and design, the Secretary of Defense complete planning and design activities for the following project: $1,300,000 for the fifth building of the Uniformed Services University of Health Sciences at Bethesda, Maryland.

LEGISLATIVE PROVISIONS

Section 2401--Authorized Defense Agencies Construction and Land Acquisition Projects

This section contains the list of authorized defense agencies construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is intended to be the binding list of the specific projects authorized at each location.

Section 2402--Improvements to Military Family Housing Units

This section would authorize improvements to existing units of family housing for fiscal year 2003.

Section 2403--Energy Conservation Projects

This section would authorize the Secretary of Defense to carry out energy conservation projects.

Section 2404--Authorization of Appropriations, Defense Agencies

This section would authorize specific appropriations for each line item in the Defense Agencies' budget for fiscal year 2003. This section also would provide an overall limit on the amount the defense agencies may spend on military construction projects.

Section 2405--Modification of Authority to Carry Out Certain Fiscal Year 2000 Project

This section would amend the table in section 2401 of the Military Construction Authorization Act for Fiscal Year 2000 (division B of Public Law 106-65) to provide for an increase in the amounts authorized for military construction at Blue Grass Army Depot, Kentucky.

Section 2406--Modification of Authority to Carry Out Certain Fiscal Year 1999 Project

This section would amend the table in section 2401 of the Military Construction Authorization Act for Fiscal Year 1999 (division B of Public Law 105-261) to provide for an increase in the amounts authorized for military construction at Newport Army Depot, Indiana.

Section 2407--Modification of Authority to Carry Out Certain Fiscal Year 1997 Project

This section would amend the table in section 2401 of the Military Construction Authorization Act for Fiscal Year 1997 (division B of Public Law 104-201) to provide for an increase in the amounts authorized for military construction at Pueblo Chemical Activity, Colorado.

TITLE XXV--NORTH ATLANTIC TREATY ORGANIZATION INFRASTRUCTURE

OVERVIEW

The budget request contained $168,200,000 for the North Atlantic Treaty Organization (NATO) infrastructure fund (NATO Security Investment Program) for fiscal year 2003. The committee recommends $168,200,000.

LEGISLATIVE PROVISIONS

Section 2501--Authorized NATO Construction and Land Acquisition Projects

This section would authorize the Secretary of Defense to make contributions to the North Atlantic Treaty Organization security investment program in an amount equal to the sum of the amount specifically authorized in section 2502 of this bill and the amount of recoupment due to the United States for construction previously financed by the United States.

Section 2502--Authorization of Appropriations, NATO

This section would authorize appropriations of $168,200,000 as the U.S. contribution to the North Atlantic Treaty Organization security investment program.

TITLE XXVI--GUARD AND RESERVE FORCES FACILITIES

SUMMARY

The budget request contained $297,301,000 for military construction of guard and reserve facilities for fiscal year 2003. The committee recommends authorization for fiscal year 2003 of $512,395,000 to be distributed as follows:

Army National Guard	$ 170,793,000
Air National Guard	119,266,000
Army Reserve	86,789,000
Naval and Marine Corps Reserve	66,971,000
Air Force Reserve	68,576,000
Total	512,395,000

ITEMS OF SPECIAL INTEREST

Dual Use Reserve Facilities

The committee understands that select Marine Reserve units are developing innovative programs with local educational institutions that may result in greater synergy between the military and civilian community at the local level. The committee is aware that these initiatives may involve efficiencies in the form of dual use of some facilities. The committee is interested in this initiative and directs the Secretary of the Navy to report to the Senate Committee on Armed Services and the House Committee on Armed Services by March 1, 2003, on the value of this program.

Joint Army Reserve and National Guard Reserve Center

The committee believes that the reserve components should construct joint facilities wherever possible. The committee understands that both the Army National Guard and Army Reserve have inadequate facilities in Scranton, Pennsylvania. The committee urges the Secretary of the Army to consider establishing a joint Army Reserve and Army National Guard center in the Scranton, Pennsylvania area to properly support the reserve components in northeast Pennsylvania. The committee is also aware that the Army National Guard and Army Reserve are considering such a joint project in the Moreno Valley, California, area, and urges the Secretary of the Army to complete this needed joint facility as soon as possible.

Planning and Design, Air National Guard

The committee recommends that, within authorized amounts for planning and design, the Secretary of the Air Force complete planning and design activities for the following projects: $1,650,000 for a fire crash rescue station and control tower at Otis Air National Guard Base, Massachusetts, $1,110,000 for an aircraft maintenance complex at Duluth International Airport, Minnesota, and $347,000 for phase two of an aircraft maintenance complex in Nashville, Tennessee.

Planning and Design, Army National Guard

The committee recommends that, within authorized amounts for planning and design, the Secretary of the Army complete planning and design activities for the following projects: $990,000 for an armed forces reserve center in Haleyville, Alabama, $1,126,000 for an aviation transformation readiness center at Windsor Locks, Connecticut, $1,580,000 for an aviation support facility at Fort Stewart, Georgia, $659,000 for a readiness center in Methuen, Massachusetts, $2,014,000 for an aviation support facility at North Kingstown, Rhode Island, and $856,000 for an information operations armory at Camp Murray, Washington.

Unspecified Minor Construction

The committee recommends that, within authorized amounts for unspecified minor construction, the Secretary of the Army execute the following project: $586,000 for readiness center utilities upgrades at Worcester, Massachusetts.

LEGISLATIVE PROVISIONS

Section 2601--Authorized Guard and Reserve Construction and Land Acquisition Projects

This section would authorize appropriations for military construction for the guard and reserve by service component for fiscal year 2003. The state list contained in this report is intended to be the binding list of the specific projects authorized at each location.

TITLE XXVII--EXPIRATION AND EXTENSION OF AUTHORIZATIONS

LEGISLATIVE PROVISIONS

Section 2701--Expiration of Authorizations and Amounts Required to Be Specified by Law

This section would provide that authorizations for military construction projects, repair of real property, land acquisition, family housing projects and facilities, contributions to the North Atlantic Treaty Organization infrastructure program, and guard and reserve projects will expire on October 1, 2005 or the date of enactment of an act authorizing funds for military construction for fiscal year 2006, whichever is later. This expiration would not apply to authorizations for which appropriated funds have been obligated before October 1, 2005 or the date of enactment of an act authorizing funds for these projects, whichever is later.

Section 2702--Extensions of Authorizations of Certain Fiscal Year 2000 Projects

This section would provide for selected extension of certain fiscal year 2000 military construction authorizations until October 1, 2003, or the date of the enactment of an act authorizing funds for military construction for fiscal year 2004, whichever is later.

Section 2703--Extension of Authorizations of Certain Fiscal Year 1999 Projects

This section would provide for selected extension of certain fiscal year 1999 military construction authorizations until October 1, 2003, or the date of the enactment of the act authorizing funds for military construction for fiscal year 2004, whichever is later.

Section 2704--Effective Date

This section would provide that Titles XXI, XXII, XXIII, XXIV, XXV, and XXVI of this bill shall take effect on October 1, 2002, or the date of the enactment of this act, whichever is later.

TITLE XXVIII--GENERAL PROVISIONS

ITEMS OF SPECIAL INTEREST

Impact of Privatized Housing on Local School Systems

The committee commends the Secretary of Defense's initiative to eliminate substandard military family housing by 2007 by aggressive use of housing privatization authorities. The committee believes that such initiatives, while worthy, should carefully consider the impact on all local support facilities, especially local school systems. It is particularly challenging for Department of Defense Education Activity Schools to respond effectively to sudden shifts in student

population, since these schools must accommodate all students on a given installation, and since new school construction must be approved in the Department's military construction budget request. Local education activities feel the effects as well, and have little chance to react as federal impact payments are slow to adjust. The committee notes that service secretaries are authorized to include new school facilities in privatized housing contracts, and is concerned that this authority has not been used to its fullest advantage. In order to understand how the Department is addressing this issue both at installations with and without Department of Defense schools, the committee directs the Secretary of Defense to report to the Senate Committee on Armed Services and the House Committee on Armed Services by March 1, 2003, the impact of privatized housing on local and any Department of Defense schools at Fort Bragg, North Carolina, Fort Hood, Texas, and Lackland Air Force Base, Texas, together with the measures taken to ameliorate those impacts.

Integrated Water Management System on Guam

The committee recognizes the need for efficient management, utilization and conservation of water resources for the civilian and military communities on Guam. For some years, the committee has encouraged the military services to privatize utility systems where possible. In that regard, the committee encourages the Department of Defense to work collaboratively with the Government of Guam for a comprehensive and integrated water supply system and wastewater system on the island. To achieve this goal, the committee urges the exploration of a public-private partnership to manage the distribution and supply of potable water on a more efficient basis in Guam.

LEGISLATIVE PROVISIONS

Subtitle A--Military Construction Program and Military Family Housing Changes

Section 2801--Changes to Alternative Authority for Acquisition and Improvement of Military Housing

This section would amend several provisions of subchapter IV of chapter 169, title 10, United States Code, to provide the secretaries of the military departments with additional flexibility in the management of family and unaccompanied housing underalternate authorities. This section would amend section 2872a of title 10, United States Code, to add police and fire protection services to the services that may be provided by a service secretary under these authorities; would amend section 2874 of title 10, United States Code, to permit service secretaries to lease existing housing and incorporate such housing into contracts negotiated under these authorities; would repeal section 2879 of title 10, United States Code; would amend section 2880 of title 10, United States Code, to remove restrictions on space limitations by grade for unaccompanied housing provided under these authorities on a military installation; and would amend section 2883 of title 10, United States Code, to consolidate the existing separate family housing and unaccompanied housing improvement funds into a single fund.

Section 2802--Modification of Authority to Carry Out Construction Projects as Part of Environmental Response Action

This section would amend section 2810 of title 10, United States Code, to clarify that the secretaries of the military departments are required to notify Congress of their intent carry out military construction projects not otherwise authorized by law necessary to carry out an environmental response action when the cost of that project exceeds the minor construction threshold.

Section 2803--Leasing of Military Family Housing in Korea

This section would amend section 2828 of title 10, United States Code, to authorize the Secretary of the Army to lease in Korea no more than 2,400 units of family housing for a maximum lease amount of $35,000 per year and no more than 1,175 units of family housing for a maximum of $25,000 per year.

Subtitle B--Real Property and Facilities Administration

Section 2811--Agreements with Private Entities to Limit Encroachments and Other Constraints on Military Training, Testing, and Operations

This section would authorize the secretary of a military department to enter into an agreement with a private organization whose principal purpose is the conservation of natural resources to acquire an interest in land near military installations for the purpose of preserving natural habitat and limiting commercial development near military installations. The committee believes that judicious use of this initiative will help to preserve the last refuge habitat of some endangered species and will reduce the risk of urban encroachment impacting training at military installations.

Section 2812--Conveyance of Surplus Real Property for Natural Resource Conservation Purposes

This section would authorize the secretary of a military department to convey surplus real property under the administrative control of the secretary to an entity of state or local government or a nonprofit conservation organization for the purpose of maintaining the property for the conservation of natural resources in perpetuity.

Section 2813--National Emergency Exemption From Screening and Other Requirements of McKinney-Vento Homeless Assistance Act for Property Used in Support of Response Activities

This section would amend section 11411 of title 42, United States Code, to provide an exception to the requirement to screen excess or surplus property for various other uses when the property may be needed by federal, state, or local agencies to support emergency efforts in times of war, national emergency, or the occurrence of a major disaster.

Section 2814--Demonstration Program on Reduction in Long-Term Facility Maintenance Costs

This section would authorize the Secretary of Defense to conduct a demonstration program to assess whether the inclusion of facility maintenance requirements in military construction contracts may reduce the long-term facility maintenance costs of the military departments. This program is limited to 12 contracts, but is in addition to similar authority provided to the Secretary of the Army by section 2814 of the Military Construction Authorization Act for Fiscal Year 2002 (division B of Public Law 107-107).

Section 2815--Expanded Authority to Transfer Property at Military Installations to Be Closed to Persons Who Construct or Provide Military Family Housing

This section would amend section 204 of the Defense Authorization Amendments and Base Closure and Realignment Act (Public Law 100-526) and section 2905 of the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510) to provide greater flexibility to the secretary of a military department to exchange property at a closed military installation for needed military family housing.

Subtitle C--Land Conveyances

Part I--Army Conveyances

Section 2821--Land Conveyances, Lands in Alaska No Longer Required for National Guard Purposes

This section would authorize the Secretary of the Army to convey to the State of Alaska, a local government entity, or Indian tribe in the State of Alaska certain parcels of real estate in the National Wildlife Refuge System in Alaska that are excess to the needs of the Alaska National Guard.

Section 2822--Land Conveyance, Fort Campbell, Kentucky

This section would authorize the Secretary of the Army to convey, without consideration, a parcel of real property at Fort Campbell, Kentucky, consisting of approximately 50 acres containing an abandoned railroad spur, to the city of Hopkinsville, Kentucky. The property is to be used by the city for storm water management, recreation, and other public purposes. The cost of any surveys necessary for the conveyance shall be borne by the city.

Section 2823--Land Conveyance, Army Reserve Training Center, Buffalo, Minnesota

This section would authorize the Secretary of the Army to convey, without consideration, a parcel of real property, with improvements, to the Buffalo Independent School District 877 of Buffalo, Minnesota. The property is to be used by the school district as a learning center. The cost of any surveys necessary for the conveyance shall be borne by the school district.

Section 2824--Land Conveyance, Fort Bliss, Texas

This section would authorize the Secretary of the Army to convey, without consideration, a parcel of real property at Fort Bliss, Texas, consisting of approximately 44 acres with and without improvements to the State of Texas. The property is to be used by the State for the construction of a veterans' nursing home. The cost of any surveys necessary for the conveyance shall be borne by the State.

Section 2825--Land Conveyance, Fort Hood, Texas

This section would authorize the Secretary of the Army to convey, without consideration a parcel of real estate at Fort Hood, Texas, consisting of approximately 174 acres with and without improvements, to the Veterans Land Board of the State of Texas. The property is to be used by the State to establish a State run veterans' cemetery. The cost of any surveys necessary for the conveyance shall be borne by the board.

Part II--Navy Conveyances

Section 2831--Land Conveyance, Marine Corps Air Station, Miramar, San Diego, California

This section would authorize the Secretary of the Navy to convey a parcel of real property at Marine Corps Air Station Miramar, San Diego, California, to ENPEX Corporation for consideration. The section would require that the corporation construct family housing in the San Diego area and convey such housing and underlying real estate to the Secretary of the Navy as consideration for the parcel to be conveyed by the secretary. The section would also require that the value of the housing and real estate to be acquired by the secretary be of at least equal value to real estate being conveyed, and would restrict the use of the land conveyed by the secretary to the generation of electric power.

Section 2832--Boundary Adjustments, Marine Corps Base, Quantico, and Prince William Forest Park, Virginia

This section would authorize the Secretary of the Interior and the Secretary of the Navy to adjust the boundaries of Marine Corps Base, Quantico, Virginia, and Prince William Forest Park, Virginia. The boundary adjustment will require the Secretary of the Navy to transfer approximately 352 acres of land to the administrative jurisdiction of the Secretary of the Interior, and will require the Secretary of the Interior to transfer approximately 3,400 acres of land to the administrative jurisdiction of the Secretary of the Navy.

Part III--Air Force Conveyances

Section 2841--Land Conveyance, Wendover Air Force Base Auxiliary Field, Nevada

This section would authorize the Secretary of the Interior and the Secretary of the Air Force to convey certain parcels of

real property at Wendover Air Force Base Auxiliary Field, Nevada, to the City of West Wendover, Nevada, and Tooele County, Utah, without consideration, for the purpose of establishing a runway protection zone and the development of an industrial park.

Subtitle D--Other Matters

Section 2861--Easement for Construction of Roads or Highways, Marine Corps Base, Camp Pendleton, California

This section would amend section 2867 of the Military Construction Authorization Act for Fiscal Year 2002 (division B of Public Law 107-107) to clarify that any state law that would restrict the construction of the proposed road through Camp Pendleton, California, has no effect on the authority of the Secretary of the Navy to grant the easement or on the Transportation Corridor Agency to construct and operate the road.

Section 2862--Sale of Excess Treated Water and Wastewater Treatment Capacity, Marine Corps Base, Camp Lejeune, North Carolina

This section would permit the Secretary of the Navy to enter into an agreement that would allow Camp Lejeune, North Carolina, to provide treated water and wastewater treatment services to Onslow County, North Carolina, if the secretary determines that such an agreement is in the public interest and will not interfere with current or future utility needs at Camp Lejeune. The section would also require the county to reimburse the Navy for the fair market value of the services provided and specify that any amounts paid would be credited to the base operations and maintenance accounts of Camp Lejeune.

Section 2863--Ratification of Agreement Regarding Adak Naval Complex, Alaska, and Related Land Conveyances

This section would ratify an agreement made by the Secretary of the Interior, the Secretary of the Navy, and the Aleut Corporation in September 2000 concerning the reuse of the Adak Naval Complex, Alaska, and other related land conveyances. The agreement would provide that real estate on Adak Island withdrawn for use by the Secretary of the Navy may be transferred to the Aleut Corporation without regard to the requirements of section 1621 of title 42, United States Code, pertaining to lands in the Alaska Maritime National Wildlife Refuge. In return, the Aleut Corporation would agree to transfer to the Secretary of the Interior at least 36,000 acres of land suitable for inclusion in the Alaska Maritime National Wildlife Refuge. The committee believes that this agreement promotes the public interest by equitably preserving wildlife habitat and allowing the Secretary of the Navy to divest of unneeded real property.

Section 2864--Special Requirements for Adding Military Installations to Closure List

This section would amend section 3003 of the Military Construction Authorization Act for Fiscal Year 2002 (division B

of Public Law 107-107) to require that the base closure commission vote unanimously to add an installation to the list of bases being considered for closure and that at least two commissioners must visit any base ultimately recommended for closure.

DIVISION C--DEPARTMENT OF ENERGY NATIONAL SECURITY AUTHORIZATIONS AND OTHER AUTHORIZATIONS

TITLE XXXI--DEPARTMENT OF ENERGY NATIONAL SECURITY PROGRAMS

OVERVIEW

The budget request contained $15,434.0 million for the national security activities of the Department of Energy for fiscal year 2003. Of this amount, $8,038.7 million is for the programs of the National Nuclear Security Administration and $7,395.2 million is for environmental and other defense activities. The committee recommends $15,400.9 million, the amount requested less $33.1 million for retirement accrual, representing an increase of $1,324.2 million from the amount authorized for fiscal year 2002. The following table summarizes the budget request and the committee recommendations.
<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

ITEM OF SPECIAL INTEREST

Full Funding for Retiree Costs in the Fiscal Year 2003 Budget Request

The Administration proposed legislation to require agencies, beginning in fiscal year 2003, to pay the full government share of the accruing cost of retirement for current Civil Service Retirement System (CSRS) employees and to pay the full accruing cost of postretirement health benefits for current civilian employees who are enrolled in the Federal Employees Health Benefits Program (FEHB). At the present time, agencies pay about half of the employer's share for accruing benefits, and the remainder is covered by a mandatory general fund payment. The Administration's proposed change would require specific legislation to move the full government share to each agency's budget.

The committee understands that the appropriate committee with jurisdiction to initiate this change has declined to consider the required legislation and, therefore, recommends continuing the current practice of funding these benefits. The fiscal year 2003 budget request for the atomic energy defense activities of the Department of Energy (DOE) includes $33.1 million to fund this proposed change in the CSRS and the FEHB program. The following represents the total budget request for funding for CSRS and FEHB that has not been included in the committee's recommendation for the atomic energy defense activities of the Department of Energy:

Program	
National Nuclear Security Administration:dollars]	
Weapons Activities--Secure Transportation Asset program direction	2,379
Naval Reactors--program direction	1,230

Office of the Administrator	11,776
Environmental Management: Defense Environmental Restoration and Waste Management--program direction	14,227
Other Defense Activities:	
Office of Security--program direction	1,703
Intelligence	313
Counterintelligence	128
Independent oversight and performance assurance	185
Environmental, Safety and Health--program direction	869
Worker and community transition--program direction	91
Office of Hearings and Appeals	203
Total	33,104

National Nuclear Security Administration

Overview

The budget request contained $8,038.7 million for the National Nuclear Security Administration (NNSA) for fiscal year 2003. The committee recommends $8,034.3 million, representing an increase of $913.3 million from the amount authorized for fiscal year 2002.

Items of Special Interest

Adjustments to the budget request

The committee recommends $8,034.3 million for the National Nuclear Security Administration (NNSA), including reductions for retirement accrual, and makes adjustments to individual programs.

The budget request contained a record $5,869.4 million for Weapons Activities, including $1,234.5 million for directed stockpile work. The committee remains concerned that NNSA nuclear weapon life extension program goals are not properly matched to Department of Defense needs, as evidenced by life extension and modernization activities for the weapon systems, and the delivery vehicles designed to carry those warheads and bombs.

The budget request contained a record $1,113.6 million for Defense Nuclear Nonproliferation programs. The committee remains concerned that, as evidenced by a pattern of high unobligated balances, many international cooperative programs have been funded at a rate in excess of what the programs can effectively absorb.

Reductions

The budget request contained $14.6 million for international nuclear safety programs. The committee recommends $11.6 million, a reduction of $3.0 million. The committee cautions that other federal and international entities already have nuclear safety as a primary mission.

The budget request contained $49.3 million for the elimination of weapons-grade plutonium production program. The committee recommends $19.3 million, a reduction of $30.0 million. The committee notes that this program is being

transferred from the Department of Defense's Cooperative Threat Reduction program, with $57.8 million in unobligated balances. The committee believes that NNSA's request for an additional $49.3 million in fiscal year 2003 is excessive, especially given that the Administration has no detailed plan for execution of the program, or even a formal agreement with the Russian Federation with regard to cost sharing and shut down of the reactors at Seversk and Zheleznogorsk.

The budget request contained $98.0 million for Russian surplus fissile materials disposition. The committee recommends $88.0 million, a reduction of $10.0 million specifically to program support and oversight in the United States. The committee notes that the budget request more than doubles funds for these activities in fiscal year 2003 to over one-third of the request for the program. The committee has cautioned NNSA in the past regarding excessive levies on international programs.

The budget request, less retirement accrual, contained $335.9 million for the Office of the Administrator. The committee recommends $315.9 million, a reduction of $20.0 million to hold this appropriation account to the comparable fiscal year 2002 level. The committee expects economies to result from the organizational streamlining and management efficiencies that Congress in large part created NNSA to effect.

Increases

The budget request contained $949.9 million in Readiness in Technical Base and Facilities for operations of facilities. The committee recommends $994.9 million, an increase of $45.0 million. The committee is aware of the poor condition of weapons complex infrastructure, particularly at the production plants, and the continuing need to address maintenance backlogs. The committee recommends $25.0 million for infrastructure maintenance and mission essential upgrades and replacements at the Pantex Plant. The committee recommends an additional $20.0 million for repairs of facilities and priority upgrades at the Y-12 Plant.

The budget request contained $451.8 million for the high energy density physics (HEDP) campaign, including $237.7 million for operations and maintenance, and $214.0 million for National Ignition Facility construction. The committee recommends $262.7 million, an increase of $25.0 million, for HEDP campaign operations and maintenance. The HEDP campaign comprises experimental programs directed towards developing data on the properties and behavior of matter under extreme conditions of temperature and pressure, and is critical to gaining a scientific understanding of how nuclear weapons work. Data developed in HEDP programs are used to validate computer simulations, which in turn are used to assess weapon characteristics, and excursions from nominal performance. In particular, the committee is concerned by reductions and terminations in the budget request of high technical quality programs such as the high average power laser program and the petawatt initiative.

The budget request contained $194.0 million for U.S. surplus materials disposition programs. The committee recommends $198.0 million, an increase of $4.0 million to investigate alternative technologies and fuel cycles for disposition of weapons grade plutonium excess to defense needs. The committee understands that the Administration has selected

fabrication of mixed oxide fuel (MOX) for consumption in commercial power reactors as its baseline approach. However, the committee is aware that, in the longer term, other approaches such as fuel cycles based on thorium could offer significant advantages in terms of proliferation resistance and efficiency of plutonium consumption. The committee encourages NNSA to work with both the private sector and the Russian Federation to assess the technical feasibility and economic viability of thorium-based fuel cycles.

Federal workforce restructuring

A number of independent assessments have described federal management of the nuclear weapons complex as burdened by excessive, and in some cases duplicative, staffing.

In its 1999 Report on Security Problems at the U.S. Department of Energy, the President's Foreign Intelligence Advisory Board (PFIAB) described a management structure comprising ``layer upon layer of bureaucracy'' that made it nearly impossible toassign responsibility or accountability. The PFIAB singled out for special comment the field offices, which have been described as redundant ``shadow headquarters,'' pressing their own agendas and priorities, concluding that the weapons labs reported to ``far too many DOE masters''. The PFIAB report was highly instrumental in triggering Congress to pass in 1999 the National Nuclear Security Administration Act, title XXXII of the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65), leading to establishment of a semi-autonomous agency within the Department to manage the weapons complex.

In its report NNSA Management: Progress in the Implementation of Title 32 dated December 12, 2001, GAO noted that longstanding issues of organizational roles and responsibilities remained unaddressed in a substantive way, and that NNSA reform efforts appeared to be losing momentum in some areas.

In its FY 2001 Report to Congress of the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile of March 15, 2002, the Panel emphasized a continuing need to reduce duplicative and non-value added management practices, and correspondingly to implement significant reductions in NNSA staff. The Panel recommended that this smaller government organization focus on oversight and policy responsibilities, and ``restore management responsibility, authority and accountability to the laboratory directors and plant managers for meeting requirements, standards, timelines, and budgets''.

The committee concurs with these assessments. While NNSA's Report to Congress on the Organization and Operations of the National Nuclear Security Administration of February 25, 2002 appears to anticipate that ``streamlined processes and redefined roles'' will lead to a ``significant reduction'' in federal staff, the report provides no specifics on the size of the reductions or the timeline over which they will occur. In the meantime, the committee notes that justification materials submitted with the budget request show that federal staffing levels at NNSA have actually grown since fiscal year 2001. The committee strongly urges the Administrator to move forward decisively and expeditiously with a restructuring of the NNSA federal workforce, and start NNSA on the path to realizing the organizational streamlining and management efficiencies

Congress intended in passing the NNSA Act in 1999.

Foster Panel Assessment of NNSA Reform Efforts

The last underground test of a nuclear weapon at the Nevada Test Site occurred a decade ago. Since that time the United States has observed a moratorium on testing, relying instead on a science-based stewardship program to certify the continued viability of the nation's nuclear stockpile. Concerns regarding the efficacy of this approach led Congress in 1998 to establish a panel to assess the process for certifying the safety, reliability and performance of nuclear weapons in the absence of testing. Section 3159 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (Public Law 105-261) established the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile (commonly know as the Foster Panel after its chairman, Dr. John S. Foster). The Panel, established for a period of three years, has consistently noted in its annual reports ``* * * the disturbing gap between the nation's policy that maintaining a safe and reliable nuclear stockpile is a supreme national interest and the actions taken to support this policy''. The committee has benefited greatly from the Panel's independent assessments, and expresses its appreciation for the contributions to national security of its members.

In 1999, Congress fundamentally restructured how the Department of Energy manages defense nuclear activities. Title 32 of the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65), the National Nuclear Security Administration Act, established a semi-autonomous NNSA within DOE. In passing the Act, Congress intended to address significant and long-standing problems relating to DOE's management of defense nuclear programs by establishing an organization that would be responsible for, and accountable for, management of the nation's nuclear stockpile and related programs. NNSA was statutorily established over two years ago, on March 1, 2000. The committee has been fortunate that the Panel's tenure has included the first two years of NNSA's organizational life.

In standing up and staffing a new organization, Congress has provided a rare opportunity to address the difficult and important problems that have confounded efforts to properly manage the nation's nuclear stockpile. On March 15, 2002, the Foster Panel submitted its fiscal year 2001 report to Congress--Expectations for the U.S. Nuclear Stockpile Stewardship Program. In it, the Panel notes that some progress has been made. However, the report also states:

> There remains an urgent need for NNSA to address the fundamental problems that Congress created it to correct. The start-up phase is now over. If NNSA cannot within the current year achieve the autonomy and provide the leadership Congress intended, it is appropriate for Congress to revisit other options for managing the nuclear weapons program.

The committee concurs with this assessment.

The committee regards the current year as a watershed, during which NNSA's organizational and management reform efforts are likely to succeed or fail. Because of the value the

committee places on independent assessment, and the critical need for attaining a functional nuclear weapons complex, the committee, in Section 3141, extends the termination date of the Panel to April 1, 2003.

Pit Manufacturing and Certification Campaign

The budget request contained $194.5 million for plutonium pit manufacturing and certification programs. The committee recommends the budget request.

The United States remains the only nuclear power without the ability to produce all the components of a nuclear weapon. In particular, the United States has not produced a plutonium pit, a critical weapon component, since manufacturing operations ceased at Rocky Flats in 1989. The goal of the manufacturing campaign is to produce a certifiable W88 pit in fiscal year 2003, and establish a limited production capability of 10 pits per year at Los Alamos National Laboratory by 2007. The National Nuclear Security Administration intends to be able to certify a W88 pit without underground testing by fiscal year 2009, with a goal of sooner achieving this capability in 2007.

The campaign as described above is designed to meet a limited need for W88 surveillance pits for destructive evaluation purposes. Ultimately the nation will require the ability to produce replacement pits at a far higher rate in order to meet the needs of the enduring stockpile. While the effects of aging, and consequently the lifetime of pits, are not known with certainty, and international agreements may further affect requirements for new pits, the committee believes that prudence dictates a need to proceed immediately, with preliminary steps to re-establish a large scale pit production facility, especially given that site selection and permitting will likely entail an extended process. The committee is somewhat concerned that the budget request of $2.0 million for design of a modern pit facility, half that appropriated in fiscal year 2004, is not commensurate with the seriousness of the need.

Robust nuclear earth penetrator

The committee understands that the NNSA intends to reprogram $7.0 million of fiscal year 2002 funds, and requests $15.0 million in fiscal year 2003, to begin formal design studies for a robust nuclear earth penetrator (RNEP). The 6.2/6.2a design study has been approved by the Nuclear Weapons Council with a cost to completion of $46.0 million, and will involve repackaging of an existing stockpile warhead. The committee understands that RNEP is not a new design, is not a low yield ``mini nuke'', and is not ``clean'' in the sense that fallout and collateral damage can be contained. Consequently the committee does not believe that RNEP represents a significant departure from current stockpile weapons. The committee expects to be informed of any changes to the parameters of this study.

Stockpile certification

In 1995 the President established a requirement for annual certification of the nuclear stockpile. The committee believes this annual certification, including an assessment of the need

to resume underground tests, provides a valuable measure of the health of the nation's strategic deterrent. In section 3144, the committee has taken action to strengthen this certification process by requiring an assessment of other factors that have strong bearing on the certification process, including the adequacy of the tools and methods on which those certifications are based, and the ability of the weapons complex infrastructure to detect and resolve problems in the stockpile. The committee has also taken measures to strengthen peer review in the certification process.

Test readiness

The President has stated that resumption of underground nuclear testing is not required at this time, and the Administration continues to observe the moratorium on nuclear testing. As reflected in justification materials submitted to Congress in support of the President's fiscal year 2003 budget request, the policy of the NNSA is to be capable of resuming underground testing within two to three years, should the President determine that such tests are necessary. The NNSA Administrator has stated that the current test readiness posture of the weapons complex is closer to three years.

The most recent Nuclear Posture Review, submitted to Congress by the Department of Defense on January 8, 2002, supports reduction of the Department of Energy's test readiness lead-time.

In its fiscal year 2001 report to Congress submitted on March 15, 2002, the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile recommends a test readiness of 3 months to a year depending on the type of test. The Panel notes that the test ``pedigree'' of existing weapons is deteriorating with time, and that prudence dictates that the President should have a ``realistic option'' to resume nuclear testing if technical or political events so require.

The committee concurs with these recommendations. The committee believes that test readiness could be greatly enhanced by, among other actions, planning for specific tests, conducting site preparation activities, laying in diagnostics, and maintaining test articles at the Nevada Test Site. Section 3145 requires the Secretary of Energy, in consultation with the NNSA Administrator, to develop and report to Congress on a plan and budget to achieve a one-year readiness posture within one year of a decision to do so.

Tritium readiness campaign

The budget request contained $126.3 million for the tritium readiness campaign. The committee recommends the budget request.

Tritium is a perishable radioactive element that is essential to the proper functioning of stockpile weapons, and consequently must periodically be replaced. The United States has not had the capability to produce tritium since 1988, and has relied on reserves, and tritium recovered and recycled from dismantled weapons, to maintain the stockpile. The committee understands that the tritium readiness campaign is on schedule to begin irradiation of tritium producing bars in commercial light water reactors at Watts Bar and Sequoyah in fiscal year 2003, and to begin production extraction for the stockpile in

fiscal year 2006 at the Savannah River Site. The committee urges the National Nuclear Security Administration to continue to maintain the schedule for this critical project.

Environmental and Other Defense Activities

Overview

The budget request contained $7,395.2 million for environmental and other defense activities for fiscal year 2003. The committee recommends $7,366.5 million, including reductions for retirement accrual, representing an increase of $410.9 million from the amount authorized for fiscal year 2002.

Items of Special Interest

Adjustments to the Budget Request

The budget request, less retirement accrual, contained $99.0 million for Other Defense Activities environment, safety, and health (ES&H) programs. The committee recommends $94.0 million, a reduction of $5.0 million. The committee notes that the budget had increased in recent years to accommodate administrative functions associated with assessment and compensation programs that should present a relatively short term increase in funding requirements, and that other worker health studies should be nearing completion.

The budget request, less retirement accrual, contained $25.7 million for Other Defense Activities worker and community transition programs. The committee recommends $19.7, a reduction of $6.0 million to hold these programs to fiscal year 2002 levels.

Environmental management cleanup reform program

The budget request contained $800.0 million to establish a new environmental management cleanup reform program. This new program is designed to provide the vehicle for implementing the recommendations of the Department of Energy's recently completed ``top to bottom review'' of its environmental management programs (EM). As structured today, this review concluded that the EM program now has a life cycle cost of $220 billion and, that without significant change in business processes, the cost estimate could easily increase to more than $300 billion. In fact only about one-third of the EM program budget is going toward actual cleanup and risk reduction work. The remainder is spent on maintenance, fixed costs, and other activities required to support safety and security. Not only have the dollar estimates proven to be overly optimistic, the schedule estimates have followed a similar path. Numerous sites are already unable to meet their commitments as outlined in an earlier 1998 Departmental report. Moreover, the three largest sites--Savannah River, Idaho National Engineering and Environmental Laboratory, and Hanford--have such long term completion dates (2038, 2050, and 2070, respectively) that the estimates for cost and schedule are highly uncertain and subject to change. The reality of an extended cleanup schedule is that eventually it could lead to more prolonged and

potentially severe public health and environmental risks.

With these facts not in dispute, it was critical for the Department to seek alternative cleanup approaches that would be designed to produce more real risk reduction, accelerated cleanup, and cost and schedule improvements. This new program is established for the purpose of meeting these goals. Evidence does suggest that a program can be turned around if a site can adopt an approach similar to that taken at Rocky Flats, Colorado. By adopting a risk based management approach, combined with a clear mission, a culture of urgency, and a performance based contract, the cleanup at Rocky Flats is now scheduled to be completed 50 years ahead of schedule and $30 billion below the original baseline. The goal of the new program is in essence to take the successes at Rocky Flats and apply those principles complex-wide.

Under this new cleanup reform program it is contemplated that the Department will work with the States and federal regulators with a goal of reaching an agreement on an accelerated and risk-based cleanup--a cleanup that eliminates unneeded activities. Once an agreement or ``site performance management plan'' is reached and a new cost savings and funding profile is established for the acceleration or alternate cleanup strategy, funds will be made available from the EM Cleanup Reform account to fund or supplement existing funding of a site's base budget. The committee expects that the site's entire budget for cleanup will be used for activities addressed and agreed to in the site performance management plan. Finally, this new program is designed to ensure that constant or greater funding levels are available to those States whose cooperative efforts lead to greater and faster risk reduction. In that regard, the committee understands that the Department has been in initial discussions with state officials representing the sites most affected by this new program. As a result of these discussions, the committee has been advised that a ``letter of intent'' has been signed with the State of Washington to accelerate cleanup at that state's Hanford site. The agreement proposes an allocation of approximately $433.0 million from this new cleanup reform account. This agreement, if and when it is fully implemented, would accelerate cleanup by 35-45 years and result in cost savings of $33 billion over the current projected costs. The committee understands that negotiations with the State of South Carolina are moving rapidly toward a similar agreement. The committee understands that this agreement, if finalized, will result in a substantial monetary increase above the site's base budget for fiscal year 2003 of $961.1 million and at the same time result in an accelerated cleanup and risk reduction. The committee is encouraged by these efforts and urges other sites to develop proposals for an accelerated and risk-based cleanup.

LEGISLATIVE PROVISIONS

Subtitle A--National Security Programs Authorizations

Section 3101--National Nuclear Security Administration

This section would authorize funds for the National Nuclear Security Administration for fiscal year 2003, including funds

for weapons activities, defense nuclear nonproliferation programs, naval reactors programs, and the Office of the Administrator.

Section 3102--Environmental and Other Defense Activities

This section would authorize funds for environmental and other defense activities for fiscal year 2003, including funds for defense environmental restoration and waste management, defense environmental management cleanup reform, defense facilities closure projects, defense environmental management privatization, other defense activities, and defense nuclear waste disposal.

Subtitle B--Department of Energy National Security Authorizations General Provisions

Section 3120--Short Title; Definitions

This section would designate this subtitle as the ``Department of Energy National Security Authorizations General Provisions Act''. This Act will make permanent lawcertain recurring provisions governing the use of funds authorized for national security programs of the Department of Energy. This section would also define the terms ``DOE national security authorization'', ``congressional defense committee'', and the term ``minor construction project''.

Section 3121--Reprogramming

This section would prohibit the reprogramming of funds in excess of the amount authorized for the program until the Secretary of Energy has notified the congressional defense committees and a period of 30 days has elapsed after the date on which the notification is received.

Section 3122--Minor Construction Projects

This section would limit the initiation of a minor construction project if the current estimated cost for the project exceeds $5.0 million, and would require the Secretary of Energy to notify the congressional defense committees in the event the estimated cost of any project exceeds $5.0 million and the reasons for the cost variation.

Section 3123--Limits on Construction Projects

This section would permit the initiation and continuation of any construction project only if the estimated cost for the project does not exceed 125 percent of the higher of: (1) the amount authorized for the project; or (2) the most recent total estimated cost presented to Congress as justification for such project. To exceed this limit, the Secretary of Energy must report in detail the reason therefore to the congressional defense committees and the report must be before the committees for 30 legislative days. This section would also specify that the 125 percent limitation would not apply to projects estimated to cost under $5.0 million.

Section 3124--Fund Transfer Authority

This section would authorize the Secretary of Energy to transfer funds to other agencies of the government for performance of work for which funds were authorized and appropriated. The provision would permit the merger of such funds with the funds made available to the agency to which they are transferred.

Section 3125--Authority for Conceptual and Construction Design

This section would require the Secretary of Energy to certify that a conceptual design for a construction project has been completed prior to requesting funding for that project, except in the case of emergencies.

Section 3126--Authority for Emergency Planning, Design, and Construction Activities

This section would authorize the Secretary of Energy to perform planning and design for construction activities utilizing available funds for any Department of Energy national security program whenever the Secretary determines that the design must proceed expeditiously to protect the public health and safety, to meet the needs of national defense, or to protect property.

Section 3127--Funds Available for all National Security Programs of the Department of Energy

This section would authorize, subject to section 3121 of this act, amounts appropriated for management and support activities and for general plant projects to be made available for use in connection with all national security programs of the Department of Energy.

Section 3128--Availability of Funds

This section would allow funds authorized for atomic energy activities of the Department of Energy to remain available until expended, except for amounts appropriated for the National Nuclear Security Administration pursuant to a DOE national security authorization. Amounts appropriated for the Office of the Administrator for Nuclear Security will remain available until the end of that fiscal year and all other amounts appropriated to the National Nuclear Security Administration will remain available for a total of three fiscal years.

Section 3129--Transfer of Defense Environmental Management Funds

This section would provide the manager of each field office of the Department of Energy with limited authority to transfer defense environmental management funds from a program or project under the jurisdiction of the office to another such program or project.

Section 3130--Transfer of Weapons Activities Funds

This section would provide the manager of each field office

of the Department of Energy with limited authority to transfer weapons activities funds from a program or project under the jurisdiction of the office to another such program or project.

Section 3131--Scope of Authority to Carry Out Plant Projects

This section would clarify that the authority of the Secretary of Energy to carry out plant projects includes authority for maintenance, restoration, planning, construction, acquisition, modification of facilities, and continuation of projects authorized in prior years, and related land acquisition.

Subtitle C--Program Authorizations, Restrictions, and Limitations

Section 3141--One-year Extension of Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile

This section would extend the statutory termination date of the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile (also known as the Foster Panel) to April 1, 2003. The section would also require an additional report from the Panel on February 1, 2003.

Section 3142--Transfer to National Nuclear Security Administration of the Department of Defense's Cooperative Threat Reduction Program Relating to Elimination of Weapons Grade Plutonium in Russia

This section would transfer the Cooperative Threat Reduction program relating to elimination of weapons grade plutonium production in Russia from the Department of Defense (DOD) to the National Nuclear Security Administration (NNSA) of the Department of Energy. The section would transfer specified assets of the program to the NNSA, including any unexpended balances of appropriations. The provision would not remove program limitations or restrictions, including the period of availability of funds for obligation. The section would also transfer responsibility for obligations under federal law from officers of DOD to those of NNSA.

Section 3143--Repeal of Requirement for Reports on Obligations of Funds for Programs on Fissile Materials in Russia

This section repeals a duplicative reporting requirement related to programs to improve the protection, control, and accountability of fissile materials in Russia.

Section 3144--Annual Certification to the President and Congress on the Condition of the United States Nuclear Weapons Stockpile

This section would require an annual certification to the President and Congress on the safety, reliability, and performance of each nuclear weapon type in the active stockpile of the United States. The certifications would be required from the directors of the National Laboratories and the commander of United States Strategic Command for each weapon type for which they are responsible. The section would also require a report from the aforementioned on other matters related to the certifications, including an assessment of the need for the

United States to resume underground nuclear testing, and would require the National Laboratory directors to use certain ``red team'' procedures for the certification process. The section would require the submission of the certifications and reports to the Secretaries of Defense and Energy, as appropriate, by January 15th of each year, and would require that the Secretaries forward the certifications and reports unchanged to the President and Congress not later than February 1st of each year.

Section 3145--Plan for Achieving One-Year Readiness for Resumption by the United States of Underground Nuclear Weapons Tests

This section would require the Secretary of Energy to submit to Congress with the fiscal year 2004 budget request a report on a plan and a budget to enhance underground nuclear test readiness. The report would detail the plan and budget required to achieve a one-year readiness posture for resumption of underground nuclear weapons tests. A one-year readiness posture is the capability of the Department of Energy to resume underground tests not later than one year after so directed by the President, should the President determine that such tests are necessary. The provision would require that the plan and budget provide for attainment of a one-year readiness posture within one year of a decision to execute the plan.

Subtitle D--Provisions Relating to Defense Environmental Management

Section 3151--Defense Environmental Management Cleanup Reform Program

This section would require the Secretary of Energy to carry out a program to reform the Department's environmental management activities using the funds authorized in section 3102(a)(2) of this act. The Secretary would be authorized to transfer funds to each site upon the execution of a site performance management plan and upon its submission to the congressional defense committees. The site performance management plan for a site is defined as a plan, agreed to by the applicable federal and state agencies with regulatory jurisdiction with respect to the site, that provides for the performance of activities that will accelerate the reduction of environmental risk and will also accelerate the environmental cleanup at the site. Upon the transfer and merger of the funds, all funds in the merged account are available only to carry out the site performance management plan at the site.

Section 3152--Report on Status of Environmental Management Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War

This section would require the Secretary of Energy to prepare a report on the status of the management initiatives recommended in the Department's report entitled ``Top-to-Bottom Review of the Environmental Management Program'' and dated February 4, 2002. Specifically, this report is to address the progress being made in streamlining risk reduction processes, contract management, acquisition strategy, and consolidation of special nuclear materials. This section would require the report to be submitted to the congressional defense committees

with the submission of the Department's budget justification materials for fiscal year 2004.

TITLE XXXII--DEFENSE NUCLEAR FACILITIES SAFETY BOARD

ITEM OF SPECIAL INTEREST

Full Funding for Retiree Costs in the Fiscal Year 2003 Budget Request

The Administration proposed legislation to require agencies, beginning in fiscal year 2003, to pay the full government share of the accruing cost of retirement for current Civil Service Retirement System (CSRS) employees and to pay the full accruing cost of post-retirement health benefits for current civilian employees who are enrolled in the Federal Employees Health Benefits Program (FEHB). At the present time, agencies pay about half of the employer's share for accruing benefits, and the remainder is covered by a mandatory general fund payment. The Administration's proposed change would require specific legislation to move the full government share to each agency's budget. The committee understands that the appropriate committee with jurisdiction to initiate this change has declined to consider the required legislation and, therefore, recommends continuing the current practice of funding these benefits. The fiscal year 2003 budget request for the Defense Nuclear Facilities Safety Board includes $0.5 million to fund this proposed change in the CSRS and the FEHB program. The committee recommendation does not include this amount.

LEGISLATIVE PROVISIONS

Section 3201--Authorization

This section would authorize $19.0 million for the Defense Nuclear Facilities Safety Board for fiscal year 2003.

TITLE XXXIII--NATIONAL DEFENSE STOCKPILE

LEGISLATIVE PROVISIONS

Section 3301--Authorized Uses Of Stockpile Funds

This section would authorize $76.4 million from the National Defense Stockpile Transaction Fund for the operation and maintenance of the National Defense Stockpile for fiscal year 2003. The provision would also permit the use of additional funds for extraordinary or emergency conditions 45 days after a notification to Congress.

TITLE XXXIV--NAVAL PETROLEUM RESERVES

LEGISLATIVE PROVISIONS

Section 3401--Authorization of Appropriations

This section would authorize $21.1 million for fiscal year 2003 for the operation of the Naval Petroleum and Oil Shale Reserves.

TITLE XXXV--MARITIME ADMINISTRATION

ITEMS OF SPECIAL INTEREST

Full Funding for Retiree Costs in the Fiscal Year 2003 Budget

The Administration proposed legislation to require agencies, beginning in fiscal year 2003, to pay the full Government share of the accruing cost of retirement for current Civil Service Retirement System (CSRS) employees and to pay the full accruing cost of post-retirement health benefits for current civilian employees who are enrolled in the Federal Employees Health Benefits Program (FEHB). At the present time, agencies pay about half of the employer's share for accruing benefits, and the remainder is covered by a mandatory general fund payment. The Administration's proposed change would require specific legislation to move the full Government share to each agency's budget.

The committee understands that the appropriate committee with jurisdiction to initiate this change has declined to consider the required legislation and, therefore, recommends continuing the current practice of funding these benefits. The fiscal year 2003 budget request included $4.4 million dollars for the Maritime Administration to fund this proposed change in the CSRS and the FEHB program. The following represents the total budget request for funding for CSRS and FEHB that has not been included in the committee's recommendation for the Maritime Administration.

[In thousands of dollars]

Operations and Training	4,089
Title XI Administrative Expenses	356
Total	4,445

Blanket Approval of Vessel Time Charters

Section 9 of the Shipping Act, 1916, (46 App. United States Code 808), requires prior approval of the Secretary Transportation of vessel charters to persons who are not U.S. citizens. In 1992, the Maritime Administration, which is charged with responsibility for administering section 9, issued regulations that granted ``blanket'' prior approval of time charters and other forms of temporary use agreements to persons who are not U.S. citizens. The committee urges the Maritime Administration to review this policy, as implemented by this regulation, to determine whether changes should be made in light of recent concerns over the security in our nation's ports. The committee expects to receive a report on the Maritime Administration's findings and any recommendations for legislative changes, by November 1, 2002.

Financial Assistance to States to Prepare Vessels for Use as Artificial Fish Reefs

The budget request contained $11.1 million for the disposal of four vessels from the National Defense Reserve Fleet. The committee recommends $20.0 million, an increase of $8.9 million above the budget request for disposal of obsolete vesselsincluding assistance to states. The National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398) required the Maritime Administration to dispose of all vessels in the National Defense Fleet that are not otherwise assigned to the Ready Reserve Force or otherwise designated for a specific purpose by September 30, 2006. The cost to accomplish this goal will likely exceed $350.0 million based on current estimates. While scrapping of certain vessels is the only method of disposal, there also appears to be a substantial demand for use of a number of these obsolete vessels as artificial fishing reefs.

While the Maritime Administration's artificial reef program was established in 1972, it has not been utilized to the extent possible since the individual states that take title to these vessels must pay for the cost of moving the vessel to the location for sinking, pay for the cost of removal of oil and other hazardous substances, and pay for the cost of sinking the vessel. In order to make this program more appealing to the states and to help offset the cost of reefing a vessel, the committee has established a new program which will allow the Secretary of Transportation, acting through the Maritime Administrator, to provide financial assistance to a state to prepare the vessel for use as an artificial reef. This assistance will include the cost of environmental remediation, towing, and sinking. The committee has not set a specific amount of assistance that can be awarded to a state but rather allows the Maritime Administrator to consider a number of elements including the total amount of funding available in the program. The committee understands that it may be substantially less expensive to sink a vessel for use as a reef than paying for the scrapping of the vessel.

The committee recognizes that the process of obtaining approval to sink a vessel as an artificial reef involves the coordination with various agencies of government, including the U.S. Army Corps of Engineers, the United States Coast Guard, and the United States Environmental Protection Agency, however this new program of financial assistance is intended to remove at least one obstacle in the system. While nothing in this section alters or removes any current environmental requirements, the committee urges the responsible agencies to work together to establish national standards for the cleaning of hazardous materials from ships prior to their sinking as artificial reefs. The committee understands that it typically takes nine months for a state to complete the federal agency coordination. The committee expects that the financial assistance provided in this act, coupled with a uniform national standard, can result in a cost effective and environmentally responsible partial alternative to traditional vessel disposal techniques.

Loan Guarantee Program

The budget request, excluding the accrued agency costs of Civil Service Retirement and Federal Health benefits, contained

$4.1 million to fund administrative expense associated with the management of the title XI loan guarantee program. The budget request contained no funds for costs, as defined in section 502 of the Federal Credit Reform Act of 1990 (Public Law 93-344). The committee recommends $54.1 million for the title XI program, an increase of $50 million above the budget request.

Marketing Efforts to Reduce Potential Losses

The committee is concerned with the recent defaults that have occurred in the title XI loan guarantee programs as a result of the bankruptcy filing by American Classic Voyages and the potential costs of these defaults on the United States Treasury. Although the recent defaults occurred for a variety of reasons, including the downturn in the economy and the events of September 11, 2001, the committee is also concerned that the Maritime Administration may be moving ahead too quickly in its efforts to dispose of the assets which it has or will receive as a result of the bankruptcy filing. It was indeed unfortunate that two of the ships in question were partially completed at the time of the filing; however, the committee is of the opinion that the Maritime Administration should use every effort possible to avoid scrapping these ships. In that regard, the committee strongly urges the Maritime Administration to explore options that will allow these ships to be completed as originally designed, including an aggressive marketing effort to find a new buyer. The committee likewise urges the shipyard where these partially completed ships are located to join in that effort. The committee believes that completion of these ships offers the best long-term opportunity for reducing the ultimate cost to the title XI program. In that regard, the committee expects to be advised on a regular basis of the progress being made in securing a suitable buyer for these ships.

LEGISLATIVE PROVISIONS

Section 3501--Authorization of Appropriations for Fiscal Year 2003

This section would authorize a total of $167.3 million for fiscal year 2003, an increase of $54.4 million above the budget request for the Maritime Administration. Of the funds authorized, $93.1 million would be for operations and training programs, $50.0 million would be for the costs as defined in section 502 of the Federal Credit Reform Act of 1990 (Public Law 93-344), of loan guarantees authorized by title XI of the Merchant Marine Act, 1936, as amended, (46 App. United States Code 1271 et seq.), $4.1 million would be for administrative expenses related to providing these loan guarantees, and $20.0 million would be for the disposal of obsolete ships in the National Defense Reserve Fleet.

Section 3502--Authorization to Transfer the USS Sphinx

This section would authorize the Secretary of Transportation to convey the vessel USS SPHINX to the Dunkirk Historical Lighthouse and Veterans Park Museum for use as a military museum.

Section 3503--Financial Assistance to States for Preparation of Obsolete Vessels for Use as Artificial Reefs

This section will allow the Secretary of Transportation to provide financial assistance to states to offset the cost of transferring the vessel to the state and preparing the vessel for use as an artificial reef. The specific amount of funding provided shall be based on the availability of funds, the benefit to the program, and the cost effectiveness compared to other ship disposal options.

Section 3504--Independent Analysis of Title XI Insurance Guarantee Applications

This section would grant authority to the Secretary to obtain an independent analysis of an application for a guarantee or commitment to guarantee under the Title XI program. It would also, subject to limits contained in current law, allow the Secretary to be reimbursed for the cost of this outside independent analysis.

DEPARTMENTAL DATA

The Department of Defense requested legislation, in accordance with the program of the President, as illustrated by the correspondence set out below:

DEPARTMENT OF DEFENSE AUTHORIZATION REQUEST

Department of Defense,
Office of General Counsel,
Washington, DC, April 19, 2002.

Hon. J. Dennis Hastert,
Speaker of the House of Representatives,
Washington, DC.

Dear Mr. Speaker: The Department of Defense proposes the enclosed draft legislation, ``To authorize appropriations for fiscal year 2003 for military activities of the Department of Defense, to prescribe military personnel strengths for fiscal year 2003, and for other purposes.''

This legislative proposal is part of the Department of Defense Legislative Program for the Second Session of the 107th Congress and is necessary to carry out the President's budget plans for fiscal year 2003. The Office of Management and Budget advises that there is no objection to the presentation of this proposal to the Congress, and that its enactment would be in accord with the program of the President.

Sincerely,

William J. Haynes II,
General Counsel.

Enclosures.

MILITARY CONSTRUCTION AUTHORIZATION REQUEST

Department of Defense,
Office of General Counsel,
Washington, DC, March 25, 2002.

Hon. J. Dennis Hastert,

Speaker of the House of Representatives,
Washington, DC.

Dear Mr. Speaker: The Department of Defense proposes the enclosed bill, Military Construction Authorizations, as part of its legislative program for the Second Session of the 107th Congress, and we urge its enactment.

The enclosed bill will authorize military construction and facility management for the military departments, the defense agencies, the North Atlantic Treaty Organization Security Investment program, and the National Guard and Reserve components. It will enhance our efforts to mitigate encroachment on and around our installations and facilities through both partnering with natural resource conservation organizations to purchase property and conveying surplus real property to conservation organizations. Revisions to the house privatization legislation will improve program execution and enable privatization of barracks. We also propose to purchase land near the Pentagon on Boundary Channel Drive in Arlington, Virginia, in order to build a new office building that meets anti-terrorism force protection standards and consolidates activities currently in leased space. Our proposed military construction legislation also includes legislation that will increase our freedom to manage and help us to achieve greater efficiency in our installation management.

The Office of Management and Budget advises that there is no objection, from the standpoint of the Administration's program, to the presentation of these initiatives for your consideration and the consideration of the Congress.

Sincerely,

William J. Haynes II,
General Counsel.

Enclosures.

COMMITTEE POSITION

On May 1, 2002 the Committee on Armed Services, a quorum being present, approved H.R. 4546, as amended, by a vote of 57-1.

COMMUNICATIONS FROM OTHER COMMITTEES

House of Representatives,
Committee of Resources,
Washington, DC, May 1, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: Thank you for contacting me with regard to several provisions within H.R. 4546, the Defense Authorization Act of 2003. Specifically, you requested to know the Resources Committee's recommended disposition with regard to:

Section 311--Incidental Taking of Migratory Birds During Military Readiness Activity

Section 312--Military Readiness and the Conservation of Protected Species

Section 601--Increase in Basic Pay

Section 602--Expansion of Basic Allowance for Housing

Section 614--One-Year Extension of Other Bonus and Special Pay Authorities
Section 615--Minimum Hardship Duty Pay for Antarctica and Artic Icepack
Section 631--Extension of Leave Travel Deferral Period
Section 641--Concurrent Receipt of Military Retired Pay and Veterans Disability
Section 2821--Land Conveyance, Lands in Alaska
Section 2832--Boundary Adjustments, Marine Corps Base, Quantico
Section 2841--Land Conveyances, Wendover Air Force Base Auxiliary Field, Nevada
Section 2863--Ratification of Agreement Regarding Adak Naval Complex, Alaska
Section 3503--Financial Assistance to States for Preparation of Transferred Obsolete Ships for Use as Artificial Reefs
Title XIV--Utah Test and Training Range

Because of the urgent need to bring this bill to the floor of the House in order to provide crucial support of our military, I am writing to inform you that I have reviewed theabove-referenced provisions and am in full support of their inclusion in H.R. 4546. Therefore, I will not seek a sequential referral of the bill. This action does not affect any future jurisdictional claims over these, or similar, provisions. In addition, I would request that the Committee on Resources be represented during any conference proceedings on all matters within its jurisdiction.

I recognize that our two committees have historically worked very closely together on matters of mutual interest, and I am pleased that I have had a hand in the drafting of several of these provisions. I also greatly appreciate the assistance and competence of your staff, and look forward to continuing to work with you to ensure that H.R. 4546 is enacted into law.

Sincerely yours,

James V. Hansen, Chairman.

House of Representatives,
Committee on Ways and Means,
Washington, DC, April 30, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: I am writing concerning H.R. 4546, the ``National Defense Authorization Act for Fiscal Year 2003,'' which is scheduled for action by your committee this week.

As you know, the Committee on Ways and Means has jurisdiction over matters concerning Medicare. Section 713 of the bill repeals the report requirement on the Medicare Subvention Demonstration Project. However, in order to expedite this legislation for floor consideration, we will not take action on this particular proposal. This is being done with the understanding that it does not in any way prejudice the Committee with respect to the appointment of conferees or its jurisdictional prerogatives on this or similar legislation.

I would appreciate your response to this letter, confirming this understanding with respect to H.R. 4546 and would ask that a copy of our exchange of letters on this matter be included in your committee report.

Best Regards,

Bill Thomas, Chairman.

House of Representatives,
Committee on Armed Services,
Washington, DC, May 1, 2002.

Hon. Bill Thomas,
Chairman, Committee on Ways and Means,
House of Representatives, Washington, DC.

Dear Mr. Chairman: Thank you for your letter of April 30, 2002 regarding H.R. 4546, the National Defense Authorization Act for Fiscal Year 2003.

I agree that the Committee on Ways and Means has valid jurisdictional claims to certain provisions in this important legislation, and I am most appreciative of your decision not to request such a referral in the interest of expediting consideration of the bill. I agree that by foregoing a sequential referral, the Committee on Ways and Means is not waiving its jurisdiction. Further, as you requested, this exchange of letters will be included in the Committee report on the bill.

Thank you for your cooperation in this matter.

Sincerely,

Bob Stump, Chairman.

House of Representatives,
Committee on Transportation and Infrastructure,
Washington, DC, May 2, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC

Dear Mr. Chairman: This letter concerns the jurisdictional interest of the Committee on Transportation and Infrastructure in H.R. 4546, the Department of Defense Authorization Act for Fiscal Year 2003.

H.R. 4546, as ordered reported by the Committee on Armed Services, contains many provisions over which the Committee on Transportation and Infrastructure has jurisdiction. These include all sections that affect the pay, benefits, and personnel of the United States Coast Guard and the United States Coast Guard Reserve as well as provisions concerning war risk insurance.

Our Committee recognizes the importance of H.R. 4546 and the need for this legislation to move expeditiously. While we have a valid claim to jurisdiction over several provisions, I do not intend to request a sequential referral of the bill. This is, of course, conditional on our mutual understanding that nothing in this legislation waives or affects the jurisdiction of the Transportation Committee, that every effort will be made to include any agreements worked out by our staffs as the bill is taken to the Floor, and that a copy of this letter and your response will be included in the Committee Report and as part of the Record during consideration of the bill by the House.

The Committee on Transportation and Infrastructure also asks that you support our request to be conferees on the provisions over which we have jurisdiction during any House-Senate conference.

Thank you for your cooperation in this matter.

Sincerely,

Don Young, Chairman.

House of Representatives,
Committee on Armed Services,
Washington, DC, May 2, 2002.

Hon. Don Young,
Chairman, Committee on Transportation and Infrastructure,
House of Representatives, Washington, DC.

Dear Mr. Chairman: Thank you for your letter of May 2, 2003 regarding H.R. 4546, the National Defense Authorization Act for Fiscal Year 2003.

I agree that the Committee on Transportation and Infrastructure has valid jurisdictional claims to certain provisions in this important legislation, and I am most appreciative of your decision not to request such a referral in the interest of expediting consideration of the bill. I agree that by foregoing a sequential referral, the Committee onTransportation and Infrastructure is not waiving its jurisdiction. Further, as you requested, this exchange of letters will be included in the Committee report on the bill.

Thank you for your cooperation in this matter.

Sincerely,

Bob Stump, Chairman.

House of Representatives,
Committee on Veterans' Affairs,
Washington, DC, May 2, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: I wish to inform the Committee on Armed Services that the Committee on Veterans' Affairs hereby waives any jurisdiction it may have over sections 641 and 651 of Title VI of the Defense Authorization Bill for Fiscal Year 2003, has no objection to them and does not desire their referral.

Sincerely,

Christopher H. Smith, Chairman.

House of Representatives,
Committee on Education and the Workforce,
Washington, DC, May 2, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: Thank you for working with me in your development of H.R. 4546, the ``National Defense Authorization Act for Fiscal Year 2003,'' specifically:

1. Section 341, ``Assistance to Local Educational Agencies that Benefit Dependents of Members of the Armed Forces and Department of Defense Civilian Employees.''

2. Section 342, ``Availability of Quarters Allowance for Unaccompanied Defense Department Teacher Required to Reside on Overseas Military Installation.''

3. Section 343, ``Provision of Summer School Programs for Students who Attend Defense Dependent's Education System.''

4. Section 366, ``Amendments to Certain Education and Nutrition Laws Relating to Acquisition and Improvement of Military Housing.''

As you know, these provisions are within the jurisdiction of the Education and the Workforce Committee. While I do not intend to seek sequential referral of H.R. 4546, the Committee does hold an interest in preserving its future jurisdiction with respect to issues raised in the aforementioned provisions and its jurisdictional prerogatives should the provisions of this bill or any Senate amendments thereto be considered in a conference with the Senate. We would expect to be appointed as conferees on these provisions should a conference with the Senate arise.

I do have concerns regarding the change made in Committee to the length of the authorization amending the National School Lunch Act; however, I am certain that we can work together to address our mutual goals.

Again, I thank you for working with me in developing the amendments to H.R 4546 and look forward to working with you on these issues in the future.

Sincerely,

John Boehner, Chairman.

House of Representatives,
Committee on Energy and Commerce,
Washington, DC, May 2, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: On May 1, 2002, the Committee on Armed Services ordered reported H.R. 4546, the National Defense Authorization Act for Fiscal Year 2003. As ordered reported by the Committee on Armed Services, this legislation contains a number of provisions that fall within the jurisdiction of the Committee on Energy and Commerce. These provisions include the following:

Section 601. Increase in basic pay for fiscal year 2003.

Section 602. Increase basic allowance for subsistence for members forced to purchase meal outside messing facilities.

Section 612. One-year extension of certain bonus and special pay authorities for certain health care professionals.

Section 614. One-year extension of other bonus and special pay authorities.

Section 615. Minimum levels of hardship duty pay for duty on the ground in Antarctica or Arctic icepack.

Section 631. Extension of leave travel deferral period for members.

Section 641. Phase-in of full concurrent receipt of military retired pay and veterans disability compensation for military retirees with disabilities rated at 60 percent or higher.

Section 704. Improvements regarding the Department of Defense Medicare-eligible retiree health care fund.

Section 713. Repeal of report requirement.

Section 3201. Defense Nuclear Facilities Safety Board Authorization.

Recognizing your interest in bringing this legislation before the House expeditiously, the Committee on Energy and Commerce agrees not to seek a sequential referral of the bill

based on the provisions listed above. By agreeing not to seek a sequential referral, the Committee on Energy and Commerce does not waive its jurisdiction over these provisions or any other provisions of the bill that may fall within its jurisdiction. In addition, the Committee on Energy and Commerce reserves its right to seek conferees on any provisions within its jurisdiction which are considered in the House-Senate conference, and asks for your support in being accorded such conferees.

I request you include this letter as part of the report on H.R. 4546 and as part of the Record during consideration of this bill by the House.

Sincerely,

W.J. ``Billy'' Tauzin, Chairman.

House of Representatives,
Committee on International Relations,
Washington, DC, May 2, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: I understand that on Wednesday, May 1, 2002, the Committee on Armed Services ordered favorably reported H.R. 4546, the National Defense Authorization Act for Fiscal Year 2003. The bill includes a number of provisions that fall within the legislative jurisdiction of the Committee on International Relations pursuant to Rule X(k) of the House of Representatives.

The specific provisions within our committee's jurisdiction are: (1) Section 1201, Support of United Nations-Sponsored Efforts to Inspect and Monitor Iraqi Weapons Activities; (2) Section 1202, Strengthening the Defense of Taiwan; (3) Section 1204, Additional Countries Covered by Loan Guarantee Program; (4) Title XIII, Cooperative Threat Reduction with States of the Former Soviet Union; (5) Section 3142, Transfer to National Nuclear Security Administration of Department of Defense Cooperative Threat Reduction Program Relating to Elimination of Weapons Grade Plutonium in Russia; and (6) Section 3143, Repeal of Requirement for Reports on Obligation of Funds for Programs on Fissile Materials in Russia.

Pursuant to Chairman Dreier's expected announcement that the Committee on Rules will move expeditiously to consider a rule for H.R. 4546 and your desire to have the bill considered on the House floor next week, the Committee on International Relations will not seek a sequential referral of the bill as a result of including these provisions, without waiving or ceding now or in the future this committee's jurisdiction over the provisions in question. I will seek to have conferees appointed for these provisions during any House-Senate conference committee.

I would appreciate your including this letter as a part of the report on H.R. 4546 and as part of the record during consideration of the bill by the House of Representatives.

With best wishes,

Henry J. Hyde, Chairman.

House of Representatives,
Committee on the Judiciary,

Washington, DC, April 30, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: I understand that Representative Van Hilleary may offer an amendment to the FY 2003 DOD Authorization bill relating to Federal Prison Industries. I have reviewed the amendment and support it. If it is included in the DOD Authorization bill, I do not intend to seek a referral on behalf of the Committee on the Judiciary.

Sincerely,

F. James Sensenbrenner, Jr., Chairman.

FISCAL DATA

Pursuant to clause 3(d) Rule XIII of the Rules of the House of Representatives, the committee attempted to ascertain annual outlays resulting from the bill during fiscal year 2003 and the following four years. The results of such efforts are reflected in the cost estimate prepared by the Director of the Congressional Budget Office under section 402 of the Congressional Budget Act of 1974, which is included in this report pursuant to clause 3(c)(3)

CONGRESSIONAL BUDGET OFFICE ESTIMATE

In compliance with clause 3(c)(3) of rule XIII of the House of Representatives, the cost estimate prepared by the Congressional Budget Office and submitted pursuant to section 402 of the Congressional Budget Act of 1974 is as follows:

May 3, 2002.

Hon. Bob Stump,
Chairman, Committee on Armed Services,
House of Representatives, Washington, DC.

Dear Mr. Chairman: The Congressional Budget Office has prepared the enclosed cost estimate for H.R. 4546, the Bob Stump National Defense Authorization Act for Fiscal Year 2003.

The CBO staff contact is Kent Christensen, who can be reached at 226-2840. If you wish further details on this estimate, we will be pleased to provide them.

Sincerely,

Dan L. Crippen.

Congressional Budget Office Cost Estimate

Summary: H.R. 4546 would authorize appropriations totaling $382 billion for fiscal year 2003 and an estimated $14 billion in additional funding for 2002 for the military functions of the Department of Defense (DoD) and the Department of Energy. It also would prescribe personnel strengths for each active-duty and selected reserve component of the U.S. armed forces. CBO estimates that appropriation of the authorized amounts for 2002 and 2003 would result in additional outlays of $392 billion over the 2002-2007 period.

The bill also contains provisions that would raise the costs of discretionary defense programs over the 2004-2007 period. CBO estimates that those provisions would require appropriations of $7.0 billion over those four years.

The bill contains provisions that would increase direct spending by an estimated $5.8 billion over the 2003-2007 period

and $17.7 billion over the 2003-2012 period, primarily from the phase-in of concurrent payment of retirement annuities with veterans' disability compensation to retirees from the military and the other uniformed services who have service-connected disabilities rated at 60 percent or greater. Because it would affect direct spending, the bill would be subject to pay-as-you-go procedures.

H.R. 4546 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA) and would impose no costs on state, local, or tribal governments.

Estimated cost to the Federal Government: The estimated budgetary impact of H.R. 4546 is shown in Table 1. Most of the costs of this legislation fall within budget function 050 (national defense).

TABLE 1.--BUDGETARY IMPACT OF H.R. 4546, THE BOB STUMP NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2003

	By fiscal year, in millions of dollars--					
	2002	2003	2004	2005	2006	2007
SPENDING SUBJECT TO APPROPRIATION						
Spending Under Current Law for Defense Programs:						
Budget Authority ^a		346,285	0	0	0	0
Estimated Outlays	346,878	116,344	38,941	13,273	5,536	2,724
Proposed Changes:						
Authorizations of Supplemental Appropriations for 2002:						
Estimated Authorization Level ^b		14,048	0	0	0	0
Estimated Outlays ^b		5,345	5,782	1,941	660	174
Authorization of Appropriations for 2003:						
Estimated Authorization Level	0	381,522	0	0	0	0
Estimated Outlays	0	252,982	86,639	27,346	7,944	2,726
Spending Under H.R. 4546 for Defense Programs:						
Estimated Authorization Level ^a		360,333	381,522	0	0	0
Estimated Outlays	352,223	375,108	127,521	41,279	13,654	5,529
CHANGES IN DIRECT SPENDING						
Estimated Budget Authority	0	509	637	1,021	1,599	1,997
Estimated Outlays	0	509	637	1,021	1,599	1,997

NOTE: This table excludes estimated authorizations of appropriations for years after 2003. (Those additional authorizations are shown in Table 3.)

^a The 2002 level is the amount appropriated for programs authorized by the bill.

^b The estimates shown for the 2002 supplemental are amounts contained in the Administration's supplemental request for defense programs. The outlay estimate for 2003 includes $5,684 million of spending from funds requested as emergency appropriations. Excluding emergency spending would lower total outlays in 2003 to $369,424 million.

Basis of Estimate

Spending Subject to Appropriation

The bill would specifically authorize appropriations totaling $381.4 billion in 2003 (see Table 2) and additional amounts as may be necessary for supplemental appropriations for defense in 2002, which CBO estimates would total $14 billion based on the Administration's request.\1\ Most of those costs would fall within budget function 050 (national defense). H.R. 4546 also would specifically authorize appropriations of $113 million for the Maritime Administration (function 400--transportation), $70 million for the Armed Forces Retirement Home (function 600--income security), and $21 million for the Naval Petroleum Reserves (function 270--energy).\2\

\1\ After adding the $92 million estimated authorization for the Coast Guard Reserve, the bill would authorize appropriations of slightly more than $381.5 million for 2003.

\2\ The authorization shown here for the Maritime Administration does not include any amounts for maritime loan guarantees and related administrative costs because they are already authorized under existing law.

The estimate assumes that the estimated authorization amount for 2002 is appropriated by the end of June 2002, and that the amounts authorized for 2003 will be appropriated before the start of fiscal year 2003. Outlays are estimated based on historical spending patterns.

The bill also contains provisions that would affect various costs, mostly for personnel, that would be covered by the fiscal year 2003 authorization and by authorizations in future years. Table 3 contains estimates of those amounts. In addition to the costs covered by the authorizations in the bill for 2003, these provisions would raise estimated costs by $7.0 billion over the 2004-2007 period. The following sections describe the provisions identified in Table 3 and provide information about CBO's cost estimates for those provisions.

TABLE 2.--SPECIFIC AUTHORIZATIONS IN H.R. 4546

Category	By fiscal year, in millions of dollars

	2003	2004	2005	2006	2007
Military Personnel:					
Authorization Level ^a	93,670	0	0	0	0
Estimated Outlays	88,612	4,402	281	94	0
Operation and Maintenance:					
Authorization Level	130,159	0	0	0	0
Estimated Outlays	96,425	26,006	5,538	1,186	378
Procurement:					
Authorization Level	73,160	0	0	0	0
Estimated Outlays 20,860	27,671	15,218	5,170	1,789	
Research, Development, Test, and Evaluation:					
Authorization Level	56,424	0	0	0	0
Estimated Outlays	31,792	20,381	3,286	591	151
Military Construction and Family Housing:					
Authorization Level	9,954	0	0	0	0
Estimated Outlays	2,687	3,718	2,192	793	324
Atomic Energy Defense Activities:					
Authorization Level	15,420	0	0	0	0
Estimated Outlays	10,369	4,094	826	74	55
Other Accounts:					
Authorization Level	2,643	0	0	0	0
Estimated Outlays	1,874	418	125	96	49
General Transfer Authority:					
Authorization Level	0	0	0	0	0
Estimated Outlays	280	-60	-120	-60	-20
Total					
Authorization Level ^b	381,430	0	0	0	0
Estimated Outlays	252,899	86,630	27,346	7,944	2,726

^a This authorization is for discretionary appropriations and does not include $55 million for mandatory payments from appropriations for military personnel.

^b These amounts comprise nearly all of the proposed changes for authorizations of appropriations for 2003 shown in Table 1; they do not include the estimated authorization of $92 million for the Coast Guard Reserve, which

is shown in Table 3.

TABLE 3.--ESTIMATED AUTHORIZATIONS OF APPROPRIATIONS FOR SELECTED PROVISIONS IN H.R. 4546

Category	By fiscal year, in millions of dollars				
	2003	2004	2005	2006	2007
MULTIYEAR PROCUREMENT					
Virginia Class Submarine	-37	-54	-60	-73	-93
C-130J Aircraft	15	-63	-121	-142	-162
FORCE STRUCTURE					
DoD Military Endstrengths	528	1,089	1,122	1,155	1,191
Coast Guard Reserve Endstrengths	92	0	0	0	0
COMPENSATION AND BENEFITS (DoD)					
Military Pay Raises	276	381	398	415	430
Expiring Bonuses and Allowances	706	796	417	234	152
Education and Training	3	6	9	13	10
DEFENSE HEALTH PROGRAM					
TRICARE Prime Remote	12	10	9	8	8
Transitional Health Care	7	5	3	2	1
OTHER PROVISIONS					
National Guard Challenge Program	16	16	17	17	18
Asbestos Payments	-110	-110	-110	-110	-110
Federal Employees Health Benefits Program	0	2	3	3	3
School Impact Aid	0	0	0	14	14
Military Housing Privatization Initiative	0	0	80	80	80
TOTAL ESTIMATED AUTHORIZATIONS					

Estimated Authorization Level..... 1,508 2,078 1,767 1,616 1,542

Note: For every item in this table except the authorization for the Coast Guard, the 2003 levels are included in the amounts specifically authorized to be appropriated in the bill. Those amounts are shown in Table 2.

Amounts shown in this table for 2004 through 2007 are not included in Table 1.

Multiyear Procurement

In most cases, purchases of weapon systems are authorized annually, and as a result, DoD negotiates a separate contract for each annual purchase. In a small number of cases, the law permits multiyear procurement; that is, it allows DoD to enter into a contract to buy specified annual quantities of a system for up to five years. In those cases, DoD can negotiate lower prices because its commitment to purchase the weapons gives the contractor an incentive to find more economical ways to manufacture the weapon, including cost-saving investments. Annual funding is provided for these multiyear contracts, but potential termination costs are covered by an initial appropriation.

Section 111 would authorize the Secretary of the Navy to enter into a multiyear contract for procurement of Virginia class submarines starting in fiscal year 2003. This authority would be conditional on the prime contractor for the Virginia class submarine program entering into a binding agreement with the U.S. government to expend from its own funds an amount not less than $385 million for nuclear and non-nuclear components purchased in economic quantities.

Based on information provided by the Navy, CBO assumes that the Navy would buy five Virginia class submarines over the 2003-2007 period if this agreement can be reached. CBO estimates that savings from buying these submarines under a multiyear contract would total $317 million, or just over $60 million a submarine, over the 2003-2007 period. CBO estimates that funding requirements to purchase these submarines, as well as funding the advance purchase of components for future boats, would total about $13 billion over the 2003-2007 period (instead of the more than $13.3 billion that would be needed under annual contracts).

Section 121 would authorize the Secretary of the Air Force to enter into a multiyear contract to purchase C-130J aircraft beginning in 2003 after the Secretary of Defense certifies that two variants of the C-130J--the CC-130J airlift aircraft and the KC-130J tanker aircraft--are operationally effective and suitable. The Secretary of Defense also must certify that this multiyear contract will result in substantial savings relative to the cost of annual contracts, that requirements for the system and the design of the system are stable, and that the program is fully funded in the department's plans for subsequent outyear budgets. Based on information provided by the Air Force, CBO assumes that DoD will procure 64 aircraft over the 2003-2008 period--40 CC-130J aircraft for the Air Force and 24 KC-130J aircraft for the Marine Corps. CBO also assumes that the CC-130J and KC-130J aircraft would be purchased under one contract administered by the Air Force and covering six years of production beginning in 2003. CBO estimates that savings from buying these aircraft under a

multiyear contract would total $473 million, or about $95 million a year, over the 2003-2007 period. CBO also estimates that additional savings of $182 million would accrue in 2008. Funding requirements to purchase these aircraft would total just under $3.4 billion over the 2003-2007 period (instead of the almost $3.9 billion that would be needed under annual contracts).

Multiyear procurement of C-130Js would raise costs in 2003 because the KC-130J did not receive advance procurement in 2002 in anticipation of multiyear procurement starting in 2003, and because the Air Force would need to provide advance procurement for the aircraft that it would purchase in 2004.

Military endstrength

The bill would authorize active and reserve endstrength levels for 2003 and would increase the minimum endstrength authorization in permanent law. The authorized endstrengths for active-duty personnel and personnel in the selected reserve would total about 1,400,000 and 865,000, respectively. Of those selected reservists, about 69,000 would serve on active duty in support of the reserves. The bill would specifically authorize appropriations of $93.7 billion for the discretionary costs of military pay and allowances in 2003. The authorized endstrength represents a net increase of 12,552 servicemembers that would boost costs for salaries and other expenses by $528 million in the first year and about $1.1 billion annually in subsequent years, compared to the authorized strengths for 2002.

The bill also would authorize an endstrength of 9,000 in 2003 for the Coast Guard Reserve. This authorization would cost about $92 million and would fall under budget function 400 (transportation).

Section 403 would allow the service secretaries to increase endstrength by 1 percent above the level authorized by the Congress. Under current law, only the Secretary of Defense has this authority. While there is the potential for increased costs, the service secretaries would still have to manage their resources given the finite amount of money appropriated each year for military personnel. As such, CBO estimates that this provision would not significantly increase costs.

Compensation and benefits

H.R. 4546 contains several provisions that would affect military compensation and benefits for uniformed personnel.

Military Pay Raises. Section 601 would raise basic pay by 4.1 percent across-the-board and authorize additional targeted pay raises, ranging from 0.9 percent to 4.4 percent, for individuals with specific ranks and years of service at a total cost of about $2.3 billion in 2003. Because the pay raises would be above those projected under current law, CBO estimates that the incremental costs associated with the larger pay raise would be about $276 million in 2003 and total $1.9 billion over the 2003-2007 period.

Expiring Bonuses and Allowances. Several sections would extend DoD's authority to pay certain bonuses and allowances to current personnel. Under current law, most of these authorities are scheduled to expire in December 2002, or three months into fiscal year 2003. The bill would extend these authorities through December 2003. Based on data provided by DoD, CBO estimates that the costs of these extensions would be as follows:

<bullet> Payment of reenlistment bonuses for active-duty personnel would cost $327 million in 2003 and $191

million in 2004; enlistment bonuses for active-duty personnel would cost $133 million in 2003 and $361 million in 2004;

<bullet> Various bonuses for the Selected and Ready Reserve would cost $99 million in 2003 and $114 million in 2004;

<bullet> Special payments for aviators and nuclear-qualified personnel would cost $67 million in 2003 and $72 million in 2004;

<bullet> Retention bonuses for officers and enlisted members with critical skills would cost $29 million in 2003 and $19 million in 2004;

<bullet> Accession bonuses for new officers with critical skills would cost $14 million in 2003 and $5 million in 2004; and

<bullet> Authorities to make special payments and give bonuses to certain health care professionals would cost $37 million in 2003 and $34 million in 2004.

Most of these changes would result in additional, smaller costs in subsequent years because payments are made in installments.

Education and Training. Section 531 would allow the military services to increase the number of students at each of the service academies from the current ceiling of 4,000 to 4,400 students over a four-year period at a maximum rate of 100 students a year for academic years 2003-2004 through 2007-2008. Under this provision, the annual increase in service-academy students could not exceed the increase in the number of students in the Reserve Officer Training Corp (ROTC) for the previous academic year.

Based on information from DoD, CBO expects that only the Navy would increase its service-academy strength and that it would bring on about 50 extra academy students a year, as well as an additional 50 ROTC students, at an average annual cost of about $34,000 per student. According to the Navy, these additional students would not be used to increase overall officer endstrength, but rather to offset a desired drawdown in the number of officers commissioned through the Officer Candidate School (OCS) program. Thus, the actual cost of the increase for the academy and ROTC students would be offset somewhat by the cost of the OCS graduates they would replace. Because the OCS program lasts less than one year, the offsetting costs would not begin to affect net outlays until 2007, when the first of the additional academy and ROTC students would graduate and be commissioned. CBO estimates the cost of implementing this provision would be $1 million in 2003 and $31 million over the 2003-2007 period, assuming appropriation of the necessary amounts.

Section 651 would extend the period during which eligible reservists may use their education benefits from 10 years to 14 years. In 2001, over 82,000 reservists trained under this program and received an average annual benefit of $1,653. These benefits are paid by the Secretary of Veterans Affairs from the DoD Education Benefits Fund. Each month, DoD pays into the fund the net present value of the education benefit granted to each person who enlisted in the previous month. Based on information from DoD about current contributions to the fund and expected accessions, CBO estimates section 651 would increase payments into the fund by about $2 million each year. (CBO estimates that there also would be direct spending of about $29 million over the 2003-2012 period for increased outlays from the fund.

CBO's estimate of those costs is discussed below under the heading of ``Direct Spending.'')

Defense health program

Title VII contains several provisions that would affect DoD health care and benefits. Tricare is the name of DoD's health care program; Tricare Prime and Tricare Prime Remote are managed care programs, and Tricare Standard is a fee-for-service program.

Tricare Prime Remote. Section 702 would affect dependents of servicemembers on active duty who live in a remote area, which is defined as roughly a one-hour or more driving distance from a military treatment facility. Under certain conditions, this sectionwould allow dependents of personnel on active duty who live in a remote area to participate in Tricare Prime Remote if the servicemember is transferred to a different duty station and is not allowed to bring his or her family. Section 702 also would allow the family members of reservists called to active duty to participate in the Tricare Prime Remote program if they live in a remote area. Under current law, dependents of personnel on active duty living in remote areas must reside with the active-duty member to participate in Tricare Prime Remote. If the active-duty servicemember is transferred to a duty station where he or she cannot bring family members, the family can no longer participate in the Tricare Prime Remote program. Families of reservists called to active duty also are not allowed to participate in this program.

Based on information provided by DoD, CBO estimates that about 36,000 dependents of personnel on active duty and about 50,000 dependents of reservists called to active duty would be affected by this provision. While CBO expects the number of family members of active-duty personnel to remain fairly constant, CBO assumes that the more than 80,000 reservists currently on active duty will decline to about 65,000 in 2003 and 10,000 by 2006. If the number of reservists called to active duty were to remain at current levels over the 2003-2007 period, then the estimated costs would be correspondingly higher.

According to DoD, about 40 percent of those dependents who would be eligible for Tricare Prime Remote under this section already participate in Tricare Standard. Based on data provided by the department, CBO estimates that the additional incremental cost of providing Tricare Prime Remote to those individuals would be $113 per person. In addition, CBO estimates that the new benefit would attract about 4,300 dependents to Tricare Prime Remote who had not previously used any Tricare program at an estimated annual cost of $1,900 per person. Thus, CBO estimates that the cost of providing Tricare Prime Remote to more individuals would be $12 million in 2003 and $47 million over the 2003-2007 period, assuming appropriation of the estimated amounts.

Transitional Health Care. Under section 706, family members of reservists who were called to active duty for more than 30 days would be eligible for health care coverage under Tricare for 60 days after the reservist is released from active duty. Under current law, only the reservist is eligible for health care coverage under Tricare for the 60 days after he or she is released from active duty. While there are currently more than 80,000 reservists on active duty, CBO assumes for this estimate that the number of reserves will fall to about 65,000 in 2003 and 10,000 by 2006. If the number of reservists remains at current levels over the 2003-2007 period, the estimated costs

would be correspondingly higher.

Based on data from DoD and the General Accounting Office, CBO estimates that about 50 percent of the reservists have families and that about 40 percent of those families would use the transitional health care. CBO further estimates that providing an additional 60 days of health care coverage to those families would cost, on average, about $600 per family. After accounting for inflation and the assumed decline in the level of reservists called to active duty, CBO estimates that this provision would cost $7 million in 2003, and $18 million over the 2003-2007 period, assuming appropriation of the estimated amounts.

National Guard Challenge Program

Section 513 would allow DoD to reimburse a state program of the National Guard Challenge Program for up to 75 percent of the cost of operating the state program in a fiscal year. If fully implemented, CBO estimates that implementing this provision would cost $84 million over the 2003-2007 period. CBO estimates that raising the federal contribution to these programs to 75 percent would increase the annual federal cost for each participant by approximately $2,500. Applying this annual cost to the 6,400 participants in the program would increase the cost by about $17 million per year over the 2003-2007 period.

Asbestos differential pay

Under section 1103, federal wage-grade employees would be subject to the same standards as general schedule employees when determining eligibility for environmental differential pay (EDP), based on exposure to asbestos. Under current law, general schedule employees are entitled to 8 percent hazard differential pay if they are exposed to asbestos that exceeds the permissible exposure limits established by the Occupational Safety and Health Administration (OSHA). The current EDP standard for wage-grade employees entitles them to the same 8 percent of pay, but does not set an objective measure for determining the level of asbestos exposure necessary to qualify for EDP. In several instances where wage-grade employees have sought back pay for EDP, arbitrators found in favor of the employees when asbestos levels were below those consistent with OSHA standards. Based on information from DoD on prior and pending arbitration rulings, CBO expects that implementing section 1103 would reduce the amount of back pay federal agencies would be required to pay for EDP based on asbestos exposure. Assuming these cases would be handled administratively, CBO estimates establishing OSHA standards for asbestos EDP would save $110 million in 2003 and $550 million over the 2003-2007 period, assuming appropriations are reduced by the estimated amounts.

Federal Employees Health Benefits (FEHB) Program

Section 1104 would extend a provision of law into fiscal year 2007 that allows DoD and certain Department of Energy employees whose employment is terminated because of a reduction-in-force action to continue to participate in the FEHB health insurance program and only pay the regular

employee's share of the insurance premium. The respective departments would be responsible for paying the normal employer's share of the premium. Under current law, this provision expires in fiscal year 2004. Based on information from DoD and the Office of Personnel Management, CBO estimates that this provision would affect about 500 people a year at an average annual cost of $5,500 per person over the 2003-2007 period. CBO estimates that extending this provision into fiscal year 2007 would cost $2 million in 2004, and $11 million over the 2004-2007 period, assuming appropriation of the estimated amounts.

School impact aid

Section 366 would allow school districts with a large percentage of children from military families to continue to receive heavy impact aid when military families are temporarily relocated. Heavy impact aid is federal funding earmarked for school districtswith large military populations. Many military families in those school districts live on federal installations and do not contribute to the local property tax base that is used to help finance school operations. Heavy impact aid helps to offset this loss of local tax revenue. Under current law, schools can only receive heavy impact aid if they meet strict criteria for numbers of federal students located in their districts, local tax rates, and per pupil expenditures. Because of population relocations associated with certain military housing initiatives, some school districts would temporarily be unable to meet these criteria and would lose their heavy impact aid for several years.

Based on data from the Department of Education and the Military Impacted Schools Association, CBO estimates that about four school districts would initially be affected by housing privatization and that these school districts receive about $18 million in heavy impact aid annually. Because applications for heavy impact aid are based on school district statistics from three years prior, CBO estimates that the cost of implementing this section would not occur until 2006. After adjusting for the changes in student population within the affected districts, CBO estimates that restoration of this aid would cost about $14 million per year. Since the requirements of the School Impact Aid program are not always fully funded, CBO expects that the Department of Education would likely fund this increase through reductions in aid to other school districts. CBO expects this cost would reoccur annually only for the duration of the privatization effort within the affected school districts, which CBO estimates to be about three years.

Military Housing Privatization Initiative (MHPI)

Section 2801 would increase the value of budget authority that DoD can use to finance special authorities for the construction and renovation of military family housing and military unaccompanied housing. Those authorities allow DoD to use direct loans, loan guarantees, long-term leases, rental guarantees, barter, direct government investment, and other financial arrangements to encourage private-sector participation in building military housing. Funding for those activities comes from the Family Housing Improvement Fund which is financed by appropriations made to the fund, transfers from other accounts, receipts from property sales and rents, returns on any capital, and other income from operations or transactions connected with the program. Currently the amounts

in the fund are available for use by DoD to acquire housing using the various techniques mentioned above, but the total value of budget authority for all contracts and investments undertaken is limited to $1 billion ($850 million for family housing and $150 million for unaccompanied housing). Under the bill, those limits would be increased to $2 billion ($1.7 billion for family housing and $300 million for unaccompanied housing).

To date, DoD has signed contracts for 16 family housing projects and is proceeding with solicitations for or considering plans for close to 60 other projects over the next few years. Based on how the Office of Management and Budget (OMB) has recorded obligations from DoD's use of this authority, DoD has only recorded obligations of about $250 million--well below the current $1 billion limit. Given DoD's plans for future projects, CBO estimates that the department will reach the current limit by the end of 2004. As a result, CBO estimates that raising the limit effectively authorizes additional appropriations beginning in 2005. Based on recent trends and DoD's current plans, CBO estimates these authorizations would total about $80 million a year over the 2005-2007 period.

CBO, however, continues to believe that OMB's current accounting for MHPI initiatives is at odds with government-wide standards for recording obligations and outlays. Those standards call for different treatments depending on the character of the transaction. The OMB accounting treats certain initiatives primarily as credit and other transactions that have relatively little cost in terms of recorded obligations and outlays. In contrast, CBO considers many MHPI projects as having characteristics of lease-purchases or of public-private partnerships, both of which require the Administration to record higher levels of obligations and outlays. Currently the Administration's approach allows DoD to obligate significantly more federal resources than the existing $1 billion limitation for such projects. Consequently, if the limitation is increased to $2 billion, DoD would be allowed to obligate much more than that figure.

Government-Wide Accounting Principles. Some of the options available for use of the Family Housing Improvement Fund involve up-front commitments of government resources that would be spent over a long period of time. According to standard principles of federal accounting, obligations of the fund should reflect the full amount of the financial liability incurred when the government makes such a commitment. In the case of a long-term capital lease or rental guarantee, for example, obligations should equal the total amount of lease or rental payments over the life of the contract, and appropriations to cover the full amount of such obligations should be available before entering into the lease or guarantee. Some commitments could take the form of lease-purchases, which would require the recording of both obligations and outlays up front. Still others could be public-private partnerships formed to borrow private funds in order to construct housing on a military base; in those instances, obligations should equal the borrowing authority--a form of budget authority--used for that project. If direct loans are used to help finance an on-base project, the value of future appropriations that will be passed through to developers--by servicemembers who pay rent with their housing allowances--

should be viewed as a subsidy, which would increase obligations.

In effect, the Administration's accounting is allowing DoD to record the costs of the projects incrementally over time rather than up front. CBO believes this is counter to the government-wide principles that require costs from such projects to be recorded up front in the budget. In future years, CBO's approach would reduce the amount of budget authority and outlays the Administration would need to record each year in the military personnel accounts--which fund housing allowances--since such costs would already be recorded.

CBO plans to consult with the Committee on the Budget in both the House and the Senate on how to score future legislation that expands or extends these authorities. Depending on the outcome of those consultations, CBO may score such future legislation as direct spending.

Matters relating to other nations

Section 1204 would expand the list of countries eligible for loan financing under the defense export loan guarantee program to include countries combating drug trafficking organizations or combating foreign terrorist organizations, as determined by the Secretary of Defense and the Secretary of State. CBO estimates that implementing this provision would have no significant budgetary effect because CBO believes that the authority would not be used. The section would not authorize appropriations for the costof any loan guarantees, as defined by the Federal Credit Reform Act. Without a subsidy appropriation, the borrowing country would be required to pay fees sufficient to cover the cost of the contingent liability of the United States under the guarantee plus administrative expenses. CBO estimates that the required fees would render the total cost of financing no more attractive to potential borrowers than financing without a government guarantee. CBO also estimates that the other limitations and authorizations provided in title 12 would have little effect on the spending of funds otherwise authorized to be appropriated.

Direct Spending

The bill contains provisions that would increase direct spending, primarily from the phase-in of concurrent payment of retirement annuities with veterans' disability compensation to retirees from the military and the other uniformed services who have service-connected disabilities rated at 60 percent or greater. The bill also contains a few provisions with small direct spending savings. On balance, CBO estimates that enacting H.R. 4546 would result in a net increase in direct spending totaling $5.8 billion over the 2003-2007 period (see Table 4).

Concurrent receipt

Section 641 would phase in over five years total or partial concurrent payment of retirement annuities together with veterans' disability compensation to retirees from the uniformed services who have service-connected disabilities rated at 60 percent or greater. The uniformed services include all branches of the U.S. military, the Coast Guard, and uniformed members of the Public Health Service (PHS) and the National Oceanic and Atmospheric Administration (NOAA).

Under current law, disabled veterans who are retired from the uniformed services cannot receive both full retirement annuities and disability compensation from the Department of

Veterans Affairs (VA). Because of this prohibition on concurrent receipt, such veterans forgo a portion of their retirement annuity equal to the nontaxable veterans' benefit. This section would permit, beginning in 2007, individuals who have significant service-connected disabilities and have a retirement annuity based on years of service, to receive both benefits in full without the reduction called for under current law. Individuals whose retirement pay is based on their degree of disability would continue to forgo retirement pay equal to the VA compensation payment, but only to the extent that their disability had entitled them to a larger retirement annuity than they would have received based on years of service.

TABLE 4.--ESTIMATED DIRECT SPENDING FROM CONCURRENT RECEIPT AND OTHER PROVISIONS IN H.R. 4546

	By fiscal year, in millions of dollars--					
	2003	2004	2005	2006	2007	
CHANGES IN DIRECT SPENDING						
Section 641--Concurrent Receipt:						
Estimated Budget Authority	516	643	1,029	1,608	2,006	
Estimated Outlays	516	643	1,029	1,608	2,006	
Section 362--Armed Forces Retirement Home Fee:						
Estimated Budget Authority	-7	-7	-7	-7	-7	
Estimated Outlays	-7	-7	-7	-7	-7	
Section 643--Cost-of-Living Adjustment (COLA) Inversion:						
Estimated Budget Authority	-3	-3	-4	-4	-4	
Estimated Outlays	-3	-3	-4	-4	-4	
Section 644--Forgotten Widows:						
Estimated Budget Authority	-1	-1	-1	-1	-1	
Estimated Outlays	-1	-1	-1	-1	-1	
Section 651--Education Benefits for Selected Reserves:						
Estimated Budget Authority	4	4	3	2	2	
Estimated Outlays	4	4	3	2	2	
Section 701--Mental Health Benefits:						
Estimated Budget Authority	0	1	1	1	1	
Estimated Outlays	0	1	1	1	1	
TOTAL CHANGES IN DIRECT SPENDING						

Estimated Budget Authority	509	637	1,021	1,599	1,997
Estimated Outlays	509	637	1,021	1,599	1,997

This section also would repeal a program that partially compensates certain severely disabled retirees for this reduction in their retirement annuities. This program currently pays a fixed benefit of $50 to $300 a month, depending on degree of disability. Taken together, CBO estimates that implementing section 641 would increase direct spending for retirement annuities and veterans' disability compensation by a net amount of about $516 million in 2003, $5.8 billion over the 2003-2007 period, and $17.8 billion over the 2003-2012 period (see Table 5).

TABLE 5.--ESTIMATED CHANGES IN RETIREE BENEFITS UNDER H.R. 4546

Description of Benefits Program	By fiscal year, in millions of dollars--				
	2003	2004	2005	2006	2007
Retirement Annuities:					
Nondisability	490	591	887	1,370	1,744
Disability	83	97	135	194	234
Veterans Compensation Payments	0	13	67	104	89
Survivor Benefit Plan Payments	8	8	8	9	9
Special Compensation for Severely Disabled	-65	-66	-68	-69	-70
Total Changes in Retiree Benefits	516	643	1,029	1,608	2,006

Retirement Annuities. Since the proposed legislation would treat retirees differently based on their type of retirement--nondisability or disability, the potential costs of the legislation depend on the number of beneficiaries, their type of retirement, their disability levels, and their benefit amounts.

Nondisability Retirees. A nondisability retirement is granted based on length of service--usually 20 or more years. Section 641 would allow those longevity retirees whose degree of disability has been rated as 60 percent or greater to receive full retirement annuities and veterans' disability benefits with no offset in 2007, and to receive an increasing

portion of their retirement annuities over the 2003-2006 period. Data from the uniformed services indicate that in 2001 the prohibition on paying both benefits concurrently caused about $1.3 billion to be withheld from the annuity payments of about 74,000 eligible DoD retirees with nondisability retirements, and about 900 eligible Coast Guard, PHS, and NOAA retirees. Using current rates of net growth in the population of new beneficiaries, CBO estimates this caseload would rise to about 78,000 nondisability retirees in 2003, and 96,000 nondisability retirees by 2012. CBO assumes that future benefit payments will increase consistent with current rates of growth in average disability levels and also increase from cost-of-living adjustments. After phasing the benefits in over five years as specified in the provision, CBO estimates that enacting the legislation would increase direct spending on retirement annuities for nondisability retirees of the uniformed services by $490 million in 2003, $5.1 billion over the 2003-2007 period, and $15.6 billion over the 2003-2012 period.

Disability Retirees. Servicemembers who are found to be unable to perform their duties because of service-related disabilities may be granted a disability retirement. Section 641 would allow eligible disability retirees to receive retirement annuities based on their years of service and veterans' disability benefits with no offset in 2007, and partial concurrent receipt of these payments in 2003 through 2006. Disability retirees would be eligible to obtain concurrent receipt of their retirement annuity and veterans' disability compensation if they served 20 or more years in the uniformed services and had a disability rating of 60 percent or greater.

Data from the uniformed services indicate that in 2001, the prohibition on paying both benefits concurrently caused about $200 million to be withheld from annuity payments of about 11,400 eligible DoD retirees with disability retirements, and about 500 eligible Coast Guard, PHS, and NOAA retirees. An analysis of retiree records by DoD indicates that, under the criteria set forth in this section, these retirees would be eligible to receive about 95 percent of their retirement annuity concurrently with their VA disability benefit. Assuming continuation of current trends in population and benefit growth, and phasing the benefit in over five years as specified in this section, CBO estimates that, of the disability retirees who would be receiving VA disability benefits in fiscal year 2003,about 12,100 would be entitled to an additional $83 million in retirement annuities. CBO estimates their retirement annuities would increase by $743 million over the 2003-2007 period and $2 billion over the 2003-2012 period.

Other Effects of Concurrent Receipt. Enacting section 641 also would affect Veterans' Disability Compensation, receipts to the Treasury for Survivor Benefit Payments, Special Compensation to Severely Disabled Retirees, and the level of contributions to the Military Retirement Trust Fund.

Veterans' Disability Compensation. Data from DoD indicates that an additional 15,100 disability retirees of the uniformed services--14,500 from DoD and about 600 from the other uniformed services--do not currently receive VA disability benefits that they are entitled to receive. Since many disability retirees are not taxed on their annuities, there is no incentive under current law for these retirees to apply for

the tax-free VA benefits, as they will be offset, dollar-for-dollar, against their retirement annuities. Section 641 would provide a significant incentive for the more disabled of these individuals to apply for VA disability benefits. CBO estimates that about 7,000 disability retirees might be eligible for concurrent receipt under section 641, but, because many of these retirees are both disabled and quite elderly, CBO expects that only about half of that number would become aware of this improved benefit and successfully complete the application process. Based on their DoD-assessed degree of disability, CBO estimates that outlays for VA disability benefits would increase by $13 million in 2004, about $270 million over the 2003-2007 period, and $760 million over the 2003-2012 period. Because of the time needed for individuals to prepare and submit their applications and the current backlog in processing applications, CBO estimates that enacting this legislation would not increase outlays for veterans' disability compensation in 2003.

Survivor Benefit Plan Offsetting Receipts. Many retirees have a Survivor Benefit Plan (SBP) premium payment deducted from their retirement annuity. The SBP was established in Public Law 92-425 to create an opportunity for military retirees to provide annuities for their survivors. Those retirees who are not receiving a paycheck from DoD because their retirement annuity is totally offset by their VA disability benefit may still participate in the SBP by paying the monthly premium to the U.S. Treasury. These payments are recorded as offsetting receipts to DoD. According to DoD, approximately 34,000 military retirees paid $23 million in SBP premiums to the Treasury in 2001. DoD also indicates that about $7 million of that amount was paid by about 8,000 retirees who would begin to receive annuity checks under section 641. CBO's estimate of the increase in retirement outlays presented above assumes that the SBP premiums of retirees who benefit from the legislation would be deducted from the retirees' annuities, and their payments to the Treasury would cease. Assuming continuation of current trends in population and benefit growth, CBO estimates these offsetting receipts (a credit against direct spending) would decrease by about $8 million in 2003, $40 million over the 2003-2007 period, and $90 million over the 2003-2012 period.

Repeal of Special Compensation for Severely Disabled Retirees. Section 641 also would repeal a special compensation program that currently pays a fixed benefit of $50 to $300 a month to certain uniformed service retirees who were determined to be 60 percent to 100 percent disabled within four years of their retirement. Based on information from DoD and assuming the population growth trends continue, CBO estimates that about 36,000 DoD retirees and about 600 retirees of the other uniformed services will receive an average monthly benefit of $150 in 2002. Under current law, this benefit is scheduled to increase over the next two years to $172 a month. CBO estimates that the savings from repealing this program would be $65 million in 2003, $338 million over the 2003-2007 period, and $706 million over the 2003-2012 period.

Increased Accrual Payment Financing. The military retirement system is financed in part by an annual payment from appropriated funds (an outlay in budget function 050) to the Military Retirement Fund, based on an estimate of the system's accruing liabilities. If this provision is enacted, the yearly

contribution to the fund would increase to reflect the added liability from the expected increase in annuities to future retirees. Under section 641, however, this incremental increase in the accrual payment would be paid to the Military Retirement Fund by the Secretary of the Treasury from the general fund of the Treasury. Using information from DoD, CBO estimates that the accrual payment from the Treasury would be $569 million in 2003, and about $3 billion over the 2003-2007 period.

Armed Forces Retirement Home fee

Section 362 would increase the fee that certain military personnel pay toward the operation of the Armed Forces Retirement Home. Currently, these personnel--which include active-duty enlisted personnel, warrant officers, and limited-duty officers--are required to pay a fee of 50 cents per month, which is used to offset the costs of operating the retirement home. Section 362 would set the fee at $1.00 per month. Based on information provided by the Department of Defense, CBO estimates this provision would increase offsetting receipts (a credit against direct spending) by $7 million per year.

Cost-of-living-adjustment (COLA) inversion

Under current law, the annual COLA for military retirement annuities, which takes effect every December, is calculated based on the amount of the increase in the consumer price index (CPI) over the course of the previous fiscal year. Members of the uniformed services who are newly retired are credited with only a partial-year COLA the first December of their retirement. The size of this partial-year COLA depends on when during the year they retired, and their retirement plan. Because the CPI declined during the fourth quarter of 2001, retirees whose ``COLA clock'' started counting during that period of deflation will receive a larger COLA than those retirees whose COLA is calculated from the previous, higher-growth quarter. Section 643 would prevent this ``COLA inversion'' by capping retirees' initial COLAs at the level of the full-year COLA received by the rest of the retiree population.

Based on data from DoD, CBO estimates that enacting this legislation would reduce the COLA adjustment of about 43,000 servicemen who retire during fiscal year 2002 by less than half a percentage point. CBO estimates that the retirement annuities they would otherwise receive in 2003 would be reduced by a total of about $3 million. This reduction in annuities would increase over time by the amount of future COLA increases that would otherwise have applied to the original $3 million. CBO estimates section 643 would reduce retiree annuities by about $18 million over the 2003-2007 period and by $38 million over the 2003-2012 period.

Forgotten widows

Section 644 would modify a program to compensate surviving spouses of certain active-duty servicemembers and reservists who died before they were able to enroll in the Survivor Benefit Plan. This program, which began in December 1997, is currently providing a monthly annuity of $186 to over 2,500 beneficiaries. Under current law, benefits are retroactive to the inception of the program. CBO estimates that a survivor enrolling in the program in 2003 would receive, in addition to the monthly annuity, a lump-sum payment of over $11,000 and that by 2012, the lump-sum payment would increase to almost $32,000. Section 644 would eliminate the retroactive portion of the benefit, so that survivors who enroll in the program after

enactment of this legislation would receive the annuity, but not the lump-sum payment. Data from DoD indicates that the eligible population is elderly, and the recent growth rate has been limited to between 100 and 150 surviving spouses a year. Without the lump-sum payment incentive, CBO assumes even fewer new enrollees would seek to become eligible each year. CBO estimates eliminating the lump-sum payment would save about $9 million over the 2003-2012 period.

Education benefits for the selected reserve

Section 651 would extend the period during which eligible reservists may use their education benefits from 10 years to 14 years. VA reported that, in 2001, over 82,000 reservists trained under this program and received an average annual benefit of $1,653. This average benefit includes both the basic benefit and a supplemental benefit that DoD can offer to enhance accessions or re-enlistment in critical skill specialties. This benefit increases each year by a COLA and by the level of supplemental benefits being offered. Based on current usage rates, CBO estimates that enacting this extension would result in an extra 2,500 trainees in fiscal year 2003 and a somewhat smaller number of additional trainees in subsequent years. The number of trainees will be larger in the first several years because reservists who are currently excluded from using their benefits because they have exceeded the 10-year limit would be expected to use the newly available benefit more intensively. Based on information from DoD and VA, CBO estimates that enacting this legislation would increase education outlays by $4 million in 2003, $15 million over the 2003-2007 period and by $29 million over the 2003-2012 period. Since DoD makes monthly payments into the DoD Education Benefits Fund in the amount of the net present value of the benefits granted during the previous month, this increase in usage of the education benefit would necessitate an increase in payments to the fund. (The discretionary costs associated with these payments are discussed earlier in the ``Spending Subject to Appropriation'' section under the heading of ``Education and Training.'')

Mental health benefits

Section 701 would remove a statutory requirement that inpatient mental health care be preauthorized for retirees and dependents who are eligible for Medicare beginning in 2004. Under current law, Tricare for Life (TFL), another medical program run by DoD, pays all Medicare copayments and deductibles for those benefits that are covered by both programs. Beginning in 2003, TFL spending for Medicare-eligible retirees and dependents will be considered direct spending. Under current law, Medicare does not require a preauthorization for inpatient mental health care but Tricare does. Removing this requirement would make the mental health benefits identical and reduce confusion among beneficiaries and health care providers.

Although most individuals would seek preauthorization before receiving inpatient mental health care, CBO expects that, under current law, some individuals would fail to obtain the necessary preauthorization from Tricare and would have to pay the copayments and deductibles on their own. Because DoD does not have any available data on the frequency or costs of inpatient mental health care for Medicare-eligible retirees and dependents, CBO extrapolated this data from the general Medicare population. Under section 701, CBO estimates that in

2004 TFL would cover the copayments and deductibles for about 600 additional people at an average cost of about $1,800 per person. Thus, CBO estimates section 701 would raise direct spending by $1 million in 2004, $4 million over the 2004-2007 period, and $14 million over the 2004-2012 period.

Land conveyance and other property transactions

Titles XXVIII and XIV would authorize a variety of property transactions involving both large and small parcels of land.

Section 2841 would authorize the Secretary of the Interior to convey to the city of West Wendover, Nevada, and Tooele County, Utah, without consideration, two parcels of federal land located in those states and identified in the bill. According to the Bureau of Land Management (BLM), those lands, which are withdrawn for military purposes, currently generate no offsetting receipts and are not expected to in the foreseeable future. Hence, CBO estimates that conveying the lands would not affect offsetting receipts. According to the U.S. Air Force, portions of the lands that could be conveyed have been used as a bombing range by the Air Force. Under the Comprehensive Environmental Response, Compensation, and Liability Act, the agency would have to remediate any expended and unexploded ordnance prior to conveying those lands. Any federal spending for remediation, which could be significant, would be subject to appropriation. At this time, CBO does not have sufficient information to estimate remediation costs.

CBO estimates that other provisions in title XXVIII would not result in significant costs to the federal government because they would either authorize DoD to exchange one piece of property for another or would authorize DoD to convey land that under current law is unlikely to be declared excess and sold or is likely to be given away.

Title XIV of H.R. 4546 would designate as wilderness more than 539,000 acres of federal lands throughout the state of Utah. Subject to valid existing rights, the bill would withdraw most of those lands from programs to develop mineral and geothermal resources. Withdrawing those lands from leasing and development could result in forgone offsetting receipts if, under current law, the lands would generate receipts from those activities. According to BLM, however, the lands currently generate no significant receipts and are not expected to over the next 10 years. Hence, we estimate that any resulting changes in offsetting receipts would be negligible.

Title XIV also would prohibit the Secretary of the Interior from issuing permits for rights-of-way through certain federal lands in Utah. According to BLM, the agency collects less than $100,000 a year from such permits; hence, CBO estimates that anyresulting loss of offsetting receipts (a credit against direct spending) would not exceed that amount in any year.

Other provisions

The following provisions would have an insignificant budgetary impact on direct spending:

<bullet> Section 364 would extend the arsenal support program initiative (ASPI) through 2004. ASPI allows government owned and operated arsenals to sign contracts with private companies for the use of excess plant space and equipment. The arsenal can then use the rents and fees from these contracts to reduce overhead costs. To date, these contracts have generated less than $500,000 a year in proceeds.

<bullet> Section 366 would allow the basic allowance

for housing (BAH) for service members who live in privatized housing to be disregarded as income when determining eligibility for free and reduced meals in the school lunch program. Under current law, the BAH is counted as income. The provision would allow more children to be eligible for free and reduced price meals for the one year period after enactment. CBO estimates that this section would increase direct spending in the child nutrition program in 2003, but that the costs would not be significant. (If this bill is enacted before the start of fiscal year 2003, then there would be some insignificant cost in 2002 also.)

<bullet> Section 2862 would allow the Navy to provide wastewater treatment services from its facilities at Camp Lejeune, North Carolina, to Onslow County and other public entities near the base. In exchange for those services, the Navy would receive cash or in-kind payment. This provision would have no net impact on direct spending because it would allow the Navy to spend any cash that it collects.

Pay-as-you-go considerations: The Balanced Budget and Emergency Deficit Control Act sets up pay-as-you-go procedures for legislation affecting direct spending or receipts. The net changes in direct spending that are subject to pay-as-you-go procedures are shown in Table 6. For the purposes of enforcing pay-as-you-go procedures, only the effects through fiscal year 2006 are counted.

TABLE 6.--ESTIMATED IMPACT OF H.R. 4546 ON DIRECT SPENDING AND RECEIPTS

By fiscal year, in millions of dollars--

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Changes in outlays	0	509	637	1,021	1,599	1,997	2,123	2,256	2,386	2,524	2,672
Changes in receipts	Not applicable										

INTERGOVERNMENTAL AND PRIVATE-SECTOR IMPACT

H.R. 4546 contains no intergovernmental or private-sector mandates as defined in UMRA and would impose no costs on state, local, or tribal governments.

Estimate prepared by: Federal Costs: Defense Outlays: Kent Christensen. Military Construction: David Newman. Military and Civilian Personnel: Michelle Patterson and Dawn Regan. Armed Forces Retirement Home: Geoffrey Gerhardt. Military Retirement: Sarah Jennings. Health Programs: Sam Papenfuss. Multiyear Procurement: David Newman and Raymond Hall. Conservation and Land Management: Megan Carroll. Maritime Administration: Deborah Reis. Naval Petroleum Reserves: Lisa Cash Driskill.

Nutrition Programs: Valerie Womer. Operation and Maintenance: Matt Schmit. Impact on State, Local, and Tribal Governments: Elyse Goldman. Impact on the Private Sector: R. William Thomas.

Estimate approved by: Peter H. Fontaine, Deputy Assistant Director for Budget Analysis.

COMMITTEE COST ESTIMATE

Pursuant to clause 3(d) of rule XIII of the Rules of the House of Representatives, the committee generally concurs with the estimates as contained in the report of the Congressional Budget Office.

OVERSIGHT FINDINGS

With respect to clause 3(c)(1) of rule XIII of the Rules of the House of Representatives, this legislation results from hearings and other oversight activities conducted by the committee pursuant to clause 2(b)(1) of rule X.

With respect to clause 3(c)(2) of rule XIII of the Rules of the House of Representatives and section 308(a) of the Congressional Budget Act of 1974, this legislation does not include any new spending or credit authority, nor does it provide for any increase or decrease in tax revenues or expenditures. The bill does, however, authorize appropriations. Other fiscal features of this legislation are addressed in the estimate prepared by the Director of the Congressional Budget Office under section 402 of the Congressional Budget Act of 1974.

With respect to clause 3(c)(4) of rule XIII of the Rules of the House of Representatives, the committee has not received a report from the Committee on Government Reform and Oversight pertaining to the subject matter of H.R. 4546.

GENERAL PERFORMANCE GOALS AND OBJECTIVES

With respect to clause 3(c)(4) of rule XIII of the Rules of the House of Representatives, this legislation would address several general and outcome-related performance goals and objectives. The general goal and objective of this legislation is to improve the quality of life for military personnel and their families, military readiness, the modernization and eventual transformation of the armed forces, to enhance the development of ballistic missile defenses, and to improve the condition of military housing and facilities.

With respect to the outcome-related goal of improving the quality of life for military personnel and their families, the objective of this legislation is to:

(1) ensure the largest one-year growth in active duty end strength since 1986 by adding 12,650 personnel, enabling all the military services to begin meeting long-standing manpower shortages, as well as new manning requirements.

(2) provide every military service member a pay raise of between 4.1 and 6.5 percent effective January 1, 2003;

(3) reduce out-of-pocket housing costs for military personnel to less than 8 percent during fiscal year 2003;

(4) eliminate unfair provisions in current law,

thereby allowing those rated 60 percent disabled or greater to receive by 2007 their full military retired pay and full veteran's disability compensation.

With respect to the outcome-related goal of improving military readiness, the objective of this legislation is to:

(1) increase funding for key readiness accounts by $4.6 billion above the fiscal year 2002 level;

(2) satisfy approximately $200 million of the service chiefs' unfunded readiness requirements;

With respect to the outcome-related goal of improving the modernization and eventual transformation of the armed forces and enhancing the development of ballistic missile defenses, the objective of this legislation is to:

(1) increase funding for military procurement accounts by $2.9 billion;

(2) satisfy more than $2 billion of the unfunded procurement requirements identified by the service chiefs; and

(3) increase funding for military research and development accounts by $914 million.

With respect to the outcome-related goal of improving military housing and facilities, the objective of this legislation is to:

(1) provide $10 billion for military construction and military family housing programs, including $2 billion for quality of life enhancements;

(2) provide several enhancements to the authority provided by current law to privatize military housing that will provide the military services more flexibility to procure adequate military family housing.

With respect to the outcome-related goal of increasing homeland and troop defenses against terrorist and ballistic missile attacks, the objective of this legislation is to:

(1) support the President's request for $7.3 billion to combat terrorism; and

(2) support the approach of the President's ballistic missile defense program and to increase funding for ballistic missile defense programs by $8.4 million above the fiscal year 2002 level.

CONSTITUTIONAL AUTHORITY STATEMENT

Pursuant to Rule XIII, clause 3 (d)(1) of the Rules of the House of Representatives, the committee finds the authority for this legislation in Article I, Section 8 of the United States Constitution.

STATEMENT OF FEDERAL MANDATES

Pursuant to section 423 of Public Law 104-4, this legislation contains no federal mandates with respect to state, local, and tribal governments, nor with respect to the private sector. Similarly, the bill provides no federal intergovernmental mandates.

RECORD VOTES

In accordance with clause 3(b) of rule XIII of the Rules of the House of Representatives, record and voice votes were taken

with respect to the committee's consideration of H.R. 4546. The record of these votes is attached to this report.

The committee ordered H.R. 4546 reported to the House with a favorable recommendation by a vote of 57-1, a quorum being present.

<GRAPHIC(S) NOT AVAILABLE IN TIFF FORMAT>

Changes in Existing Law Made by the Bill, as Reported

In compliance with clause 3(e) of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italics, existing law in which no change is proposed is shown in roman):

TITLE 10, UNITED STATES CODE

* * * * * * *

Subtitle A--General Military Law

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PART I--ORGANIZATION AND GENERAL MILITARY POWERS

* * * * * * *

CHAPTER 2--DEPARTMENT OF DEFENSE

Sec.
111. Executive department.
* * * * * * *
113a. Transmission of annual defense authorization request.

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Sec. 113a. Transmission of annual defense authorization request

(a) Time for Transmittal.--The Secretary of Defense shall transmit to Congress the annual defense authorization request for a fiscal year during the first 30 days after the date on which the President transmits to Congress the budget for that fiscal year pursuant to section 1105 of title 31.

(b) Defense Authorization Request Defined.--In this section, the term ``defense authorization request'', with respect to a fiscal year, means a legislative proposal submitted to Congress for the enactment of the following:

(1) Authorizations of appropriations for that fiscal year, as required by section 114 of this title.

(2) Personnel strengths for that fiscal year, as required by section 115 of this title.

(3) Any other matter that is proposed by the Secretary of Defense to be enacted as part of the

annual defense authorization bill for that fiscal year.

* * * * * * *

Sec. 115. Personnel strengths: requirement for annual authorization

(a) * * *

* * * * * * *

(f) Upon determination by the Secretary of a military department that such action would enhance manning and readiness in essential units or in critical specialties or ratings, the Secretary may increase the end strength authorized pursuant to subsection (a)(1)(A) for a fiscal year for the armed force under the jurisdiction of that Secretary or, in the case of the Secretary of the Navy, for any of the armed forces under the jurisdiction of that Secretary. Any such increase for a fiscal year--

(1) shall be by a number equal to not more than 1 percent of such authorized end strength; and

(2) shall be counted as part of the increase for that armed force for that fiscal year authorized under subsection (c)(1).

* * * * * * *

Sec. 118. Quadrennial defense review

(a) Review Required.--The Secretary of Defense shall every four years, [during a year] during the second year following a year evenly divisible by four, conduct a comprehensive examination (to be known as a ``quadrennial defense review'') of the national defense strategy, force structure, force modernization plans, infrastructure, budget plan, and other elements of the defense program and policies of the United States with a view toward determining and expressing the defense strategy of the United States and establishing a defense program for the next 20 years. Each such quadrennial defense review shall be conducted in consultation with the Chairman of the Joint Chiefs of Staff.

* * * * * * *

(d) Submission of QDR to Congressional Committees.--The Secretary shall submit a report on each quadrennial defense review to the Committees on Armed Services of the Senate and the House of Representatives. The report shall be submitted not later than September 30 of the year in which the review is conducted. The report shall include the following:

(1) * * *

* * * * * * *

(14) The national defense mission of the Coast Guard.

[(14)] (15) Any other matter the Secretary considers appropriate.

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CHAPTER 5--JOINT CHIEFS OF STAFF

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Sec. 153. Chairman: functions

(a) Planning; Advice; Policy Formulation.--Subject to the authority, direction, and control of the President and the Secretary of Defense, the Chairman of the Joint Chiefs of Staff shall be responsible for the following:

(1) * * *

* * * * * * *

CHAPTER 8--DEFENSE AGENCIES AND DEPARTMENT OF DEFENSE FIELD ACTIVITIES

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SUBCHAPTER II--MISCELLANEOUS DEFENSE AGENCY MATTERS

Sec.
201. Certain intelligence officials: consultation and concurrence regarding appointments; evaluation of performance.
[203. Director of Ballistic Missile Defense Organization.]
203. Director of Missile Defense Agency.

* * * * * * *

[Sec. 203. Director of Ballistic Missile Defense Organization]

Sec. 203. Director of Missile Defense Agency

If an officer of the armed forces on active duty is appointed to the position of Director of the [Ballistic Missile Defense Organization] Missile Defense Agency, the position shall be treated as having been designated by the President as a position of importance and responsibility for purposes of section 601 of this title and shall carry the grade of lieutenant general or general or, in the case of an officer of the Navy, vice admiral or admiral.

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CHAPTER 9--DEFENSE BUDGET MATTERS

Sec.
221. Future-years defense program: submission to Congress; consistency in budgeting.
* * * * * * *
[230. Amounts for declassification of records.]

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Sec. 223. Ballistic missile defense programs: program elements

(a) Program Elements Specified.--In the budget justification materials submitted to Congress in support of the Department of Defense budget for any fiscal year (as submitted with the budget of the President under section 1105(a) of title 31), the amount requested for activities of the [Ballistic Missile Defense Organization] Missile Defense Agency shall be set forth in accordance with program elements governing functional areas as follows:

(1) * * *

* * * * * * *

Sec. 224. Ballistic missile defense programs: display of amounts for research, development, test, and evaluation

(a) Requirement.--Any amount in the budget submitted to Congress under section 1105 of title 31 for any fiscal year for research, development, test, and evaluation for a Department of Defense missile defense program described in subsection (b) shall be set forth under the account of the Department of Defense for Defense-wide research, development, test, and evaluation and, within that account, under the subaccount (or other budget activity level) for the [Ballistic Missile Defense Organization] Missile Defense Agency.

(b) Transfer Criteria.--(1) The Secretary of Defense shall establish criteria for the transfer of responsibility for a ballistic missile defense program from the Director of the [Ballistic Missile Defense Organization] Missile Defense Agency to the Secretary of a military department. The criteria established for such a transfer shall, at a minimum, address the following:

(A) * * *

* * * * * * *

(c) Notification of Transfer.--Before responsibility for a ballistic missile defense program is transferred from the Director of the [Ballistic Missile Defense Organization] Missile Defense Agency to the Secretary of a military department, the Secretary of Defense shall submit to the congressional defense committees notice in writing of the Secretary's intent to make that transfer. The Secretary shall include with such notice a certification that the program has met the criteria established under subsection (b) for such a transfer. The transfer may then be carried out after the end of the 60-day period beginning on the date of such notice.

(d) Conforming Budget and Planning Transfers.--When a ballistic missile defense program is transferred from the [Ballistic Missile Defense Organization] Missile Defense Agency to the Secretary of a military department in accordance with this section, the Secretary of Defense shall ensure that all appropriate conforming changes are made to proposed or projected funding allocations in the future-years defense program under section 221 of this title and other Department of Defense program, budget, and planning documents.

(e) Follow-on Research, Development, Test, and Evaluation.--The Secretary of Defense shall ensure that, [before a] for each ballistic missile defense program [is] transferred from the Director of the [Ballistic Missile Defense Organization] Missile Defense Agency to the Secretary of a military department, [roles and responsibilities for research, development, test, and evaluation related to system improvements for that program are clearly defined.] responsibility for research, development, test, and evaluation related to system improvements for that program remains with the Director.

* * * * * * *

Sec. 228. Monthly reports on allocation of funds within operation and maintenance budget subactivities

(a) Monthly Report.--The Secretary of Defense shall submit [to Congress] to the congressional defense committees a monthly report on the allocation of appropriations to O&M budget activities and to the subactivities of those budget activities. Each such report shall be submitted not later than 60 days after the end of the month to which the report pertains.

* * * * * * *

[(e) O&M Budget Activity Defined.--For purposes of this section, the] (e) Definitions.--In this section:

(1) The term ``O&M budget activity'' means a budget activity within an operation and maintenance appropriation of the Department of Defense for a fiscal year.

(2) The term ``congressional defense committees'' means the Committee on Armed Services and the Committee on Appropriations of the Senate and the Committee on Armed Services and the Committee on Appropriations of the House of Representatives.

* * * * * * *

[Sec. 230. Amounts for declassification of records

[The Secretary of Defense shall include in the budget justification materials submitted to Congress in support of the Department of Defense budget for any fiscal year (as submitted with the budget of the President under section 1105(a) of title 31) specific identification of the amounts required to carry out programmed activities during that fiscal year to declassify records pursuant to Executive Order No. 12958 (50 U.S.C. 435 note) or any successor Executive order or to comply with any statutory requirement, or any request, to declassify Government records. Identification of such amounts in such budget justification materials shall be in a single display that shows the total amount for the Department of Defense and the amount for each military department and Defense Agency.]

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CHAPTER 23--MISCELLANEOUS STUDIES AND REPORTS

Sec.
480. Reports to Congress: submission in electronic form.
* * * * * * *
488. Status of female members of the armed forces: annual report.

Sec. 480. Reports to Congress: submission in electronic form

(a) Requirement.--Whenever the Secretary of Defense or any other official of the Department of Defense submits to Congress (or any committee of either House of Congress) a report that the Secretary (or other official) is required by law to submit, the Secretary (or other official) [shall, upon request by any committee of Congress to which the report is submitted or referred, provide to Congress (or each] shall provide to Congress (or such committee) a copy of the report in an electronic medium.

* * * * * * *

Sec. 488. Status of female members of the armed forces: annual report

(a) Annual Report.--The Secretary of Defense shall submit to Congress an annual report on the status of female members of the armed forces. Information in the report shall be shown for the Department of Defense as a whole and separately for each of the Army, Navy, Air Force, and Marine Corps.

(b) Matters To Be Included.--Each report under subsection (a) shall include, at a minimum, the following information with respect to female members:

(1) Access to health care.
(2) Positions open.
(3) Assignment policies.
(4) Joint spouse assignments.
(5) Deployment availability rates.
(6) Promotion and retention rates.
(7) Assignments in nontraditional fields.
(8) Assignments to command positions.
(9) Selection for service schools.
(10) Sexual harassment.

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PART II--PERSONNEL

* * * * * * *

CHAPTER 32--OFFICER STRENGTH AND DISTRIBUTION IN GRADE

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Sec. 525. Distribution of commissioned officers on active duty in general officer and flag officer grades

(a) * * *
(b)(1) * * *
(2)(A) * * *
(B) No appointment may be made in a grade above major general in the Marine Corps if that appointment would result in more than [16.2] 17.5 percent of the general officers of the Marine Corps on active duty being in grades above major general.
(5)(A) * * *

* * * * * * *

(C) This paragraph shall cease to be effective at the end of [September 30, 2003] December 31, 2004.

* * * * * * *

(8) An officer while serving in a position designated by the Secretary of Defense as Senior Military Assistant to the Secretary of Defense, if serving in the grade of lieutenant general or vice admiral, is in addition to the number that otherwise would be permitted for that officer's armed force for that grade under paragraph (1) or (2). Only one officer may be designated as Senior Military Assistant to the Secretary of Defense for purposes of this paragraph.

* * * * * * *

Sec. 526. Authorized strength: general and flag officers on active duty

(a) * * *
(b) Limited Exclusion for Joint Duty Requirements.--(1) * * *

* * * * * * *

(3) This subsection shall cease to be effective on [October 1, 2002] December 31, 2004.
[(c) Notice to Congress Upon Change in Grade for Certain Positions.--(1) Not later than 60 days before an action specified in paragraph (2) may become effective, the Secretary of Defense shall submit to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives a report providing notice of the intended action and an analytically based justification for the intended action.
[(2) Paragraph (1) applies in the case of the following actions:
[(A) A change in the grade authorized as of July 1, 1994, for a general officer position in the National Guard Bureau, a general or flag officer position in the Office of a Chief of a reserve component, or a general or flag officer position in the headquarters of a reserve component command.
[(B) Assignment of a reserve component officer to a general officer position in the National Guard Bureau, to a general or flag officer position in the Office of a Chief of a reserve component, or to a general or flag officer position in the headquarters of a reserve component command in a grade other than the grade authorized for that position as of July 1, 1994.

[(C) Assignment of an officer other than a general or flag officer as the military executive to the Reserve Forces Policy Board.]

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CHAPTER 35--TEMPORARY APPOINTMENTS IN OFFICER GRADES

* * * * * * *

Sec. 604. Senior joint officer positions: recommendations to the Secretary of Defense

(a) * * *

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(c) Expiration.--This section shall cease to be effective at the end of [September 30, 2003] December 31, 2004.

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CHAPTER 38--JOINT OFFICER MANAGEMENT

* * * * * * *

Sec. 663. Education

(a) * * *

* * * * * * *

(e) Duration of Principal Course of Instruction at Joint Forces Staff College.--(1) * * *

(2) In this subsection, the term ``principal course of instruction'' means any course of instruction offered at the [Armed Forces Staff College] Joint Forces Staff College as Phase II joint professional military education.

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CHAPTER 39--ACTIVE DUTY

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Sec. 691. Permanent end strength levels to support two major regional contingencies

(a) * * *

(b) Unless otherwise provided by law, the number of members of the armed forces (other than the Coast Guard) on active duty at the end of any fiscal year shall be not less than the following:

(1) For the Army, [480,000] 484,800.

(2) For the Navy, [376,000] 379,457.
(3) For the Marine Corps, [172,600] 175,000.
(4) For the Air Force, [358,800] 360,795.

* * * * * * *

CHAPTER 40--LEAVE

Sec.
701. Entitlement and accumulation.
* * * * * * *
709. Voluntary transfers of leave.

* * * * * * *

Sec. 705. Rest and recuperative absence for qualified enlisted members extending duty at designated locations overseas

(a) * * *
(b) The benefits authorized by subsection (a) are--
(1) * * *
(2) a period of rest and [recuperative] recuperation absence for not more than 15 days and round-trip transportation at Government expense from the location of the extended tour of duty to the nearest port in the 48 contiguous States and return, or to an alternate location at a cost not to exceed the cost of transportation to the nearest port in the 48 contiguous States, and return.

* * * * * * *

Sec. 709. Voluntary transfers of leave

(a) Program.--The Secretary concerned shall, by regulation, establish a program under which leave accrued by a member of an armed force may be transferred to another member of the same armed force who requires additional leave because of a qualifying emergency. Any such transfer of leave may be made only upon the voluntary written application of the member whose leave is to be transferred.
(b) Approval of Commanding Officer Required.--Any transfer of leave under a program under this section may only be made with the approval of the commanding officer of the leave donor and the leave recipient.
(c) Qualifying Emergency.--In this section, the term ``qualifying emergency'', with respect to a member of the armed forces, means a circumstance that--
(1) is likely to require the prolonged absence of the member from duty; and
(2) is due to--
(A) a medical condition of a member of the immediate family of the member; or
(B) any other hardship that the Secretary concerned determines appropriate for purposes of this section.
(d) Military Department Regulations.--Regulations prescribed

under this section by the Secretaries of the military department shall be as uniform as practicable and shall be subject to approval by the Secretary of Defense.

* * * * * * *

CHAPTER 41--SPECIAL APPOINTMENTS, ASSIGNMENTS, DETAILS, AND DUTIES

* * * * * * *

Sec. 721. General and flag officers: limitation on appointments, assignments, details, and duties outside an officer's own service

(a) * * *

* * * * * * *

(d) Treatment of Officers Holding Multiple Positions.--[(1)] If an officer described in subsection (b) simultaneously holds both a position external to that officer's armed force and another position not external to that officer's armed force, the Secretary of Defense shall determine whether that officer shall be counted for the purposes of this section.

[(2) The Secretary of Defense shall submit to Congress an annual report on the number of officers to whom paragraph (1) was applicable during the year covered by the report. The report shall set forth the determination made by the Secretary under that paragraph in each such case.]

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CHAPTER 47--UNIFORM CODE OF MILITARY JUSTICE

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SUBCHAPTER VII--TRIAL PROCEDURE

Sec.

Art.

836.

36.

President may prescribe rules.

* * * * * * *

852a.

52a.

Right of accused to request sentencing by military judge rather than by members.

* * * * * * *

Sec. 852a. Art. 52a. Right of accused to request sentencing by military judge rather than by members

(a) In the case of an accused convicted of an offense by a court-martial composed of a military judge and members, the sentence shall be tried before and adjudged by the military judge rather than the members if, after the findings are announced and before evidence in the sentencing proceeding is introduced, the accused, knowing the identity of the military judge and after consultation with defense counsel, requests orally on the record or in writing that the sentence be tried before and adjudged by the military judge rather than the members.

(b) This section shall not apply with respect to an offense for which the death penalty may be adjudged unless the case has been previously referred to trial as a noncapital case.

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CHAPTER 49--MISCELLANEOUS PROHIBITIONS AND PENALTIES

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Sec. 986. Security clearances: limitations

(a) * * *

* * * * * * *

[(e) Annual Report.--Not later than February 1 each year, the Secretary of Defense shall submit to the Committees on Armed Services of the Senate and House of Representatives a report identifying each waiver issued under subsection (d) during the preceding year with an explanation for each case of the disqualifying factor in subsection (c) that applied, and the reason for the waiver of the disqualification.]

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CHAPTER 54--COMMISSARY AND EXCHANGE BENEFITS

Sec.
1061. Survivors of certain Reserve and Guard members.
* * * * * * *
[1063a. Use of commissary stores and MWR retail facilities: members of National Guard serving in federally declared disaster.]
1063a. Use of commissary stores and MWR retail facilities: members of National Guard serving in federally declared disaster or national emergency.

* * * * * * *

[Sec. 1063a. Use of commissary stores and MWR retail facilities:

members of National Guard serving in federally declared disaster]

Sec. 1063a. Use of commissary stores and MWR retail facilities: members of National Guard serving in federally declared disaster or national emergency

(a) Eligibility of Members.--A member of the National Guard who, although not in Federal service, is called or ordered to duty in response to a federally declared disaster or national emergency shall be permitted to use commissary stores and MWR retail facilities during the period of such duty on the same basis as members of the armed forces on active duty.

* * * * * * *

(c) Definitions.--In this section:

(1) * * *

* * * * * * *

(3) National emergency.--The term ``national emergency'' means a national emergency declared by the President or Congress.

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CHAPTER 55--MEDICAL AND DENTAL CARE

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Sec. 1076a. TRICARE dental program

(a) * * *

* * * * * * *

(k) Eligible Dependent Defined.--In this section, the term ``eligible dependent''--

(1) * * *

(2) includes any such dependent of a member who dies while on active duty for a period of more than 30 days or a member of the Ready Reserve if the dependent is enrolled on the date of the death of the member in a dental benefits plan established under subsection (a) (or, if not enrolled, if the member discontinued participation under subsection (f)), except that the term does not include the dependent after the end of the three-year period beginning on the date of the member's death.

* * * * * * *

Sec. 1079. Contracts for medical care for spouses and children: plans

(a) * * *

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(i)(1) * * *

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(3) Except in the case of an emergency or in the case of a person eligible for health care benefits under section 1086(d)(2) of this title for whom payment for such services is made under subsection 1086(d)(3) of this title, the Secretary of Defense shall require preadmission authorization before inpatient mental health services may be provided to persons covered by this section or section 1086 of this title. In the case of the provision of emergency inpatient mental health services, approval for the continuation of such services shall be required within 72 hours after admission.

* * * * * * *

(p)(1)(A) Subject to such exceptions as the Secretary of Defense considers necessary, coverage for medical care under this section for the dependents [referred to in subsection (a) of a member of the uniformed services referred to in section 1074(c)(3) of this title who are residing with the member] described in subparagraph (B), and standards with respect to timely access to such care, shall be comparable to coverage for medical care and standards for timely access to such care under the managed care option of the TRICARE program known as TRICARE Prime.

(B) A dependent referred to in subparagraph (A) is--

(i) a dependent referred to in subsection (a) of a member of the uniformed services referred to in section 1074(c)(3) of this title, who is residing with the member; or

(ii) a dependent referred to in subsection (a) of a member of the uniformed services with a permanent duty assignment for which the dependent is not authorized to accompany the member and one of the following circumstances exists:

(I) The dependent continues to reside at the location of the former duty assignment of the member (or residence in the case of a member of a reserve component ordered to active duty for a period of more than 30 days), and that location is more than 50 miles, or approximately one hour of driving time, from the nearest military medical treatment facility that can adequately provide needed health care.

(II) There is no reasonable expectation the member will return to the location of the former duty assignment, and the dependent moves to a location that is more than 50 miles, or approximately one hour of driving time, from the nearest military medical treatment facility that can adequately provide needed health care.

(q) For purposes of designating institutional and non-institutional health care providers authorized to provide care under this section, the Secretary of Defense shall prescribe regulations (in consultation with the other administering Secretaries) that will, to the extent practicable and subject

to the limitations of subsection (a), so designate any provider authorized to provide care under title XVIII of the Social Security Act (42 U.S.C. 1395 et seq.).

* * * * * * *

Sec. 1095. Health care services incurred on behalf of covered beneficiaries: collection from third-party payers

(a) * * *

* * * * * * *

(g)[(1)] Amounts collected under this section from a third-party payer or under any other provision of law from any other payer for health care services provided at or through a facility of the uniformed services shall be credited to the appropriation supporting the maintenance and operation of the facility and shall not be taken into consideration in establishing the operating budget of the facility.

[(2) Not later than February 15 of each year, the Secretary of Defense shall submit to Congress a report specifying for each facility of the uniformed services the amount credited to the facility under this subsection during the preceding fiscal year.]

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CHAPTER 56--DEPARTMENT OF DEFENSE MEDICARE-ELIGIBLE RETIREE HEALTH CARE FUND

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Sec. 1111. Establishment and purpose of Fund; definitions; authority to enter into agreements

(a) * * *

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(c) The Secretary of Defense [may enter into an agreement with any other administering Secretary] shall enter into an agreement with each other administering Secretary (as defined in section 1072(3) of this title) for participation in the Fund by a uniformed service under the jurisdiction of that Secretary. [Any] Each such agreement shall require that Secretary to determine contributions to the Fund on behalf of the members of the uniformed service under the jurisdiction of that Secretary in a manner comparable to the determination with respect to contributions to the Fund made by the Secretary of Defense under section 1116 of this title, and such administering Secretary may make such contributions.

* * * * * * *

Sec. 1116. Payments into the Fund

(a) * * *

* * * * * * *

[(c) Amounts paid into the Fund under subsection (a) shall be paid from funds available for the health care programs of the participating uniformed services under the jurisdiction of the respective administering Secretaries.]

(c) Amounts paid into the Fund under subsection (a) shall be paid from funds available for the pay of members of the participating uniformed services under the jurisdiction of the respective administering Secretaries.

* * * * * * *

CHAPTER 58--BENEFITS AND SERVICES FOR MEMBERS BEING SEPARATED OR RECENTLY SEPARATED

* * * * * * *

Sec. 1145. Health benefits

(a) Transitional Health Care.--(1) For the applicable time period described in paragraph (3), a member of the armed forces who is separated from active duty as described in paragraph (2) (and the dependents of the member) shall be entitled to receive--

(A) * * *

* * * * * * *

CHAPTER 71--COMPUTATION OF RETIRED PAY

Sec.
1401. Computation of retired pay.
* * * * * * *
[1413. Special compensation for certain severely disabled uniformed services retirees.
[1414. Members eligible for retired pay who have service-connected disabilities: payment of retired pay and veterans' disability compensation; contingent authority.]
1414. Members eligible for retired pay who have service-connected disabilities rated at 60 percent or higher: concurrent payment of retired pay and veterans' disability compensation.

* * * * * * *

Sec. 1401a. Adjustment of retired pay and retainer pay to reflect changes in Consumer Price Index

(a) * * *

* * * * * * *

(c) First COLA Adjustment for Members With Retired Pay

Computed Using Final Basic Pay.--

(1) First adjustment with intervening increase in basic pay.--Notwithstanding subsection (b) but subject to subsection (f)(2), if a person described in paragraph (3) becomes entitled to retired pay based on rates of monthly basic pay that became effective after the last day of the calendar quarter of the base index, the retired pay of the member or former member shall be increased on the effective date of the next adjustment of retired pay under subsection (b) only by the percent (adjusted to the nearest one-tenth of 1 percent) by which--

(A) the price index for the base quarter of that year, exceeds

(B) the price index for the calendar quarter immediately before the calendar quarter in which the rates of monthly basic pay on which the retired pay is based became effective.

(2) First adjustment with no intervening increase in basic pay.--If a person described in paragraph (3) becomes entitled to retired pay on or after the effective date of an adjustment in retired pay under subsection (b) but before the effective date of the next increase in the rates of monthly basic pay, the retired pay of the member or former member shall be increased (subject to subsection (f)(2) as applied to other members whose retired pay is computed on the current rates of basic pay in the most recent adjustment under this section), effective on the date the member becomes entitled to that pay, by the percent (adjusted to the nearest one-tenth of 1 percent) by which--

(A) the base index, exceeds

(B) the price index for the calendar quarter immediately before the calendar quarter in which the rates of monthly basic pay on which the retired pay is based became effective.

(d) First COLA Adjustment for Members With Retired Pay Computed Using High-Three.--Notwithstanding subsection (b) but subject to subsection (f)(2), the retired pay of a member or former member of an armed force who first became a member of a uniformed service before August 1, 1986, or on or after August 1, 1986, if the member or former member did not elect to receive a bonus under section 322 of title 37 and whose retired pay base is determined under section 1407 of this title shall be increased on the effective date of the first adjustment of retired pay under subsection (b) after the member or former member becomes entitled to retired pay by the percent (adjusted to the nearest one-tenth of 1 percent) equal to the difference between the percent by which--

(1) the price index for the base quarter of that year, exceeds

(2) the price index for the calendar quarter immediately before the calendar quarter during which the member became entitled to retired pay.

(e) Pro Rating of Initial Adjustment.--Notwithstanding subsection (b) but subject to subsection (f)(2), the retired pay of a member or former member of an armed force who first became a member of a uniformed service on or after August 1, 1986, and elected to receive a bonus under section 322 of title

37 shall be increased on the effective date of the first adjustment of retired pay under subsection (b) after the member or former member becomes entitled to retired pay by the percent (adjusted to the nearest one-tenth of 1 percent) equal to the difference between--

(1) * * *

* * * * * * *

(f) Prevention of Pay Inversions.--

(1) Prevention of retired pay inversions.--Notwithstanding any other provision of law, the monthly retired pay of a member or a former member of an armed force who initially became entitled to that pay on or after January 1, 1971, may not be less than the monthly retired pay to which he would be entitled if he had become entitled to retired pay at an earlier date based on the grade in which the member is retired, adjusted to reflect any applicable increases in such pay under this section. In computing the amount of retired pay to which such a member or former member would have been entitled on that earlier date, the computation shall be based on his grade, length of service, and the rate of basic pay applicable to him at that time, except that such computation may not be based on a rate of basic pay for a grade higher than the grade in which the member is retired. This subsection does not authorize any increase in the monthly retired pay to which a member was entitled for any period before October 7, 1975.

(2) Prevention of cola inversions.--The percentage of the first adjustment under this section in the retired pay of any person, as determined under subsection (c)(1), (c)(2), (d), or (e), may not exceed the percentage increase in retired pay determined under subsection (b)(2) that is effective on the same date as the effective date of such first adjustment.

* * * * * * *

[Sec. 1413. Special compensation for certain severely disabled uniformed services retirees

[(a) Authority.--The Secretary concerned shall pay to each eligible disabled uniformed services retiree a monthly amount determined under subsection (b). If the provisions of subsection (a) of section 1414 of this title become effective in accordance with subsection (f) of that section, payments under this section shall be terminated effective as of the month beginning on the effective date specified in subsection (e) of that section.

[(b) Amount.--The amount to be paid to an eligible disabled uniformed services retiree in accordance with subsection (a) is the following:

[(1) For payments for months beginning with February 2002 and ending with December 2002, the following:

[(A) For any month for which the retiree has a qualifying service-connected disability rated as total, $300.

[(B) For any month for which the retiree has a qualifying service-connected disability rated as 90 percent, $200.

[(C) For any month for which the retiree has a qualifying service-connected disability rated as 80 percent or 70 percent, $100.

[(D) For any month for which the retiree has a qualifying service-connected disability rated as 60 percent, $50.

[(2) For payments for months beginning with January 2003 and ending with September 2004, the following:

[(A) For any month for which the retiree has a qualifying service-connected disability rated as total, $325.

[(B) For any month for which the retiree has a qualifying service-connected disability rated as 90 percent, $225.

[(C) For any month for which the retiree has a qualifying service-connected disability rated as 80 percent, $125.

[(D) For any month for which the retiree has a qualifying service-connected disability rated as 70 percent, $100.

[(E) For any month for which the retiree has a qualifying service-connected disability rated as 60 percent, $50.

[(3) For payments for months after September 2004, the following:

[(A) For any month for which the retiree has a qualifying service-connected disability rated as total, $350.

[(B) For any month for which the retiree has a qualifying service-connected disability rated as 90 percent, $250.

[(C) For any month for which the retiree has a qualifying service-connected disability rated as 80 percent, $150.

[(D) For any month for which the retiree has a qualifying service-connected disability rated as 70 percent, $125.

[(E) For any month for which the retiree has a qualifying service-connected disability rated as 60 percent, $50.

[(c) Eligible Members.--An eligible disabled uniformed services retiree referred to in subsection (a) is a member of the uniformed services in a retired status who--

[(1) completed at least 20 years of service in the uniformed services that are creditable for purposes of computing the amount of retired pay to which the member is entitled; and

[(2) has a qualifying service-connected disability.

[(d) Qualifying Service-Connected Disability Defined.--In this section, the term ``qualifying service-connected disability'' means a service-connected disability that--

[(1) was incurred or aggravated in the performance of duty as a member of a uniformed service, as determined by the Secretary concerned; and

[(2) is rated as not less than 60 percent disabling--

[(A) by the Secretary concerned as of the date on which the member is retired from the

uniformed services; or

[(B) by the Secretary of Veterans Affairs within four years following the date on which the member is retired from the uniformed services.

[(e) Status of Payments.--Payments under this section are not retired pay.

[(f) Source of Funds.--Payments under this section for any fiscal year shall be paid out of funds appropriated for pay and allowances payable by the Secretary concerned for that fiscal year.

[(g) Other Definitions.--In this section:

[(1) The term ``service-connected'' has the meaning given that term in section 101 of title 38.

[(2) The term ``disability rated as total'' means--

[(A) a disability that is rated as total under the standard schedule of rating disabilities in use by the Department of Veterans Affairs; or

[(B) a disability for which the scheduled rating is less than total but for which a rating of total is assigned by reason of inability of the disabled person concerned to secure or follow a substantially gainful occupation as a result of service-connected disabilities.

[(3) The term ``retired pay'' includes retainer pay, emergency officers' retirement pay, and naval pension.

[Sec. 1414. Members eligible for retired pay who have service-connected disabilities: payment of retired pay and veterans' disability compensation; contingent authority

[(a) Payment of Both Retired Pay and Compensation.--Subject to subsection (b), a member or former member of the uniformed services who is entitled to retired pay (other than as specified in subsection (c)) and who is also entitled to veterans' disability compensation is entitled to be paid both without regard to sections 5304 and 5305 of title 38, subject to the enactment of qualifying offsetting legislation as specified in subsection (f).

[(b) Special Rule for Chapter 61 Career Retirees.--The retired pay of a member retired under chapter 61 of this title with 20 years or more of service otherwise creditable under section 1405 of this title at the time of the member's retirement is subject to reduction under sections 5304 and 5305 of title 38, but only to the extent that the amount of the member's retired pay under chapter 61 of this title exceeds the amount of retired pay to which the member would have been entitled under any other provision of law based upon the member's service in the uniformed services if the member had not been retired under chapter 61 of this title.

[(c) Exception.--Subsection (a) does not apply to a member retired under chapter 61 of this title with less than 20 years of service otherwise creditable under section 1405 of this title at the time of the member's retirement.

[(d) Definitions.--In this section:

[(1) The term ``retired pay'' includes retainer pay, emergency officers' retirement pay, and naval pension.

[(2) The term ``veterans' disability compensation''

has the meaning given the term ``compensation'' in section 101(12) of title 38.

[(e) Effective Date.--If qualifying offsetting legislation (as defined in subsection (f)) is enacted, the provisions of subsection (a) shall take effect on--

[(1) the first day of the first month beginning after the date of the enactment of such qualifying offsetting legislation; or

[(2) the first day of the fiscal year that begins in the calendar year in which such legislation is enacted, if that date is later than the date specified in paragraph (1).

[(f) Effectiveness Contingent on Enactment of Offsetting Legislation.--(1) The provisions of subsection (a) shall be effective only if--

[(A) the President, in the budget for any fiscal year, proposes the enactment of legislation that, if enacted, would be qualifying offsetting legislation; and

[(B) after that budget is submitted to Congress, there is enacted qualifying offsetting legislation.

[(2) In this subsection:

[(A) The term ``qualifying offsetting legislation'' means legislation (other than an appropriations Act) that includes provisions that--

[(i) offset fully the increased outlays to be made by reason of the provisions of subsection (a) for each of the first 10 fiscal years beginning after the date of the enactment of such legislation;

[(ii) expressly state that they are enacted for the purpose of the offset described in clause (i); and

[(iii) are included in full on the PayGo scorecard.

[(B) The term ``PayGo scorecard'' means the estimates that are made by the Director of the Congressional Budget Office and the Director of the Office of Management and Budget under section 252(d) of the Balanced Budget and Emergency Deficit Control Act of 1985 (2 U.S.C. 902(d)) with respect to the ten fiscal years following the date of the enactment of the legislation that is qualifying offsetting legislation for purposes of this section.]

Sec. 1414. Members eligible for retired pay who have service-connected disabilities rated at 60 percent or higher: concurrent payment of retired pay and veterans' disability compensation

(a) Payment of Both Retired Pay and Compensation.--Subject to subsection (b), a member or former member of the uniformed services who is entitled for any month to retired pay and who is also entitled for that month to veterans' disability compensation for a qualifying service-connected disability (hereinafter in this section referred to as a ``qualified retiree'') is entitled to be paid both for that month without regard to sections 5304 and 5305 of title 38. For fiscal years 2003 through 2006, payment of retired pay to such a member or former member is subject to subsection (c).

(b) Special Rules for Chapter 61 Disability Retirees.--

(1) Career retirees.--The retired pay of a member retired under chapter 61 of this title with 20 years or more of service otherwise creditable under section 1405 of this title at the time of the member's retirement is subject to reduction under sections 5304 and 5305 of title 38, but only to the extent that the amount of the member's retired pay under chapter 61 of this title exceeds the amount of retired pay to which the member would have been entitled under any other provision of law based upon the member's service in the uniformed services if the member had not been retired under chapter 61 of this title.

(2) Disability retirees with less than 20 years of service.--Subsection (a) does not apply to a member retired under chapter 61 of this title with less than 20 years of service otherwise creditable under section 1405 of this title at the time of the member's retirement.

(c) Phase-in of Full Concurrent Receipt.--For fiscal years 2003 through 2006, retired pay payable to a qualified retiree shall be determined as follows:

(1) Fiscal year 2003.--For a month during fiscal year 2003, the amount of retired pay payable to a qualified retiree is the amount (if any) of retired pay in excess of the current baseline offset plus the following:

(A) For a month for which the retiree receives veterans' disability compensation for a qualifying service-connected disability rated as total, $750.

(B) For a month for which the retiree receives veterans' disability compensation for a qualifying service-connected disability rated as 90 percent, $500.

(C) For a month for which the retiree receives veterans' disability compensation for a qualifying service-connected disability rated as 80 percent, $250.

(D) For a month for which the retiree receives veterans' disability compensation for a qualifying service-connected disability rated as 70 percent, $250.

(E) For a month for which the retiree receives veterans' disability compensation for a qualifying service-connected disability rated as 60 percent, $125.

(2) Fiscal year 2004.--For a month during fiscal year 2004, the amount of retired pay payable to a qualified retiree is the sum of--

(A) the amount specified in paragraph (1) for that qualified retiree; and

(B) 23 percent of the difference between (i) the current baseline offset, and (ii) the amount specified in paragraph (1) for that member's disability.

(3) Fiscal year 2005.--For a month during fiscal year 2005, the amount of retired pay payable to a qualified retiree is the sum of--

(A) the amount determined under paragraph (2) for that qualified retiree; and

(B) 30 percent of the difference between (i) the current baseline offset, and (ii) the amount determined under paragraph (2) for that qualified retiree.

(4) Fiscal year 2006.--For a month during fiscal year 2006, the amount of retired pay payable to a qualified retiree is the sum of--

(A) the amount determined under paragraph (3) for that qualified retiree; and

(B) 64 percent of the difference between (i) the current baseline offset, and (ii) the amount determined under paragraph (3) for that qualified retiree.

(d) Definitions.--In this section:

(1) Retired pay.--The term ``retired pay'' includes retainer pay, emergency officers' retirement pay, and naval pension.

(2) Veterans' disability compensation.--The term ``veterans' disability compensation'' has the meaning given the term ``compensation'' in section 101(13) of title 38.

(3) Service-connected.--The term ``service-connected'' has the meaning given that term in section 101(16) of title 38.

(4) Qualifying service-connected disability.--The term ``qualifying service-connected disability'' means a service-connected disability or combination of service-connected disabilities that is rated as not less than 60 percent disabling by the Secretary of Veterans Affairs.

(5) Disability rated as total.--The term ``disability rated as total'' means--

(A) a disability, or combination of disabilities, that is rated as total under the standard schedule of rating disabilities in use by the Department of Veterans Affairs; or

(B) a disability, or combination of disabilities, for which the scheduled rating is less than total but for which a rating of total is assigned by reason of inability of the disabled person concerned to secure or follow a substantially gainful occupation as a result of service-connected disabilities.

(6) Current baseline offset.--

(A) In general.--The term ``current baseline offset'' for any qualified retiree means the amount for any month that is the lesser of--

(i) the amount of the applicable monthly retired pay of the qualified retiree for that month; and

(ii) the amount of monthly veterans' disability compensation to which the qualified retiree is entitled for that month.

(B) Applicable retired pay.--In subparagraph (A), the term ``applicable retired pay'' for a qualified retiree means the amount of monthly retired pay to which the qualified retiree is entitled, determined without regard to this section or sections 5304 and 5305 of title 38),

except that in the case of such a retiree who was retired under chapter 61 of this title, such amount is the amount of retired pay to which the member would have been entitled under any other provision of law based upon the member's service in the uniformed services if the member had not been retired under chapter 61 of this title.

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CHAPTER 74--DEPARTMENT OF DEFENSE MILITARY RETIREMENT FUND

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Sec. 1465. Determination of contributions to the Fund

(a) * * *
(b)(1) * * *

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(3) At the same time that the Secretary of Defense makes the determination required by paragraph (1) for any fiscal year, the Secretary shall determine the amount of the Treasury contribution to be made to the Fund for the next fiscal year under section 1466(b)(2)(D) of this title. That amount shall be determined in the same manner as the determination under paragraph (1) of the total amount of Department of Defense contributions to be made to the Fund during that fiscal year under section 1466(a) of this title, except that for purposes of this paragraph the Secretary, in making the calculations required by subparagraphs (A) and (B) of that paragraph, shall use the single level percentages determined under subsection (c)(4), rather than those determined under subsection (c)(1).

(c)(1) Not less often than every four years, the Secretary of Defense shall carry out an actuarial valuation of Department of Defense military retirement and survivor benefit programs. Each actuarial valuation of such programs shall include--

(A) a determination (using the aggregate entry-age normal cost method) of a single level percentage of basic pay for members of the armed forces (other than the Coast Guard) on active duty (other than active duty for training) or full-time National Guard duty (other than full-time National Guard duty for training only), to be determined without regard to section 1414 of this title; and

(B) a determination (using the aggregate entry-age normal cost method) of a single level percentage of basic pay and of compensation (paid pursuant to section 206 of title 37) for members of the Ready Reserve of the armed forces (other than the Coast Guard and other than members on full-time National Guard duty other than for training) who are not otherwise described by subparagraph (A), to be determined without regard to section 1414 of this title.

Such single level percentages shall be used for the purposes of subsection (b)(1) and section 1466(a) of this title.

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(4) Whenever the Secretary carries out an actuarial valuation under paragraph (1), the Secretary shall include as part of such valuation the following:

(A) A determination of a single level percentage determined in the same manner as applies under subparagraph (A) of paragraph (1), but based only upon the provisions of section 1414 of this title.

(B) A determination of a single level percentage determined in the same manner as applies under subparagraph (B) of paragraph (1), but based only upon the provisions of section 1414 of this title.

Such single level percentages shall be used for the purposes of subsection (b)(3).

[(4)] (5) Contributions to the Fund in accordance with amortization schedules under paragraphs (2) and (3) shall be made as provided in section 1466(b) of this title.

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Sec. 1466. Payments into the Fund

(a) * * *

(b)(1) At the beginning of each fiscal year the Secretary of the Treasury shall promptly pay into the Fund from the General Fund of the Treasury the amount certified to the Secretary by the Secretary of Defense under paragraph (3). Such payment shall be the contribution to the Fund for that fiscal year required by [sections 1465(a) and 1465(c)] sections 1465(a), 1465(b)(3), 1465(c)(2), and 1465(c)(3) of this title.

(2) At the beginning of each fiscal year the Secretary of Defense shall determine the sum of the following:

(A) * * *

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(D) The amount for that year determined by the Secretary of Defense under section 1465(b)(3) of this title for the cost to the Fund arising from increased amounts payable from the Fund by reason of section 1414 of this title.

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CHAPTER 75--DECEASED PERSONNEL

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SUBCHAPTER II--DEATH BENEFITS

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Sec. 1491. Funeral honors functions at funerals for veterans

(a) * * *

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(d) Support.--[To provide a](1) To support a funeral honors detail under this section, the Secretary of a military department may provide the following:

[(1) Transportation, or reimbursement for transportation, and expenses for a person who participates in the funeral honors detail and is not a member of the armed forces or an employee of the United States.]

(A) For a person who participates in a funeral honors detail (other than a person who is a member of the armed forces not in a retired status or an employee of the United States), either transportation (or reimbursement for transportation) and expenses or the daily stipend prescribed under paragraph (2).

[(2) Materiel, equipment, and training for] (B) For members of a veterans organization or other organization referred to in subsection (b)(2) and for members of the armed forces in a retired status, materiel, equipment, and training.

[(3) Articles of clothing for] (C) For members of a veterans organization or other organization referred to in subsection (b)(2), articles of clothing that, as determined by the Secretary concerned, are appropriate as a civilian uniform for persons participating in a funeral honors detail.

(2) The Secretary of Defense shall prescribe annually a flat rate daily stipend for purposes of paragraph (1)(A). Such stipend shall be set at a rate so as to encompass typical costs for transportation and other miscellaneous expenses for persons participating in funeral honors details who are members of the armed forces in a retired status and other persons are not members of the armed forces or employees of the United States.

(3) A stipend paid under this subsection to a member of the armed forces in a retired status is in addition to any compensation to which the member is entitled under section 435(a)(2) of title 37 and any other compensation to which the member may be entitled.

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CHAPTER 76--MISSING PERSONS

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Sec. 1501. System for accounting for missing persons

(a) Office for Missing Personnel.--(1) The Secretary of Defense shall establish within the Office of the Secretary of Defense an office to have responsibility for Department of Defense policy relating to missing persons. Such office shall be known as the Defense Prisoner of War/Missing Personnel Office. Subject to the authority, direction, and control of the Secretary of Defense, the responsibilities of the office shall include--

(A) * * *

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(5)(A) The Secretary of Defense shall ensure that the office is provided sufficient military and civilian personnel levels, and sufficient funding, to enable the office to fully perform its complete range of missions. The Secretary shall ensure that Department of Defense programming, planning, and budgeting procedures are structured so as to ensure compliance with the preceding sentence for each fiscal year.

(B) For any fiscal year, the number of military and civilian personnel assigned or detailed to the office may not be less than the number requested in the President's budget for fiscal year 2003, unless a level below such number is expressly required by law.

(C) For any fiscal year, the level of funding allocated to the office within the Department of Defense may not be below the level requested for such purposes in the President's budget for fiscal year 2003, unless such a level of funding is expressly required by law.

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CHAPTER 79--CORRECTION OF MILITARY RECORDS

Sec.
1551. Correction of name after separation from service under an assumed name.
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1559. Personnel limitation.

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Sec. 1559. Personnel limitation

(a) Limitation.--During fiscal years 2003, 2004, and 2005, the Secretary of a military department may not carry out any reduction in the number of military and civilian personnel assigned to duty with the service review agency for that military department below the baseline number for that agency until--

(1) the Secretary submits to Congress a report that--

(A) describes the reduction proposed to be made;

(B) provides the Secretary's rationale for that reduction; and

(C) specifies the number of such personnel that would be assigned to duty with that agency after the reduction; and

(2) a period of 90 days has elapsed after the date on which the report is submitted.

(b) Baseline Number.--The baseline number for a service review agency under this section is--

(1) for purposes of the first report with respect to a service review agency under this section, the number of military and civilian personnel assigned to duty with that agency as of January 1, 2002; and

(2) for purposes of any subsequent report with respect to a service review agency under this section, the number of such personnel specified in the most recent report with respect to that agency under this section.

(c) Service Review Agency Defined.--In this section, the term ``service review agency'' means--

(1) with respect to the Department of the Army, the Army Review Boards Agency;

(2) with respect to the Department of the Navy, the Board for Correction of Naval Records; and

(3) with respect to the Department of the Air Force, the Air Force Review Boards Agency.

CHAPTER 81--CIVILIAN EMPLOYEES

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Sec. 1588. Authority to accept certain voluntary services

(a) Authority To Accept Services.--Subject to subsection (b) and notwithstanding section 1342 of title 31, the Secretary concerned may accept from any person the following services:

(1) * * *

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(6) Voluntary services as a proctor for administration to secondary school students of the test known as the ``Armed Services Vocational Aptitude Battery''.

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CHAPTER 87--DEFENSE ACQUISITION WORKFORCE

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SUBCHAPTER IV--EDUCATION AND TRAINING

Sec.
1741. Policies and programs: establishment and implementation.
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[2410h.] 1747. Acquisition fellowship program.
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[Sec. 2410h.] Sec. 1747. Acquisition fellowship program

(a) * * *

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CHAPTER 88--MILITARY FAMILY PROGRAMS AND MILITARY CHILD CARE

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SUBCHAPTER II--MILITARY CHILD CARE

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Sec. 1798. Child care services and youth program services for dependents: financial assistance for providers

(a) * * *

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[(d) Biennial Report.--(1) Every two years the Secretary of Defense shall submit to Congress a report on the exercise of authority under this section. The report shall include an evaluation of the effectiveness of that authority for meeting the needs of members of the armed forces or employees of the Department of Defense for child care services and youth program services. The report may include any recommendations for legislation that the Secretary considers appropriate to enhance the capability of the Department of Defense to meet those needs.

[(2) A biennial report under this subsection may be combined with the biennial report under section 1799(d) of this title into a single report for submission to Congress.]

Sec. 1799. Child care services and youth program services for dependents: participation by children and youth otherwise ineligible

(a) * * *

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[(d) Biennial Report.--(1) Every two years the Secretary of Defense shall submit to Congress a report on the exercise of authority under this section. The report shall include an evaluation of the effectiveness of that authority for achieving the objectives set out under subsection (c). The report may include any recommendations for legislation that the Secretary considers appropriate to enhance the capability of the Department of Defense to attain those objectives.

[(2) A biennial report under this subsection may be combined with the biennial report under section 1798(d) of this title into a single report for submission to Congress.]

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PART III--TRAINING AND EDUCATION

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CHAPTER 101--TRAINING GENERALLY

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Sec. 2010. Participation of developing countries in combined exercises: payment of incremental expenses

(a) * * *

[(b) The Secretary of Defense shall submit to Congress a report each year, not later than March 1, containing--

[(1) a list of the developing countries for which expenses have been paid by the United States under this section during the preceding year; and

[(2) the amounts expended on behalf of each government.]

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CHAPTER 103--SENIOR RESERVE OFFICERS' TRAINING CORPS

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Sec. 2107. Financial assistance program for specially selected members

(a) * * *

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(h)(1) [Not more than 29,500 cadets and midshipmen appointed under this section may be in the financial assistance programs at any one time.] The Secretary of Defense shall determine the number of cadets and midshipmen appointed under this section who may be in the financial assistance programs at any one time in each military department.

* * * * * * *

(i) The Secretary of each military department shall seek to achieve an increase in the number of agreements entered into under this section so as to achieve an increase, by the 2006-2007 academic year, of not less than 400 in the number of cadets or midshipmen, as the case may be, enrolled under this section, compared to such number enrolled for the 2002-2003 academic year. In the case of the Secretary of the Navy, the Secretary shall seek to ensure that not less than one-third of such increase in agreements under this section are with students enrolled (or seeking to enroll) in programs of study leading to a baccalaureate degree in nuclear engineering or another appropriate technical, scientific, or engineering field of study.

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CHAPTER 105--ARMED FORCES HEALTH PROFESSIONS FINANCIAL ASSISTANCE PROGRAMS

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SUBCHAPTER II--NURSE OFFICER CANDIDATE ACCESSION PROGRAM

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Sec. 2130a. Financial assistance: nurse officer candidates

(a) Bonus Authorized.--(1) A person described in subsection (b) who, during the period beginning on November 29, 1989, and ending on December 31, [2002] 2003, executes a written agreement in accordance with subsection (c) to accept an appointment as a nurse officer may, upon the acceptance of the agreement by the Secretary concerned, be paid an accession bonus of not more than $5,000. The bonus shall be paid in periodic installments, as determined by the Secretary concerned at the time the agreement is accepted, except that the first installment may not exceed $2,500.

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CHAPTER 109--EDUCATIONAL LOAN REPAYMENT PROGRAMS

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Sec. 2173. Education loan repayment program: commissioned officers in specified health professions

(a) * * *

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(d) Certain Persons Ineligible.--[Participants of the Armed Forces Health Professions Scholarship and Financial Assistance program under subchapter I of chapter 105 of this title and students] Students of the Uniformed Services University of the Health Sciences established under section 2112 of this title are not eligible for the repayment of an education loan under this section.

(e) Loan Repayments.--(1) * * *

(2) For each year of obligated service that a person agrees to serve in an agreement described in subsection (b)(3), the Secretary of the military department concerned may pay not more than $22,000 on behalf of the person. This maximum amount shall be increased annually by the Secretary of Defense effective October 1 of each year by the percentage equal to the percent increase in the average annual cost of educational expenses and stipend costs of a single scholarship under the Armed Forces Health Professions Scholarship and Financial Assistance program. [The total amount that may be repaid on behalf of any person may not exceed an amount determined on the basis of a four-year active duty service obligation.]

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PART IV--SERVICE, SUPPLY, AND PROCUREMENT

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CHAPTER 131--PLANNING AND COORDINATION

Sec.
2201. Apportionment of funds: authority for exemption; excepted expenses.
* * * * * * *
2214a. Transfer of funds: transfers from procurement accounts to research and development accounts for major acquisition programs.

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Sec. 2214a. Transfer of funds: transfers from procurement accounts to research and development accounts for major acquisition programs

(a) Transfer Authority Within Major Programs.--Subject to subsection (b), the Secretary of Defense may transfer amounts provided in an appropriation Act for procurement for a covered acquisition program to amounts provided in the same appropriation Act for research, development, test, and evaluation for that program.

(b) Congressional Notice-and-Wait.--A transfer may be made under this section only after--

(1) the Secretary submits to the congressional defense committees notice in writing of the Secretary's intent to make such transfer, together with the Secretary's justification for the transfer; and

(2) a period of 30 days has elapsed following the date of such notification.

(c) Limitations.--From amounts appropriated for the Department of Defense for any fiscal year for procurement--

(1) the total amount transferred under this section may not exceed $250,000,000; and

(2) the total amount so transferred for any acquisition program may not exceed $20,000,000.

(d) Covered Acquisition Programs.--In this section, the term ``covered acquisition program'' means an acquisition program of the Department of Defense that is--

(A) a major defense acquisition program for purposes of chapter 144 of this title; or

(B) any other acquisition program of the Department of Defense--

(i) that is designated by the Secretary of Defense as a covered acquisition program for purposes of this section; or

(ii) that is estimated by the Secretary of Defense to require an eventual total expenditure for research, development, test, and evaluation of more than $140,000,000 (based on fiscal year 2000 constant dollars) or an eventual total expenditure for procurement of more than $660,000,000 (based on fiscal year 2000 constant dollars.)

(e) Transfer Back of Unused Transferred Funds.--If funds transferred under this section are not used for the purposes for which transferred, such funds shall be transferred back to the account from which transferred and shall be available for their original purpose.

(f) Additional Authority.--The transfer authority provided in this section is in addition to any other transfer authority available to the Secretary of Defense.

CHAPTER 137--PROCUREMENT GENERALLY

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Sec. 2304a. Task and delivery order contracts: general authority

(a) * * *

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(e) Contract Modifications.--(1) A task or delivery order may not increase the scope, period, or maximum value of the task or delivery order contract under which the order is issued. The scope, period, or maximum value of the contract may be increased only by modification of the contract.

(2) Unless use of procedures other than competitive procedures is authorized by an exception in subsection (c) of section 2304 of this title and approved in accordance with subsection (f) of such section, competitive procedures shall be used for making such a modification.

(3) Notice regarding the modification shall be provided in accordance with section 18 of the Office of Federal Procurement Policy Act (41 U.S.C. 416) and section 8(e) of the Small Business Act (15 U.S.C. 637(e)).

[(f) Inapplicability to Contracts for Advisory and Assistance Services.--Except as otherwise specifically provided in section 2304b of this title, this section does not apply to a task or delivery order contract for the procurement of advisory and assistance services (as defined in section 1105(g) of title 31).]

(f) Limitation on Contract Period.--The base period of a task order contract or delivery order contract entered into under this section may not exceed five years unless a longer period is specifically authorized in a law that is applicable to such contract. The contract may be extended for an additional 5 years (for a total contract period of not more than 10 years) through modifications, options, or otherwise.

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Sec. 2304b. Task order contracts: advisory and assistance services

[(a) Authority To Award.--(1) Subject to the requirements of this section, section 2304c of this title, and other applicable law, the head of an agency may enter into a task order contract (as defined in section 2304d of this title) for procurement of advisory and assistance services.

[(2) The head of an agency may enter into a task order contract for procurement of advisory and assistance services only under the authority of this section.

[(b) Limitation on Contract Period.--The period of a task order contract entered into under this section, including all periods of extensions of the contract under options, modifications, or otherwise, may not exceed five years unless a

longer period is specifically authorized in a law that is applicable to such contract.]

(a) In General.--A task order contract (as defined in section 2304d of this title) for procurement of advisory and assistance services shall be subject to the requirements of this section, sections 2304a and 2304c of this title, and other applicable provisions of law.

[(c)] (b) Content of Notice.--The notice required by section 18 of the Office of Federal Procurement Policy Act (41 U.S.C. 416) and section 8(e) of the Small Business Act (15 U.S.C. 637(e)) shall reasonably and fairly describe the general scope, magnitude, and duration of the proposed task order contract in a manner that would reasonably enable a potential offeror to decide whether to request the solicitation and consider submitting an offer.

[(d) Required Content of Solicitation and Contract.--(1) The solicitation for the proposed task order contract shall include the information (regarding services) described in section 2304a(b) of this title.

[(2) A task order contract entered into under this section shall contain the same information that is required by paragraph (1) to be included in the solicitation of offers for that contract.]

(c) Required Content of Contract.--A task order contract described in subsection (a) shall contain the same information that is required by section 2304a(b) to be included in the solicitation of offers for that contract.

[(e)] (d) Multiple Awards.--(1) The head of an agency may, on the basis of one solicitation, award separate task order contracts [under this section] described in subsection (a) for the same or similar services to two or more sources if the solicitation states that the head of the agency has the option to do so.

(2) If, in the case of a task order contract for advisory and assistance services to be entered into [under this section], the contract period is to exceed three years and the contract amount is estimated to exceed $10,000,000 (including all options), the solicitation shall--

(A) * * *

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[(f) Contract Modifications.--(1) A task order may not increase the scope, period, or maximum value of the task order contract under which the order is issued. The scope, period, or maximum value of the contract may be increased only by modification of the contract.

[(2) Unless use of procedures other than competitive procedures is authorized by an exception in subsection (c) of section 2304 of this title and approved in accordance with subsection (f) of such section, competitive procedures shall be used for making such a modification.

[(3) Notice regarding the modification shall be provided in accordance with section 18 of the Office of Federal Procurement Policy Act (41 U.S.C. 416) and section 8(e) of the Small Business Act (15 U.S.C. 637(e)).

[(g) Contract Extensions.--(1) Notwithstanding the limitation on the contract period set forth in subsection (b) or in a solicitation or contract pursuant to subsection (e), a task order contract entered into by the head of an agency under this

section may be extended on a sole-source basis for a period not exceeding six months if the head of such agency determines that--

[(A) the award of a follow-on contract has been delayed by circumstances that were not reasonably foreseeable at the time the initial contract was entered into; and

[(B) the extension is necessary in order to ensure continuity of the receipt of services pending the award of, and commencement of performance under, the follow-on contract.

[(2) A task order contract may be extended under the authority of paragraph (1) only once and only in accordance with the limitations and requirements of this subsection.]

[(h)] (e) Inapplicability to Certain Contracts.--This section does not apply to a contract for the acquisition of property or services that includes acquisition of advisory and assistance services if the head of an agency entering into such contract determines that, under the contract, advisory and assistance services are necessarily incident to, and not a significant component of, the contract.

[(i)] (f) Advisory and Assistance Services Defined.--In this section, the term ``advisory and assistance services'' has the meaning given such term in section 1105(g) of title 31.

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Sec. 2306b. Multiyear contracts: acquisition of property

(a) * * *

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(i) Defense Acquisitions Specifically Authorized by Law.--(1) * * *

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(4)(A) Unless otherwise authorized by law, the Secretary of Defense may obligate funds for procurement of an end item under a multiyear contract for the purchase of property only for procurement of a complete and usable end item.

(B) Unless otherwise authorized by law, the Secretary of Defense may obligate funds appropriated for any fiscal year for advance procurement under a multiyear contract for the purchase of property only for the procurement of those long-lead items necessary in order to meet a planned delivery schedule for complete major end items that are programmed under the contract to be acquired with funds appropriated for a subsequent fiscal year.

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Sec. 2327. Contracts: consideration of national security objectives

(a) * * *

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(c) Waiver.--(1)(A) If the Secretary of Defense determines under paragraph (2) that entering into a contract with a firm or a subsidiary of a firm described in subsection (b) is not inconsistent with the national security objectives of the United States, the head of an agency may enter into a contract with such firm or subsidiary [after the date on which such head of an agency submits to Congress a report on the contract] if in the best interests of the Government.

[(B) A report under subparagraph (A) shall include the following:

[(i) The identity of the foreign government concerned.

[(ii) The nature of the contract.

[(iii) The extent of ownership or control of the firm or subsidiary concerned (or, if appropriate in the case of a subsidiary, of the firm that owns the subsidiary) by the foreign government concerned or the agency or instrumentality of such foreign government.

[(iv) The reasons for entering into the contract.]

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CHAPTER 138--COOPERATIVE AGREEMENTS WITH NATO ALLIES AND OTHER COUNTRIES

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SUBCHAPTER II--OTHER COOPERATIVE AGREEMENTS

Sec.
2350a. Cooperative research and development agreements: NATO organizations; allied and friendly foreign countries.
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2350m. Administrative services and support for foreign liaison officers.

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Sec. 2350f. Procurement of communications support and related supplies and services

(a) * * *

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[(c) The Secretary of Defense shall submit to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives copies of all documents evidencing an arrangement entered into under subsection (a) not later than 45 days after entering into such an arrangement.]

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Sec. 2350k. Relocation within host nation of elements of armed forces

overseas

(a) * * *

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[(d) Annual Report to Congress.--Not later than 30 days after the end of each fiscal year, the Secretary shall submit to Congress a report specifying--

[(1) the amount of the contributions accepted by the Secretary during the preceding fiscal year under subsection (a) and the purposes for which the contributions were made; and

[(2) the amount of the contributions expended by the Secretary during the preceding fiscal year and the purposes for which the contributions were expended.]

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Sec. 2350m. Administrative services and support for foreign liaison officers

(a) Authority To Provide Services and Support.--The Secretary of Defense may provide administrative services and support for foreign liaison officers performing duties while such officers temporarily are assigned to components or commands of the armed forces. Such administrative services and support may include base or installation operation support services, office space, utilities, copying services, fire and police protection, and computer support. The Secretary may provide such administrative services and support with or without reimbursement, as the Secretary considers appropriate.

(b) Expiration of Authority.--The authority under this section shall expire on September 30, 2005.

CHAPTER 139--RESEARCH AND DEVELOPMENT

Sec.
2351. Availability of appropriations.
* * * * * * *
2359a. Technology Transition Initiative.
2359b. Defense Acquisition Challenge Program.
* * * * * * *

Sec. 2359a. Technology Transition Initiative

(a) Initiative Required.--The Secretary of Defense, acting through the Under Secretary of Defense for Acquisition, Technology, and Logistics, shall carry out an initiative, to be known as the Technology Transition Initiative (hereinafter in this section referred to as the ``Initiative''), to facilitate the rapid transition of new technologies from science and technology programs of the Department of Defense into acquisition programs of the Department for the production of such technologies.

(b) Objectives.--The Initiative shall have the following objectives:

(1) To accelerate the introduction of new technologies into appropriate acquisition programs.

(2) To successfully demonstrate new technologies in relevant environments.

(3) To ensure that new technologies are sufficiently mature for production.

(c) Management of Initiative.--(1) The Initiative shall be managed by a senior official in the Office of the Secretary of Defense designated by the Secretary (hereinafter in this section referred to as the ``Manager''). In managing the Initiative, the Manager shall report directly to the Under Secretary of Defense for Acquisition, Technology, and Logistics.

(2) The Secretary shall establish a board of directors (hereinafter in this section referred to as the ``Board''), composed of the acquisition executive of each military department, the members of the Joint Requirements Oversight Council, and the commander of the Joint Forces Command. The Board shall assist the Manager in managing the Initiative.

(3) The Secretary shall establish, under the auspices of the Under Secretary of Defense for Acquisition, Technology, and Logistics, a panel of highly qualified scientists and engineers. The panel shall advise the Under Secretary on matters relating to the Initiative.

(d) Duties of Manager.--The Manager shall have following duties:

(1) To identify, in consultation with the Board, promising technologies that have been demonstrated in science and technology programs of the Department.

(2) To identify potential sponsors in the Department to undertake the transition of such technologies into production.

(3) To work with the science and technology community and the acquisition community to develop memoranda of agreement, joint funding agreements, and other cooperative arrangements to provide for the transition of such technologies into production.

(4) Provide funding support for projects selected under subsection (e).

(e) Jointly Funded Projects.--(1) The acquisition executive of each military department shall identify technology projects of that military department to recommend for funding support under the Initiative and shall submit to the Manager a list of such recommended projects, ranked in order of priority. Such executive shall identify such projects, and establish priorities among such projects, using a competitive process, on the basis of the greatest potential benefits in areas of interest identified by the Secretary of that military department.

(2) The Manager, in consultation with the Board, shall select projects for funding support from among the projects on the lists submitted under paragraph (1). From the funds made available to the Manager for the Initiative, the Manager shall provide funds for each selected project in an amount determined by mutual agreement between the Manager and the acquisition executive of the military department concerned, but not less than 50 percent of the total cost of the project.

(3) The acquisition executive of the military department concerned shall manage each project selected under paragraph (2) that is undertaken by the military department. Memoranda of agreement, joint funding agreements, and other cooperative arrangements between the science and technology community and

the acquisition community shall be used in carrying out the project if the acquisition executive determines that it is appropriate to do so to achieve the objectives of the project.

(f) Requirement for Program Element.--In the budget justification materials submitted to Congress in support of the Department of Defense budget for any fiscal year (as submitted with the budget of the President under section 1105(a) of title 31), the amount requested for activities of the Initiative shall be set forth in a separate program element within amounts requested for research, development, test, and evaluation for Defense-wide activities.

(g) Definition of Acquisition Executive.--In this section, the term ``acquisition executive'', with respect to a military department, means the official designated as the senior procurement executive for that military department under section 16(3) of the Office of Federal Procurement Policy Act (41 U.S.C. 414(3)).

Sec. 2359b. Defense Acquisition Challenge Program

(a) Program Required.--The Secretary of Defense shall carry out a program to provide opportunities for the increased introduction of innovative and cost-saving technology in acquisition programs of the Department of Defense. The program, to be known as the Defense Acquisition Challenge Program (hereinafter in this section referred to as the ``Challenge Program''), shall provide any person or activity within or outside the Department of Defense with the opportunity to propose alternatives, to be known as challenge proposals, at the component, subsystem, or system level of an existing Department of Defense acquisition program that would result in improvements in performance, affordability, manufacturability, or operational capability of that acquisition program.

(b) Panel.--(1) In carrying out the Challenge Program, the Secretary shall establish a panel of highly qualified scientists and engineers (hereinafter in this section referred to as the ``Panel'') under the auspices of the Under Secretary of Defense for Acquisition, Technology, and Logistics. The duty of the Panel shall be to carry out evaluations of challenge proposals under subsection (c).

(2) A member of the Panel may not participate in any evaluation of a challenge proposal under subsection (c) if at any time within the previous five years that member has, in any capacity, participated in or been affiliated with the acquisition program for which the challenge proposal is submitted.

(c) Evaluation by Panel.--(1) Under procedures prescribed by the Secretary, a person or activity within or outside the Department of Defense may submit challenge proposals to the Panel.

(2) The Panel shall carry out an evaluation of each challenge proposal submitted under paragraph (1) to determine each of the following criteria:

(A) Whether the challenge proposal has merit.

(B) Whether the challenge proposal is likely to result in improvements in performance, affordability, manufacturability, or operational capability at the component, subsystem, or system level of the applicable acquisition program.

(C) Whether the challenge proposal could be

implemented rapidly in the applicable acquisition program.

(3) If the Panel determines that a challenge proposal satisfies each of the criteria specified in paragraph (2), the person or activity submitting that challenge proposal shall be provided an opportunity to submit such challenge proposal for a full review and evaluation under subsection (d).

(d) Full Review and Evaluation.--(1) Under procedures prescribed by the Secretary, for each challenge proposal submitted for a full review and evaluation as provided in subsection (c)(3), the office carrying out the applicable acquisition program, and the prime system contractor carrying out such program, shall jointly conduct a full review and evaluation of the challenge proposal.

(2) The full review and evaluation shall, independent of the determination of the Panel under subsection (c)(2), determine each of the matters specified in subparagraphs (A), (B), and (C) of such subsection.

(e) Action Upon Favorable Full Review and Evaluation.--(1) Under procedures prescribed by the Secretary, each challenge proposal determined under a full review and evaluation to satisfy each of the criteria specified in subsection (c)(2) shall be considered by the prime system contractor for incorporation into the applicable acquisition program as a new technology insertion at the component, subsystem, or system level.

(2) The Secretary shall encourage the adoption of each challenge proposal referred to in paragraph (1) by providing suitable incentives to the office carrying out the applicable acquisition program and the prime system contractor carrying out such program.

(f) Access to Technical Resources.--The Secretary shall ensure that the Panel (in carrying out evaluations of challenge proposals under subsection (c)) and each office and prime system contractor (in conducting a full review and evaluation under subsection (d)) have the authority to call upon the technical resources of the laboratories, research, development, and engineering centers, test and evaluation activities, and other elements of the Department.

(g) Elimination of Conflicts of Interest.--In carrying out each evaluation under subsection (c) and full review under subsection (d), the Secretary shall ensure the elimination of conflicts of interest.

(h) Report.--The Secretary shall submit to Congress, with the submission of the budget request for the Department of Defense for each fiscal year during which the Challenge Program is carried out, a report on the Challenge Program for that fiscal year. The report shall include the number and scope of challenge proposals submitted, evaluated, subjected to full review, and adopted.

(i) Sunset.--The authority to carry out this section shall terminate on September 30, 2007.

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CHAPTER 141--MISCELLANEOUS PROCUREMENT PROVISIONS

Sec.
2381. Contracts: regulations for bids.

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2397. Rapid acquisition and deployment procedures.
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2403. Quick-reaction special projects acquisition team.
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Sec. 2397. Rapid acquisition and deployment procedures

(a) Establishment.--The Secretary of Defense shall establish tailored rapid acquisition and deployment procedures for items urgently needed to react to an enemy threat or to respond to significant and urgent safety situations.

(b) Procedures.--The procedures established under subsection (a) shall include the following:

(1) A process for streamlined communications between the Chairman of the Joint Chiefs of Staff, the acquisition community, and the testing community.

(2) A process for expedited technical, programmatic, and financial decisions.

(3) An expedited procurement and contracting process.

(c) Specific Steps To Be Included.--The procedures established under subsection (a) shall provide for the following:

(1) The commander of a unified combatant command may notify the Chairman of the Joint Chiefs of Staff of the need for an item described in subsection (a) that is currently under development.

(2) The Chairman may request the Secretary of Defense to use rapid acquisition and deployment procedures with respect to the item.

(3) The Secretary of Defense shall decide whether to use such procedures with respect to the item and shall notify the Secretary of the appropriate military department of the decision.

(4) If the Secretary of Defense decides to use such procedures with respect to the item, the Secretary of the military department shall prepare a funding strategy for the rapid acquisition of the item and shall conduct a demonstration of the performance of the item.

(5) The Director of Operational Test and Evaluation shall immediately evaluate the existing capability of the item (but under such evaluation shall not assess the capability of the item as regards to the function the item was originally intended to perform).

(6) The Chairman of the Joint Chiefs of Staff shall review the evaluation of the Director of Operational Test and Evaluation and report to the Secretary of Defense regarding whether the capabilities of the tested item are able to meet the urgent need for the item.

(7) The Secretary of Defense shall evaluate the information regarding funding and rapid acquisition prepared pursuant to paragraph (4) and approve or disapprove of the acquisition of the item using the procedures established pursuant to subsection (a).

(d) Limitation.--The quantity of items of a system procured using the procedures established under this section may not exceed the number established for low-rate initial production for the system, and any such items shall be counted for

purposes of the number of items of the system that may be procured through low-rate initial production.

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Sec. 2399. Operational test and evaluation of defense acquisition programs

(a) Condition for Proceeding Beyond Low-Rate Initial Production.--(1) * * *

(2) In this subsection, the term ``major defense acquisition program'' [means--] means a conventional weapons system that--

(A) [a conventional weapons system that] is a major system within the meaning of that term in section 2302(5) of this title; and

* * * * * * *

Sec. 2403. Quick-reaction special projects acquisition team

The Secretary of Defense shall establish a quick-reaction special projects acquisition team, the purpose of which shall be to advise the Secretary on actions that can be taken to expedite the procurement of urgently needed systems. The team shall address problems with the intention of creating expeditious solutions relating to--

(1) industrial-base issues such as the limited availability of suppliers;

(2) compliance with acquisition regulations and lengthy procedures;

(3) compliance with environmental requirements;

(4) compliance with requirements regarding small-business concerns; and

(5) compliance with requirements regarding the purchase of products made in the United States.

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CHAPTER 146--CONTRACTING FOR PERFORMANCE OF CIVILIAN COMMERCIAL OR INDUSTRIAL TYPE FUNCTIONS

Sec.
2460. Definition of depot-level maintenance and repair.
* * * * * * *
[2469a. Use of competitive procedures in contracting for performance of depot-level maintenance and repair workloads formerly performed at certain military installations.]

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Sec. 2461. Commercial or industrial type functions: required studies and reports before conversion to contractor performance

(a) * * *

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[(c) Notification of Decision.--(1) If, as a result of the completion of the examinations under subsection (b)(3), a decision is made to change the commercial or industrial type function that was the subject of the analysis to performance by the private sector, the Secretary of Defense shall submit to Congress a report describing that decision. The report shall contain the following:

[(A) The date when the analysis of that commercial or industrial type function for possible change to performance by the private sector was commenced.

[(B) An indication that the examinations required under subsection (b)(3) have been completed.

[(C) The Secretary's certification that the Government calculation of the cost of performance of the function by Department of Defense civilian employees is based on an estimate of the most cost effective manner for performance of the function by Department of Defense civilian employees.

[(D) The number of Department of Defense civilian employees who were performing the function when the analysis was commenced, the number of such employees whose employment was terminated or otherwise affected in implementing the most efficient organization of the function, and the number of such employees whose employment would be terminated or otherwise affected by changing to performance of the function by the private sector.

[(E) The Secretary's certification that the factors considered in the examinations performed under subsection (b)(3), and in the making of the decision to change performance, did not include any predetermined personnel constraint or limitation in terms of man years, end strength, full-time equivalent positions, or maximum number of employees.

[(F) The Secretary's certification that the examination required by subsection (b)(3)(A) as part of the analysis demonstrates that the performance of the function by the private sector will result in savings to the Government over the life of the contract.

[(G) A statement of the potential economic effect of the change on each affected local community, as determined in the examination under subsection (b)(3)(B)(ii).

[(H) The Secretary's certification that the entire analysis is available for examination.

[(I) A schedule for completing the change to performance of the function by the private sector.

[(2) If the commercial or industrial type function to be changed to performance by the private sector is performed at a Center of Industrial and Technical Excellence designated under section 2474(a) of this title or an Army ammunition plant--

[(A) the report required by this subsection shall also include a description of the effect that the performance and administration of the resulting contract will have on the overhead costs of the center or ammunition plant, as the case may be; and

[(B) notwithstanding paragraph (3), the change of the function to contractor performance may not begin until

at least 60 days after the submission of the report.

[(3) The change of the function to contractor performance may not begin until after the submission of the report required by this subsection.]

(c) Submission of Analysis Results.--(1) Upon the completion of an analysis of a commercial or industrial type function described in subsection (a) for possible change to performance by the private sector, the Secretary of Defense shall submit to Congress a report containing the results of the analysis, including the results of the examinations required by subsection (b)(3).

(2) The report shall also contain the following:

(A) The date when the analysis of the function was commenced.

(B) The Secretary's certification that the Government calculation of the cost of performance of the function by Department of Defense civilian employees is based on an estimate of the most cost effective manner for performance of the function by Department of Defense civilian employees.

(C) The number of Department of Defense civilian employees who were performing the function when the analysis was commenced and the number of such employees whose employment was or will be terminated or otherwise affected by changing to performance of the function by the private sector or by implementation of the most efficient organization of the function.

(D) The Secretary's certification that the factors considered in the examinations performed under subsection (b)(3), and in the making of the decision regarding changing to performance of the function by the private sector or retaining performance in the most efficient organization of the function, did not include any predetermined personnel constraint or limitation in terms of man years, end strength, full-time equivalent positions, or maximum number of employees.

(E) A statement of the potential economic effect of implementing the decision regarding changing to performance of the function by the private sector or retaining performance in the most efficient organization of the function on each affected local community, as determined in the examination under subsection (b)(3)(B)(ii).

(F) A schedule for completing the change to performance of the function by the private sector or implementing the most efficient organization of the function

(G) In the case of a commercial or industrial type function performed at a Center of Industrial and Technical Excellence designated under section 2474(a) of this title or an Army ammunition plant, a description of the effect that the manner of performance of the function, and administration of the resulting contract if any, will have on the overhead costs of the center or ammunition plant, as the case may be.

(H) The Secretary's certification that the entire analysis is available for examination.

(3)(A) If a decision is made to change the commercial or industrial type function that was the subject of the analysis

to performance by the private sector, the change of the function to contractor performance may not begin until after the submission of the report required by paragraph (1).

(B) Notwithstanding subparagraph (A), in the case of a commercial or industrial type function performed at a Center of Industrial and Technical Excellence designated under section 2474(a) of this title or an Army ammunition plant, the change of the function to contractor performance may not begin until at least 60 days after the submission of the report.

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Sec. 2464. Core logistics capabilities

(a) Necessity for Core Logistics Capabilities.--(1) * * *

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(3) The core logistics capabilities identified under paragraphs (1) and (2) shall include [those capabilities that are necessary to maintain and repair the weapon systems] those logistics capabilities (including acquisition logistics, supply management, system engineering, maintenance, and modification management) that are necessary to sustain the weapon systems and other military equipment (including mission-essential weapon systems or materiel not later than four years after achieving initial operational capability, but excluding systems and equipment under special access programs, nuclear aircraft carriers, and commercial items described in paragraph (5)) that are identified by the Secretary, in consultation with the Chairman of the Joint Chiefs of Staff, as necessary to enable the armed forces to fulfill the strategic and contingency plans prepared by the Chairman of the Joint Chiefs of Staff under section 153(a) of this title.

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Sec. 2465. Prohibition on contracts for performance of firefighting or security-guard functions

(a) * * *

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(c) The Secretary of Defense or the Secretary of a military department may waive the prohibition under subsection (a) regarding contracting for the performance of security-guard functions at a military installation or facility under the jurisdiction of the Secretary if such functions--

(1) are or will be performed by members of the armed forces in the absence of a waiver; or

(2) were not performed at the installation or facility before September 11, 2001.

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[Sec. 2469a. Use of competitive procedures in contracting for

performance of depot-level maintenance and repair workloads formerly performed at certain military installations

[(a) Definitions.--In this section:

[(1) The term ``closed or realigned military installation'' means a military installation where a depot-level maintenance and repair facility was approved in 1995 for closure or realignment under the Defense Base Closure and Realignment Act of 1990 (part A of title XXIX of Public Law 101-510; 10 U.S.C. 2687 note).

[(2) The term ``military installation'' includes a former military installation that was a military installation when it was approved in 1995 for closure or realignment under the Defense Base Closure and Realignment Act of 1990 and that has been closed or realigned under the Act.

[(3) The terms ``realignment'' and ``realigned'' mean a decision under the Defense Base Closure and Realignment Act of 1990 that results in both a reduction and relocation of functions and civilian personnel positions.

[(b) Covered Depot-Level Maintenance and Repair Workloads.--Except as provided in subsection (c), this section applies with respect to any depot-level maintenance and repair workload that--

[(1) was performed as of January 1, 1997, at a military installation that was approved in 1995 for closure or realignment under the Defense Base Closure and Realignment Act of 1990 and that has been closed or realigned under the Act; and

[(2) is proposed to be converted from performance by Department of Defense personnel to performance by a private sector source.

[(c) Exceptions.--This section shall not apply with respect to--

[(1) a depot-level maintenance and repair workload that is to be consolidated to another military installation (other than a closed or realigned military installation) as a result of a base closure or realignment action or a decision made by the Secretary concerned or the Defense Depot Maintenance Council;

[(2) a workload necessary to maintain a core logistics capability identified under section 2464 of this title; or

[(3) any contract originally entered into before November 18, 1997.

[(d) Conditions and Solicitation.--A solicitation of offers for the performance of any depot-level maintenance and repair workload described in subsection (b) may be issued, and a contract may be awarded pursuant to such a solicitation, only if the following conditions are met with respect to the contract and the solicitation specifically states the conditions:

[(1) The source selection process used in the case of the solicitation and contract permits the consideration of offers submitted by private sector sources and offers submitted by public sector sources.

[(2) The source selection process used in the case of

the solicitation and contract requires that, in the comparison of offers, there be taken into account--

[(A) the fair market value (or if fair market value cannot be determined, the estimated book value) of any land, plant, or equipment from a military installation that is proposed by a private offeror to be used to meet a specific workload (whether these assets are provided to the offeror by a local redevelopment authority or by any other source approved by an official of the Department of Defense); and

[(B) the total estimated direct and indirect costs that will be incurred by the Department of Defense and the total estimated direct and indirect savings (including overhead) that will be derived by the Department of Defense.

[(3) The cost standards used to determine the depreciation of facilities and equipment shall, to the maximum extent practicable, provide identical treatment to all public and private sector offerors.

[(4) Any offeror, whether public or private, may offer to perform the workload at any location or locations selected by the offeror and to team with any other public or private entity to perform that workload at one or more locations, including a Center of Industrial and Technical Excellence designated under section 2474 of this title.

[(5) No offeror may be given any preferential consideration for, or in any way be limited to, performing the workload in-place or at any other single location.

[(e) Contracts for Multiple Workloads.--(1) A solicitation may be issued for a single contract for the performance of multiple depot-level maintenance and repair workloads described in subsection (b) only if--

[(A) the Secretary of Defense determines in writing that the individual workloads cannot as logically and economically be performed without combination by sources that are potentially qualified to submit an offer and to be awarded a contract to perform those individual workloads;

[(B) the Secretary submits to Congress a report setting forth the determination together with the reasons for the determination; and

[(C) the solicitation of offers for the contract is issued more than 60 days after the date on which the Secretary submits the report.

[(2) The Comptroller General shall review each report submitted under paragraph (1)(B) and, not later than 30 days after the report is submitted to Congress, shall submit to Congress the Comptroller General's views regarding the determination of the Secretary that is set forth in the report, together with any other findings that the Comptroller General considers appropriate.

[(f) Competitive Procedures Required.--Section 2304(c)(7) of this title shall not be used as the basis for an exception to the requirement to use competitive procedures for any contract for a depot-level maintenance and repair workload described in subsection (b).

[(g) Reviews of Competitive Procedures.--If a solicitation of

offers for a contract for, or award of, any depot-level maintenance and repair workload described in subsection (b) is issued, the Comptroller General shall--

[(1) within 45 days after the issuance of the solicitation, review the solicitation and report to Congress on whether the solicitation--

[(A) provides substantially equal opportunity for public and private offerors to compete for the contract without regard to the location at which the workload is to be performed; and

[(B) is in compliance with the requirements of this section and all applicable provisions of law and regulations; and

[(2) within 45 days after any contract or award resulting from the solicitation is entered into or made, review the contract or award, including the contracting or award process, and report to Congress on whether--

[(A) the procedures used to conduct the competition--

[(i) provided substantially equal opportunity for public and private offerors to compete for the contract without regard to the location at which the workload is to be performed; and

[(ii) were in compliance with the requirements of this section and all applicable provisions of law and regulations;

[(B) appropriate consideration was given to factors other than cost in the selection of the source for performance of the workload; and

[(C) the contract or award resulted in the lowest total cost to the Department of Defense for performance of the workload.

[(h) Resolution of Workload Award Objections.--Any public or private entity may, pursuant to procedures established by the Secretary, object to a solicitation of offers under this section for the performance of any depot-level maintenance and repair workload, or the award or proposed award of any workload pursuant to such a solicitation. The Secretary may designate a qualified individual or entity to review the objection; however, the Secretary shall not designate the Source Selection Authority or any individual from the same military department as the Source Selection Authority to review the objection. The Secretary shall take appropriate action to address any defect in the solicitation or award in the event that the objection is sustained.

[(i) Oversight of Contracts Awarded Public Entities.--The Secretary of Defense or the Secretary concerned may not impose on a public sector entity awarded a contract for the performance of any depot-level maintenance and repair workload described in subsection (b) any requirements regarding management systems, reviews, oversight, or reporting that are significantly different from the requirements used in the performance and management of other similar or identical depot-level maintenance and repair workloads by the entity, unless the requirements are specifically provided in the solicitation for the contract or are necessary to ensure compliance with the terms of the contract.]

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Sec. 2474. Centers of Industrial and Technical Excellence: designation; public-private partnerships

(a) * * *

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(f) Exclusion of Certain Expenditures From Percentage Limitation.--(1) * * *

(2) The funds referred to in paragraph (1) are funds available to the military departments and Defense Agencies for depot-level maintenance and repair workloads [for fiscal years 2002 through 2005].

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CHAPTER 147--COMMISSARIES AND EXCHANGES AND OTHER MORALE, WELFARE, AND RECREATION ACTIVITIES

Sec.
2482. Commissary stores: operation.
* * * * * * *
2494. Uniform funding and management of morale, welfare, and recreation programs.

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Sec. 2492. Overseas commissary and exchange stores: access and purchase restrictions

(a) * * *

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[(c) Annual Report.--The Secretary of Defense shall submit to Congress an annual report describing the host nation laws and the treaty obligations of the United States, and the conditions within host nations, that necessitate the use of quantity or other restrictions on purchases in commissary and exchange stores located outside the United States.]

Sec. 2493. Fisher Houses: administration as nonappropriated fund instrumentality

(a) * * *

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[(f) Special Authority for Navy.--The Secretary of the Navy shall provide base operating support for Fisher Houses associated with health care facilities of the Navy. The level of the support shall be equivalent to the base operating support that the Secretary provides for morale, welfare, and recreation category B community activities (as defined in

regulations, prescribed by the Secretary, that govern morale, welfare, and recreation activities associated with Navy installations).

[(g) Annual Report.--Not later than January 15 of each year, the Secretary of each military department shall submit to Congress a report describing the operation of Fisher Houses and Fisher Suites associated with health care facilities of that military department. The report shall include, at a minimum, the following:

[(1) The amount in the fund established by that Secretary under subsection (d) as of October 1 of the previous year.

[(2) The operation of the fund during the preceding fiscal year, including--

[(A) all gifts, fees, and interest credited to the fund; and

[(B) all disbursements from the fund.

[(3) The budget for the operation of the Fisher Houses and Fisher Suites for the fiscal year in which the report is submitted.]

(f) Base Operating Support.--The Secretary of a military department may provide base operating support for Fisher Houses associated with health care facilities of that military department.

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Sec. 2494. Uniform funding and management of morale, welfare, and recreation programs

(a) Authority for Uniform Funding and Management.--Under regulations prescribed by the Secretary of Defense, funds appropriated to the Department of Defense and available for morale, welfare, and recreation programs may be treated as nonappropriated funds and expended in accordance with laws applicable to the expenditures of nonappropriated funds. When made available for morale, welfare, and recreation programs under such regulations, appropriated funds shall be considered to be nonappropriated funds for all purposes and shall remain available until expended.

(b) Conditions on Availability.--Funds appropriated to the Department of Defense may be made available to support a morale, welfare, or recreation program only if the program is authorized to receive appropriated fund support and only in the amounts the program is authorized to receive.

(c) Conversion of Employment Positions.--(1) The Secretary of Defense may identify positions of employees in morale, welfare, and recreation programs within the Department of Defense who are paid with appropriated funds whose status may be converted from the status of an employee paid with appropriated funds to the status of an employee of a nonappropriated fund instrumentality.

(2) The status of an employee in a position identified by the Secretary under paragraph (1) may, with the consent of the employee, be converted to the status of an employee of a nonappropriated fund instrumentality. An employee who does not consent to the conversion may not be removed from the position because of the failure to provide such consent.

(3) The conversion of an employee from the status of an

employee paid by appropriated funds to the status of an employee of a nonappropriated fund instrumentality shall be without a break in service for the concerned employee. The conversion shall not entitle an employee to severance pay, back pay or separation pay under subchapter IX of chapter 55 of title 5, or be considered an involuntary separation or other adverse personnel action entitling an employee to any right or benefit under such title or any other provision of law or regulation.

(4) In this subsection, the term ``an employee of a nonappropriated fund instrumentality'' means an employee described in section 2105(c) of title 5.

CHAPTER 148--NATIONAL DEFENSE TECHNOLOGY AND INDUSTRIAL BASE, DEFENSE REINVESTMENT, AND DEFENSE CONVERSION

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SUBCHAPTER III--PROGRAMS FOR DEVELOPMENT, APPLICATION, AND SUPPORT OF DUAL-USE TECHNOLOGIES

Sec.
2511. Defense dual-use critical technology program.
* * * * * * *
2520. Transfer of technology items and equipment in support of homeland security.
* * * * * * *

Sec. 2520. Transfer of technology items and equipment in support of homeland security

The Secretary of Defense shall enter into an agreement with an independent, nonprofit, technology-oriented entity that has demonstrated the ability to facilitate the transfer of defense technologies, developed by both the private and public sectors, to aid Federal, State, and local first responders. Under the agreement the entity shall develop and deploy technology items and equipment, through coordination between Government agencies and private sector, commercial developers and suppliers of technology, that will enhance public safety and shall--

(1) work in coordination with the InterAgency Board for Equipment Standardization and Interoperability;

(2) develop technology items and equipment that meet the standardization requirements established by the Board;

(3) evaluate technology items and equipment that have been identified using the standards developed by the Board and other state-of-the-art technology items and equipment that may benefit first responders;

(4) identify and coordinate among the public and private sectors research efforts applicable to national security and homeland security;

(5) facilitate the timely transfer of technology items and equipment between public and private sources;

(6) eliminate redundant research efforts with respect to technologies to be deployed to first responders;

(7) expedite the advancement of high priority projects from research through implementation of initial manufacturing; and

(8) establish an outreach program, in coordination with the Board, with first responders to facilitate awareness of available technology items and equipment to support crisis response.

SUBCHAPTER IV--MANUFACTURING TECHNOLOGY

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Sec. 2521. Manufacturing Technology Program

(a) * * *

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(e) Five-Year Plan.--(1) The Secretary of Defense shall [prepare a five-year plan for the program which establishes--

[(A) the overall manufacturing technology goals, milestones, priorities, and investment strategy for the program; and

[(B) for each of the five fiscal years covered by the plan, the objectives of, and funding for the program by, each military department and each Defense Agency participating in the program.

[(2) The plan shall include the following:

[(A) An assessment of the effectiveness of the program, including a description of all completed projects and status of implementation.

[(B) An assessment of the extent to which the costs of projects are being shared by the following:

[(i) Commercial enterprises in the private sector.

[(ii) Department of Defense program offices, including weapon system program offices.

[(iii) Departments and agencies of the Federal Government outside the Department of Defense.

[(iv) Institutions of higher education.

[(v) Other institutions not operated for profit.

[(vi) Other sources.] prepare and maintain a five-year plan for the program.

(2) The plan shall establish the following:

(A) The overall manufacturing technology objectives, milestones, priorities, and investment strategy for the program.

(B) The specific objectives of, and funding for the program by, each military department and each Defense Agency participating in the program.

(3) The plan shall be updated [annually] biennially and shall be included in the budget justification documents submitted in support of the budget of the Department of Defense [for a fiscal year] for each even-numbered fiscal year (as included in the budget of the President submitted to Congress under section 1105 of title 31).

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SUBCHAPTER V--MISCELLANEOUS TECHNOLOGY BASE POLICIES AND PROGRAMS

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Sec. 2534. Miscellaneous limitations on the procurement of goods other than United States goods

(a) Limitation on Certain Procurements.--The Secretary of Defense may procure any of the following items only if the manufacturer of the item satisfies the requirements of subsection (b):

(1) * * *

* * * * * * *

(5) Ball bearings and roller bearings.--Ball bearings and roller bearings, in accordance with subpart [225.71] 225.70 of part 225 of the Defense Federal Acquisition Regulation Supplement, as in effect on [October 23, 1992] April 27, 2002. In this section the term ``ball bearings and roller bearings'' includes unconventional or hybrid ball and roller bearings and cam follower bearings, ball screws, and other derivatives of ball and roller bearings.

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SUBCHAPTER VI--DEFENSE EXPORT LOAN GUARANTEES

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Sec. 2540. Establishment of loan guarantee program

(a) * * *

(b) Covered Countries.--The authority under subsection (a) applies with respect to the following countries:

(1) * * *

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(5) A country that, as determined by the Secretary of Defense in consultation with the Secretary of State, assists in combatting drug trafficking organizations or foreign terrorist organizations.

* * * * * * *

(d) Report.--The Secretary of Defense and the Secretary of State, whenever the Secretaries consider such action to be warranted, shall jointly submit to the Committees on Armed Services and Foreign Relations of the Senate and the Committees on Armed Services and International Relations of the House of Representatives a report enumerating those countries to be added or removed under subsection (b).

* * * * * * *

CHAPTER 152--ISSUE OF SUPPLIES, SERVICES, AND FACILITIES

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Sec. 2563. Articles and services of industrial facilities: sale to persons outside the Department of Defense

(a) * * *

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(c) Conditions for Sales.--(1) * * *
(2) The Secretary of Defense may waive the condition in paragraph (1)(A) and subsection (a)(1) that an article or service must be not available from a United States commercial source in the case of a particular sale if the Secretary determines that the waiver is necessary for reasons of national security [and notifies Congress regarding the reasons for the waiver].

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CHAPTER 155--ACCEPTANCE OF GIFTS AND SERVICES

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Sec. 2611. Asia-Pacific Center for Security Studies: acceptance of foreign gifts and donations

(a) * * *

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[(e) Notice to Congress.--If the total amount of funds accepted under subsection (a) in any fiscal year exceeds $2,000,000, the Secretary shall notify Congress of the amount of those donations for that fiscal year. Any such notice shall list each of the contributors of such amounts and the amount of each contribution in that fiscal year.]

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CHAPTER 157--TRANSPORTATION

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Sec. 2634. Motor vehicles: transportation or storage for members on change of permanent station or extended deployment

(a) * * *
[(b)(1) In lieu of transportation authorized by this section, if a member is ordered to make a change of permanent station to a foreign country and the laws, regulations, or other restrictions imposed by the foreign country or the United

States preclude entry of a motor vehicle described in subsection (a) into that country, or would require extensive modification of the vehicle as a condition to entry, the member may elect to have the vehicle stored at the expense of the United States at a location approved by the Secretary concerned.

[(2) If a member is transferred or assigned in connection with a contingency operation to duty at a location other than the permanent station of the member for a period of more than 30 consecutive days, but the transfer or assignment is not considered a change of permanent station, the member may elect to have a motor vehicle described in subsection (a) stored at the expense of the United States at a location approved by the Secretary concerned.]

(b)(1) When a member receives a vehicle storage qualifying order, the member may elect to have a motor vehicle described in subsection (a) stored at the expense of the United States at a location approved by the Secretary concerned. In the case of a vehicle storage qualifying order that is to make a change of permanent station, such storage is in lieu of transportation authorized by subsection (a).

(2) In this subsection, the term ``vehicle storage qualifying order'' means any of the following:

(A) An order to make a change of permanent station to a foreign country in a case in which the laws, regulations, or other restrictions imposed by the foreign country or by the United States either--

(i) preclude entry of a motor vehicle described in subsection (a) into that country; or

(ii) would require extensive modification of the vehicle as a condition to entry.

(B) An order to make a change of permanent station to a nonforeign area outside the continental United States in a case in which the laws, regulations, or other restrictions imposed by that area or by the United States either--

(i) preclude entry of a motor vehicle described in subsection (a) into that area; or

(ii) would require extensive modification of the vehicle as a condition to entry.

(C) An order under which a member is transferred or assigned in connection with a contingency operation to duty at a location other than the permanent station of the member for a period of more than 30 consecutive days but which is not considered a change of permanent station.

* * * * * * *

(h) In this section:

(1) * * *

* * * * * * *

(3) The term ``nonforeign area outside the continental United States'' means any of the following: the States of Alaska and Hawaii, the Commonwealths of Puerto Rico and the Northern Mariana Islands, and any possession of the United States.

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CHAPTER 159--REAL PROPERTY; RELATED PERSONAL PROPERTY; AND LEASE OF NONEXCESS PROPERTY

Sec.
2661. Miscellaneous administrative provisions relating to real property.
* * * * * * *
2684a. Agreements to limit encroachments and other constraints on military training, testing, and operations.
* * * * * * *
2694a. Conveyance of surplus real property for natural resource conservation.
* * * * * * *

Sec. 2677. Options: property required for military construction projects

(a) * * *

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[(c)(1) Before acquiring an option on real property under subsection (a), the Secretary of a military department shall review the most recent inventory of real property assets published by the Resolution Trust Corporation under section 21A(b)(11)(F) of the Federal Home Loan Bank Act (12 U.S.C. 1441a(b)(11)(F)) and determine whether any real property listed in the inventory is suitable for use by the military department for the purposes for which the real property is sought.

[(2) The requirement for the review referred to in paragraph (1) shall terminate on September 30, 1996.]

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Sec. 2680. Leases: land for special operations activities

(a) * * *

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(e) Reports.--Not later than March 1 of each year, the Secretary of Defense shall submit to the Committee on [the] Armed Services of the Senate and the Committee on Armed Services of the House of Representatives a report that--

(1) * * *

* * * * * * *

Sec. 2684a. Agreements to limit encroachments and other constraints on military training, testing, and operations

(a) Agreements Authorized.--The Secretary of a military department may enter into an agreement with a private entity described in subsection (b) to address the use or development

of real property in the vicinity of a military installation for purposes of--

(1) limiting any development or use of the property that would otherwise be incompatible with the mission of the installation; or

(2) preserving habitat on the property in a manner that is compatible with both--

(A) current or anticipated environmental restrictions that would or might otherwise restrict, impede, or otherwise interfere, whether directly or indirectly, with current or anticipated military training, testing, or operations on the installation; and

(B) current or anticipated military training, testing, or operations on the installation.

(b) Covered Private Entities.--A private entity referred to in subsection (a) is any private entity that has as its stated principal organizational purpose or goal the conservation, restoration, or preservation of land and natural resources, or a similar purpose or goal, as determined by the Secretary concerned.

(c) Inapplicability of Certain Contract Requirements.--Chapter 63 of title 31 shall not apply to any agreement entered into under this section.

(d) Acquisition and Acceptance of Property and Interests.--(1) An agreement with a private entity under this section--

(A) may provide for the private entity to acquire all right, title, and interest in and to any real property, or any lesser interest in the property, as may be appropriate for purposes of this section; and

(B) shall provide for the private entity to transfer to the United States, upon the request of the United States, any property or interest so acquired.

(2) Property or interests may not be acquired pursuant to an agreement under this section unless the owner of the property or interests, as the case may be, consents to the acquisition.

(3) An agreement under this section providing for the acquisition of property or interests under paragraph (1)(A) shall provide for the sharing by the United States and the private entity concerned of the costs of the acquisition of the property or interests.

(4) The Secretary concerned shall identify any property or interests to be acquired pursuant to an agreement under this section. The property or interests shall be limited to the minimum property or interests necessary to ensure that the property concerned is developed and used in a manner appropriate for purposes of this section.

(5) Notwithstanding any other provision of law, the Secretary concerned may accept on behalf of the United States any property or interest to be transferred to the United States under paragraph (1)(B).

(6) The Secretary concerned may, for purposes of the acceptance of property or interests under this subsection, accept an appraisal or title documents prepared or adopted by a non-Federal entity as satisfying the applicable requirements of section 301 of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4651) or section 355 of the Revised Statutes (40 U.S.C. 255) if the Secretary finds that the appraisal or title documents substantially comply with the requirements.

(e) Additional Terms and Conditions.--The Secretary concerned may require such additional terms and conditions in an agreement under this section as the Secretary considers appropriate to protect the interests of the United States.

(f) Funding.--(1) Except as provided in paragraph (2), funds authorized to be appropriated for operation and maintenance of the Army, Navy, Marine Corps, Air Force, or Defense-wide activities, including funds authorized to be appropriated for the Legacy Resources Management Program, may be used to enter into agreements under this section.

(2) In the case of a military installation operated primarily with funds authorized to be appropriated for research, development, test, and evaluation, funds authorized to be appropriated for the Army, Navy, Marine Corps, Air Force, or Defense-wide activities for research, development, test, and evaluation may be used to enter into agreements under this section with respect to the installation.

* * * * * * *

Sec. 2694a. Conveyance of surplus real property for natural resource conservation

(a) Authority to Convey.--The Secretary of a military department may convey to an eligible recipient described in subsection (b) any surplus real property that--

(1) is under the administrative control of the Secretary;

(2) is suitable and desirable for conservation purposes;

(3) has been made available for public benefit transfer for a sufficient period of time to potential claimants; and

(4) is not subject to a pending request for transfer to another Federal agency or for conveyance to any other qualified recipient for public benefit transfer under the real property disposal processes and authorities established pursuant to the Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471, et seq.).

(b) Eligible Recipients.--The conveyance of surplus real property under subsection (a) may be made to any of the following:

(A) A State or political subdivision of a State.

(B) A nonprofit organization that exists for the primary purpose of conservation of natural resources on real property.

(c) Revisionary Interest and Other Deed Requirements.--(1) The deed of conveyance of any surplus real property conveyed under subsection (a) disposed of under this subsection shall require the property to be used and maintained for the conservation of natural resources in perpetuity. If the Secretary of the military department that made the conveyance determines at any time that the property is not being used or maintained for such purpose, then, at the option of the Secretary, all or any portion of the property shall revert to the United States.

(2) The deed of conveyance may permit the recipient of the

property--

(A) to convey the property to another eligible entity described in subsection (b), subject to the approval of the Secretary of the military department that made the conveyance and subject to the same covenants and terms and conditions as provided in the deed from the United States; and

(B) to conduct incidental revenue-producing activities on the property that are compatible with the use of the property for conservation purposes.

(3) The deed of conveyance may contain such additional terms, reservations, restrictions, and conditions as the Secretary of the military department considers appropriate to protect the interests of the United States.

(d) Release of Covenants.--The Secretary of the military department that conveys real property under subsection (a), with the concurrence of the Secretary of Interior, may grant a release from a covenant included in the deed of conveyance of the property under subsection (c) on the condition that the recipient of the property pay the fair market value, as determined by the Secretary of the military department, of the property at the time of the release of the covenant. The Secretary of the military department may reduce the amount required to be paid under this subsection to account for the value of the natural resource conservation benefit that has accrued to the United States during the period the covenant was in effect, if the benefit was not taken into account in determining the original consideration for the conveyance.

(e) Limitations.--A conveyance under subsection (a) shall not be used in settlement of any litigation, dispute, or claim against the United States, or as a condition of allowing any defense activity under any Federal, State, or local permitting or review process. The Secretary of a military department may make a conveyance under subsection (a), with the restrictions specified in subsection (c), to establish a mitigation bank, but only if the establishment of the mitigation bank does not occur in order to satisfy any condition for permitting military activity under a Federal, State, or local permitting or review process.

(f) Consideration.--In fixing the consideration for the conveyance of real property under subsection (a) or in determining the amount of any reduction of the amount to be paid for the release of a covenant under subsection (d), the Secretary of the military department concerned shall take into consideration any benefit that has accrued or may accrue to the United States from the use of such property for the conservation of natural resources.

(g) Relation to Other Conveyance Authorities.--(1) The Secretary of a military department may not make a conveyance under this section of any real property to be disposed of under a base closure law in a manner that is inconsistent with the requirements and conditions of the base closure law.

(2) In the case of real property on Guam, the Secretary of a military department may not make a conveyance under this section unless the Government of Guam has been first afforded the opportunity to acquire the real property as authorized by section 1 of Public Law 106-504 (114 Stat. 2309).

(h) Definitions.--In this section:

(1) The term ``State'' includes the District of Columbia, the Commonwealth of Puerto Rico, the

Commonwealth of the Northern Marianas, and the territories and possessions of the United States.

(2) The term ``base closure law'' means the following:

(A) Section 2687 of this title.

(B) Title II of the Defense Authorization Amendments and Base Closure and Realignment Act of 1988 (10 U.S.C. 2687 note).

(C) The Defense Base Closure and Realignment Act of 1990 (part A of title XXIX of Public Law 101-510; 10 U.S.C. 2687 note).

(D) Any other similar authority for the closure or realignment of military installations that is enacted after the date of the enactment of the National Defense Authorization Act for Fiscal Year 2003.

Sec. 2695. Acceptance of funds to cover administrative expenses relating to certain real property transactions

(a) * * *

(b) Covered Transactions.--Subsection (a) applies to the following transactions involving real property under the control of the Secretary of a military department:

(1) * * *

* * * * * * *

(5) The conveyance of real property under section 2694a of this title.

* * * * * * *

CHAPTER 160--ENVIRONMENTAL RESTORATION

* * * * * * *

Sec. 2701. Environmental restoration program

(a) * * *

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(d) Services of Other Agencies.--

(1) In general.--Subject to paragraph (2), the Secretary may enter into agreements on a reimbursable or other basis with any other Federal agency, [with any State or local government agency, or with any Indian tribe,] any State or local government agency, any Indian tribe, or any nonprofit conservation organization to obtain the services of the agency to assist the Secretary in carrying out any of the Secretary's responsibilities under this section. Services which may be obtained under this subsection include the identification, investigation, and cleanup of any off-site contamination resulting from the release of a hazardous substance or waste at a facility under the Secretary's jurisdiction.

* * * * * * *

[(3) Definition.--In this subsection, the term ``Indian tribe'' has the meaning given such term in section 101(36) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(36)).]

(3) Definitions.--In this subsection:

(A) The term ``Indian tribe'' has the meaning given such term in section 101(36) of Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601(36)).

(B) The term ``nonprofit conservation organization'' means any non-governmental nonprofit organization whose primary purpose is conservation of open space or natural resources.

* * * * * * *

(k) UXO Program Manager.--(1) The Secretary of Defense shall establish a program manager who shall serve as the single point of contact in the Department of Defense for policy and budgeting issues involving the characterization, remediation, and management of explosive and related risks with respect to unexploded ordnance, discarded military munitions, and munitions constituents at defense sites (as such terms are defined in section 2710 of this title) that pose a threat to human health or safety.

(2) The Secretary of Defense may delegate this authority to the Secretary of a military department, who may delegate the authority to the Under Secretary of that military department. The authority may not be further delegated.

(3) The program manager may establish an independent advisory and review panel that may include representatives of the National Academy of Sciences, nongovernmental organizations with expertise regarding unexploded ordnance, discarded military munitions, or munitions constituents, the Environmental Protection Agency, States (as defined in section 2710 of this title), and tribal governments. If established, the panel would report annually to Congress on progress made by the Department of Defense to address unexploded ordnance, discarded military munitions, or munitions constituents at defense sites and make such recommendations as the panel considered appropriate.

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CHAPTER 165--ACCOUNTABILITY AND RESPONSIBILITY

Sec.

2771. Final settlement of accounts: deceased members.

* * * * * * *

2773a. Departmental accountable officials.

* * * * * * *

[2784. Management of credit cards.]

2784. Management of purchase cards.

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2787. Reports of survey.
* * * * * * *

Sec. 2773a. Departmental accountable officials

(a) Designation.--(1) The Secretary of Defense may designate as a ``departmental accountable official'' any civilian employee of the Department of Defense or member of the armed forces under the Secretary's jurisdiction who is described in paragraph (2). Any such designation shall be in writing.

(2) An employee or member of the armed forces described in this paragraph is an employee or member who is responsible in the performance of the employee's or member's duties for providing to a certifying official of the Department of Defense information, data, or services that are directly relied upon by the certifying official in the certification of vouchers for payment.

(b) Pecuniary Liability.--(1) The Secretary of Defense may impose pecuniary liability on a departmental accountable official to the extent that an illegal, improper, or incorrect payment results from the information, data, or services that that official provides to a certifying official and upon which the certifying official directly relies in certifying the voucher supporting that payment.

(2) The pecuniary liability of a departmental accountable official under this subsection for such an illegal, improper, or incorrect payment is joint and several with that of any other officials who are pecuniarily liable for such payment.

(c) Relief from Liability.--The Secretary of Defense shall relieve a departmental accountable official from liability under subsection (b) if the Secretary determines that the illegal, improper, or incorrect payment was not the result of fault or negligence by that official.

* * * * * * *

[Sec. 2784. Management of credit cards

[(a) Management of Credit Cards.--The Secretary of Defense, acting through the Under Secretary of Defense (Comptroller), shall prescribe regulations governing the use and control of all credit cards and convenience checks that are issued to Department of Defense personnel for official use. Those regulations shall be consistent with regulations that apply Government-wide regarding use of credit cards by Government personnel for official purposes.

[(b) Required Safeguards and Internal Controls.--Regulations under subsection (a) shall include safeguards and internal controls to ensure the following:

[(1) That there is a record in the Department of Defense of each holder of a credit card issued by the Department of Defense for official use, annotated with the limitations on amounts that are applicable to the use of each such card by that credit card holder.

[(2) That the holder of a credit card and each official with authority to authorize expenditures charged to the credit card are responsible for--

[(A) reconciling the charges appearing on each statement of account for that credit card

with receipts and other supporting documentation; and

[(B) forwarding that statement after being so reconciled to the designated disbursing office in a timely manner.

[(3) That any disputed credit card charge, and any discrepancy between a receipt and other supporting documentation and the credit card statement of account, is resolved in the manner prescribed in the applicable Government-wide credit card contract entered into by the Administrator of General Services.

[(4) That payments on credit card accounts are made promptly within prescribed deadlines to avoid interest penalties.

[(5) That rebates and refunds based on prompt payment on credit card accounts are properly recorded.

[(6) That records of each credit card transaction (including records on associated contracts, reports, accounts, and invoices) are retained in accordance with standard Government policies on the disposition of records.]

Sec. 2784. Management of purchase cards

(a) Management of Purchase Cards.--The Secretary of Defense, acting through the Under Secretary of Defense (Comptroller), shall prescribe regulations governing the use and control of all purchase cards and convenience checks that are issued to Department of Defense personnel for official use. Those regulations shall be consistent with regulations that apply Government-wide regarding use of purchase cards by Government personnel for official purposes.

(b) Required Safeguards and Internal Controls.--Regulations under subsection (a) shall include safeguards and internal controls to ensure the following:

(1) That there is a record in the Department of Defense of each holder of a purchase card issued by the Department of Defense for official use, annotated with the limitations on amounts that are applicable to the use of each such card by that purchase card holder.

(2) That the holder of a purchase card and each official with authority to authorize expenditures charged to the purchase card are responsible for--

(A) reconciling the charges appearing on each statement of account for that purchase card with receipts and other supporting documentation; and

(B) forwarding that statement after being so reconciled to the designated disbursing office in a timely manner.

(3) That any disputed purchase card charge, and any discrepancy between a receipt and other supporting documentation and the purchase card statement of account, is resolved in the manner prescribed in the applicable Government-wide purchase card contract entered into by the Administrator of General Services.

(4) That payments on purchase card accounts are made promptly within prescribed deadlines to avoid interest penalties.

(5) That rebates and refunds based on prompt payment

on purchase card accounts are properly recorded.

(6) That records of each purchase card transaction (including records on associated contracts, reports, accounts, and invoices) are retained in accordance with standard Government policies on the disposition of records.

(7) That an annual review is performed of the use of purchase cards issued by the Department of Defense to determine whether each purchase card holder has a need for the purchase card.

(8) That the Inspectors General of the Department of Defense and the military services perform periodic audits with respect to the use of purchase cards issued by the Department of Defense to ensure that such use is in compliance with regulations.

(9) That appropriate annual training is provided to each purchase card holder and each official with responsibility for overseeing the use of purchase cards issued by the Department of Defense.

(c) Penalties for Violations.--The Secretary shall provide in the regulations prescribed under subsection (a)--

(1) that procedures are implemented providing for appropriate punishment of employees of the Department of Defense for violations of such regulations and for negligence, misuse, abuse, or fraud with respect to a purchase card, including dismissal in appropriate cases; and

(2) that a violation of such regulations by a person subject to chapter 47 of this title (the Uniform Code of Military Justice) is punishable as a violation of section 892 of this title (article 92 of the Uniform Code of Military Justice).

* * * * * * *

Sec. 2787. Reports of survey

(a) Regulations.--Under such regulations as the Secretary of Defense may prescribe, any officer of the Army, Navy, Air Force, or Marine Corps or any civilian employee of the Department of Defense designated by the Secretary may act upon reports of surveys and vouchers pertaining to the loss, spoilage, unserviceability, unsuitability, or destruction of, or damage to, property of the United States under the control of the Department of Defense.

(b) Finality of Action.--Action taken under subsection (a) is final, except that action holding a person pecuniarily liable for loss, spoilage, destruction, or damage is not final until approved by the Secretary.

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CHAPTER 169--MILITARY CONSTRUCTION AND MILITARY FAMILY HOUSING

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SUBCHAPTER I--MILITARY CONSTRUCTION

* * * * * * *

Sec. 2810. Construction projects for environmental response actions

[(a) Subject to subsection (b), the Secretary of Defense may carry out a military construction project not otherwise authorized by law (or may authorize the Secretary of a military department to carry out such a project) if the Secretary of Defense determines that the project is necessary to carry out a response action under chapter 160 of this title or under the Comprehensive Environmental Reponse, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.).]

(a) Authority to Carry Out Unauthorized Construction Projects.--The Secretary concerned may carry out a military construction project not otherwise authorized by law if the Secretary determines that the project is necessary to carry out a response under chapter 160 of this title or the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.).

(b)[(1) When a decision is made to carry out a military construction project under this section, the Secretary of Defense shall submit a report in writing to the appropriate committees of Congress on that decision.] Congressional Notification.--(1) When a decision is made to carry out a military construction project under this section that exceeds the amount specified in section 2805(b)(1) of this title, the Secretary concerned shall submit a report in writing to the appropriate committees of Congress on that decision. Each such report shall include--

(A) the justification for the project and the current estimate of the cost of the project; and

(B) the justification for carrying out the project under this section.

(2) The project may then be carried out only after the end of the 21-day period beginning on the date the notification is received by such committees.

(c) Response Defined.--In this section, the term ``response [action]'' has the meaning given that term in section 101 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601).

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Sec. 2814. Special authority for development of Ford Island, Hawaii

(a) * * *

* * * * * * *

(i) Use of Account.--(1) * * *

* * * * * * *

(3)[(A) The Secretary may transfer funds from the Ford Island Improvement Account to the following funds:

[(i) The Department of Defense Family Housing Improvement Fund established by section 2883(a)(1) of

this title.

[(ii) The Department of Defense Military Unaccompanied Housing Improvement Fund established by section 2883(a)(2) of this title.] (A) The Secretary may transfer funds from the Ford Island Improvement Account to the Department of Defense Housing Improvement Fund established by section 2883(a) of this title.

(B) Amounts transferred under subparagraph (A) to [a fund] the Fund referred to in that subparagraph shall be available in accordance with the provisions of section 2883 of this title for activities authorized under subchapter IV of this chapter at Ford Island.

* * * * * * *

Sec. 2815. Joint use military construction projects: annual evaluation

(a) * * *

(b) Annual Evaluation.--In the case of the budget submitted under section 1105 of title 31 [for fiscal year 2003 and each fiscal year thereafter] for any fiscal year, the Secretary of Defense shall include in the budget justification materials submitted to Congress in support of the budget a certification by each Secretary concerned that, in evaluating military construction projects for inclusion in the budget for that fiscal year, the Secretary concerned evaluated the feasibility of carrying out the projects as joint use military construction projects.

* * * * * * *

SUBCHAPTER II--MILITARY FAMILY HOUSING

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Sec. 2828. Leasing of military family housing

(a) * * *

(b)(1) * * *

(2) Except as provided in paragraphs (3) and (4), expenditures for the rental of housing units under subsection (a) (including the cost of utilities, maintenance, and operation) may not exceed $12,000 per unit per year, as adjusted from time to time under paragraph (5).

* * * * * * *

(e)(1) * * *

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[(3) In addition to the 450 units of family housing referred to in paragraph (1) for which the maximum lease amount is $25,000 per unit per year, the Secretary of the Army may lease not more than 800 units of family housing in Korea subject to that maximum lease amount.]

(3) In addition to the 450 units of family housing referred to in paragraph (1) for which the maximum lease amount is $25,000 per unit per year, the Secretary of the Army may lease in Korea--

(A) not more than 1,175 units of family housing subject to that maximum lease amount; and

(B) not more than 2,400 units of family housing subject to a maximum lease amount of $35,000 per unit per year.

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SUBCHAPTER IV--ALTERNATIVE AUTHORITY FOR ACQUISITION AND IMPROVEMENT OF MILITARY HOUSING

Sec.
2871. Definitions.
* * * * * * *
[2874. Leasing of housing to be constructed.]
2874. Leasing of housing.
* * * * * * *
[2879. Interim leases.]
* * * * * * *
[2883. Department of Defense Housing Funds.]
2883. Department of Defense Housing Improvement Fund.

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Sec. 2871. Definitions

In this subchapter:

(1) * * *

* * * * * * *

(6) The term ``Fund'' means the [Department of Defense Family Housing Improvement Fund or the Department of Defense Military Unaccompanied Housing Improvement Fund] Department of Defense Housing Improvement Fund established under section 2883(a) of this title.

* * * * * * *

Sec. 2872a. Utilities and services

(a) * * *

(b) Covered Utilities and Services.--The utilities and services that may be furnished under subsection (a) are the following:

(1) * * *

* * * * * * *

(11) Firefighting and fire protection services.

(12) Police protection services.

* * * * * * *

[Sec. 2874. Leasing of housing to be constructed

[(a) Build and Lease Authorized.--The Secretary concerned may enter into contracts for the lease of military family housing units or military unaccompanied housing units to be constructed under this subchapter.]

Sec. 2874. Leasing of housing

(a) Lease Authorized.--(1) The Secretary concerned may enter into contracts for the lease of housing units that the Secretary determines are suitable for use as military family housing or military unaccompanied housing.

(2) The Secretary concerned shall utilize housing units leased under paragraph (1) as military family housing or military unaccompanied housing, as appropriate.

* * * * * * *

Sec. 2875. Investments

(a) * * *

* * * * * * *

(e) Congressional Notification Required.--Amounts in the [Department of Defense Family Housing Improvement Fund or the Department of Defense Military Unaccompanied Housing Improvement Fund] Department of Defense Housing Improvement Fund may be used to make a cash investment under this section in an eligible entity only after the end of the 30-day period beginning on the date the Secretary of Defense submits written notice of, and justification for, the investment to the appropriate committees of Congress.

* * * * * * *

[Sec. 2879. Interim leases

[Pending completion of a project to acquire or construct military family housing units or military unaccompanied housing units under this subchapter, the Secretary concerned may provide for the interim lease of such units of the project as are complete. The term of a lease under this section may not extend beyond the date of the completion of the project concerned.]

Sec. 2880. Unit size and type

(a) * * *

(b) Inapplicability of Limitations on Space by Pay Grade.--(1) * * *

(2) The regulations prescribed under section 2856 of this title shall not apply to any military unaccompanied housing unit acquired or constructed under this subchapter [unless the

unit is located on a military installation].

* * * * * * *

[Sec. 2883. Department of Defense Housing Funds

[(a) Establishment.--There are hereby established on the books of the Treasury the following accounts:

[(1) The Department of Defense Family Housing Improvement Fund.

[(2) The Department of Defense Military Unaccompanied Housing Improvement Fund.

[(b) Commingling of Funds Prohibited.--(1) The Secretary of Defense shall administer each Fund separately.

[(2) Amounts in the Department of Defense Family Housing Improvement Fund may be used only to carry out activities under this subchapter with respect to military family housing.

[(3) Amounts in the Department of Defense Military Unaccompanied Housing Improvement Fund may be used only to carry out activities under this subchapter with respect to military unaccompanied housing.

[(c) Credits to Funds.--(1) There shall be credited to the Department of Defense Family Housing Improvement Fund the following:

[(A) Amounts authorized for and appropriated to that Fund.

[(B) Subject to subsection (f), any amounts that the Secretary of Defense transfers, in such amounts as provided in appropriation Acts, to that Fund from amounts authorized and appropriated to the Department of Defense for the acquisition or construction of military family housing.

[(C) Proceeds from the conveyance or lease of property or facilities under section 2878 of this title for the purpose of carrying out activities under this subchapter with respect to military family housing.

[(D) Income derived from any activities under this subchapter with respect to military family housing, including interest on loans made under section 2873 of this title, income and gains realized from investments under section 2875 of this title, and any return of capital invested as part of such investments.

[(E) Any amounts that the Secretary of the Navy transfers to that Fund pursuant to section 2814(i)(3) of this title, subject to the restrictions on the use of the transferred amounts specified in that section.

[(2) There shall be credited to the Department of Defense Military Unaccompanied Housing Improvement Fund the following:

[(A) Amounts authorized for and appropriated to that Fund.

[(B) Subject to subsection (f), any amounts that the Secretary of Defense transfers, in such amounts as provided in appropriation Acts, to that Fund from amounts authorized and appropriated to the Department of Defense for the acquisition or construction of military unaccompanied housing.

[(C) Proceeds from the conveyance or lease of property or facilities under section 2878 of this title for the purpose of carrying out activities under this

subchapter with respect to military unaccompanied housing.

[(D) Income derived from any activities under this subchapter with respect to military unaccompanied housing, including interest on loans made under section 2873 of this title, income and gains realized from investments under section 2875 of this title, and any return of capital invested as part of such investments.

[(E) Any amounts that the Secretary of the Navy transfers to that Fund pursuant to section 2814(i)(3) of this title, subject to the restrictions on the use of the transferred amounts specified in that section.]

Sec. 2883. Department of Defense Housing Improvement Fund

(a) Establishment.--There is hereby established on the books of the Treasury an account to be known as the Department of Defense Housing Improvement Fund (in this section referred to as the ``Fund'').

(b) Credits to Fund.--There shall be credited to the Fund the following:

(1) Amounts authorized for and appropriated to the Fund.

(2) Subject to subsection (e), any amounts that the Secretary of Defense transfers, in such amounts as are provided for in appropriation Acts, to the Fund from amounts authorized and appropriated to the Department of Defense for the acquisition or construction of military family housing or military unaccompanied housing.

(3) Proceeds from the conveyance or lease of property or facilities under section 2878 of this title for the purpose of carrying out activities under this subchapter with respect to military family housing or military unaccompanied housing.

(4) Income derived from any activities under this subchapter with respect to military family housing or military unaccompanied housing, income and gains realized from investments under section 2875 of this title, and any return of capital invested as part of such investments.

(5) Any amounts that the Secretary of the Navy transfers to the Fund pursuant to section 2814(i)(3) of this title, subject to the restrictions on the use of the transferred amounts specified in that section.

[(d)] (c) Use of Amounts in [Funds] Fund.--(1) In such amounts as provided in appropriation Acts and except as provided in subsection [(e)] (d), the Secretary of Defense may use amounts in the [Department of Defense Family Housing Improvement] Fund to carry out activities under this subchapter with respect to military family housing, including activities required in connection with the planning, execution, and administration of contracts entered into under the authority of this subchapter. The Secretary may also use for expenses of activities required in connection with the planning, execution, and administration of such contracts funds that are otherwise available to the Department of Defense for such types of expenses.

[(2) In such amounts as provided in appropriation Acts and except as provided in subsection (e), the Secretary of Defense

may use amounts in the Department of Defense Military Unaccompanied Housing Improvement Fund to carry out activities under this subchapter with respect to military unaccompanied housing, including activities required in connection with the planning, execution, and administration of contracts entered into under the authority of this subchapter. The Secretary may also use for expenses of activities required in connection with the planning, execution, and administration of such contracts funds that are otherwise available to the Department of Defense for such types of expenses.]

[(3)] (2) Amounts made available under this subsection shall remain available until expended. The Secretary of Defense may transfer amounts made available under this subsection to the Secretaries of the military departments to permit such Secretaries to carry out the activities for which such amounts may be used.

[(e)] (d) Limitation on Obligations.--The Secretary may not incur an obligation under a contract or other agreement entered into under this subchapter in excess of the unobligated balance, at the time the contract is entered into, of the Fund [required to be used to satisfy the obligation].

[(f)] (e) Notification Required for Transfers.--A transfer of appropriated amounts to [a Fund under paragraph (1)(B) or (2)(B) of subsection (c)] the Fund under subsection (b)(2) may be made only after the end of the 30-day period beginning on the date the Secretary of Defense submits written notice of, and justification for, the transfer to the appropriate committees of Congress.

[(g)] (f) Limitation on Amount of Budget Authority.--The total value in budget authority of all contracts and investments undertaken using the authorities provided in this subchapter shall not exceed--

(1) [$850,000,000] $1,700,000,000 for the acquisition or construction of military family housing; and

(2) [$150,000,000] $300,000,000 for the acquisition or construction of military unaccompanied housing.

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Subtitle B--Army

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PART I--ORGANIZATION

* * * * * * *

CHAPTER 305--THE ARMY STAFF

* * * * * * *

Sec. 3038. Office of Army Reserve: appointment of Chief

(a) * * *

(b) Appointment.--(1) * * *

* * * * * * *

(4) Until [October 1, 2003] December 31, 2004, the Secretary of Defense may waive subparagraph (B) of paragraph (2) with respect to the appointment of an officer as Chief of Army Reserve if the Secretary of the Army requests the waiver and, in the judgment of the Secretary of Defense--

(A) the officer is qualified for service in the position; and

(B) the waiver is necessary for the good of the service.

Any such waiver shall be made on a case-by-case basis.

* * * * * * *

CHAPTER 307--THE ARMY

Sec.
3061. Regulations.
* * * * * * *
3084. Chief of Veterinary Corps: grade.
* * * * * * *

Sec. 3084. Chief of Veterinary Corps: grade

The Chief of the Veterinary Corps of the Army serves in the grade of brigadier general. An officer appointed to that position who holds a lower grade shall be appointed in the grade of brigadier general.

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PART III--TRAINING

* * * * * * *

CHAPTER 403--UNITED STATES MILITARY ACADEMY

* * * * * * *

Sec. 4342. Cadets: appointment; numbers, territorial distribution

(a) The authorized strength of the Corps of Cadets of the Academy (determined for any year as of the day before the last day of the academic year) is 4,000 or such higher number as may be prescribed by the Secretary of the Army under subsection (j). Subject to that limitation, cadets are selected as follows:

(1) * * *

* * * * * * *

(i) For purposes of the limitation in subsection (a) establishing the aggregate authorized strength of the Corps of Cadets, the Secretary of the Army may for any year [(beginning with the 2001-2002 academic year)] permit a variance in that

limitation by not more than one percent. In applying that limitation, and any such variance, the last day of an academic year shall be considered to be graduation day.

(j)(1) Beginning with the 2003-2004 academic year, the Secretary of the Army may prescribe annual increases in the cadet strength limit in effect under subsection (a). For any academic year, any such increase shall be by no more than 100 cadets or such lesser number as applies under paragraph (3) for that year. Such annual increases may be prescribed until the cadet strength limit is 4,400. However, no increase may be prescribed for any academic year after the 2007-2008 academic year.

(2) Any increase in the cadet strength limit under paragraph (1) with respect to an academic year shall be prescribed not later than the date on which the budget of the President is submitted to Congress under section 1105 of title 31 for the fiscal year beginning in the same year as the year in which that academic year begins. Whenever the Secretary prescribes such an increase, the Secretary shall submit to Congress a notice in writing of the increase. The notice shall state the amount of the increase in the cadet strength limit and the new cadet strength limit, as so increased, and the amount of the increase in Senior Army Reserve Officers' Training Corps enrollment under each of sections 2104 and 2107 of this title.

(3) The amount of an increase under paragraph (1) in the cadet strength limit for an academic year may not exceed the increase (if any) for the preceding academic year in the total number of cadets enrolled in the Army Senior Reserve Officers' Training Corps program under chapter 103 of this title who have entered into an agreement under section 2104 or 2107 of this title.

(4) In this subsection, the term ``cadet strength limit'' means the authorized maximum strength of the Corps of Cadets of the Academy.

* * * * * * *

Sec. 4357. Acceptance of guarantees with gifts for major projects

(a) Acceptance Authority.--[Subject to subsection (c), the Secretary] The Secretary of the Army may accept from a donor or donors a qualified guarantee for the completion of a major project for the benefit of the Academy.

* * * * * * *

[(c) Notice of Proposed Acceptance.--The Secretary of the Army may not accept a qualified guarantee under this section for the completion of a major project until after the expiration of 30 days following the date upon which a report of the facts concerning the proposed guarantee is submitted to Congress.]

* * * * * * *

CHAPTER 407--SCHOOLS AND CAMPS

* * * * * * *

Sec. 4416. Academy of Health Sciences: admission of civilians in physician assistant training program

(a) * * *

* * * * * * *

[(f) Annual Report.--(1) Each year, the Secretary shall submit to Congress a report on the exchange of services under this section during the year. The report shall contain the following:

[(A) The number of civilian students who receive instruction at the Academy under this section.

[(B) An assessment of the benefits derived by the United States.

[(2) Reports are required under paragraph (1) only for years during which an agreement is in effect under this section.]

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PART IV--SERVICE, SUPPLY, AND PROCUREMENT

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CHAPTER 453--ACCOUNTABILITY AND RESPONSIBILITY

Sec.
4831. Custody of departmental records and property.
* * * * * * *
[4835. Reports of survey.]
* * * * * * *

[Sec. 4835. Reports of survey

[(a) Under such regulations as the Secretary of the Army may prescribe, any officer of the Army or any civilian employee of the Department of the Army designated by him may act upon reports of surveys and vouchers pertaining to the loss, spoilage, unserviceability, unsuitability, or destruction of or damage to property of the United States under the control of the Department of the Army.

[(b) Action taken under subsection (a) is final, except that action holding a person pecuniarily liable for loss, spoilage, destruction, or damage is not final until approved by the Secretary or the Secretary's designee. The Secretary may designate officers of the Army or civilian employees of the Department of the Army to approve such action.]

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Subtitle C--Navy and Marine Corps

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PART I--ORGANIZATION

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CHAPTER 506--HEADQUARTERS, MARINE CORPS

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Sec. 5045. Deputy Commandants

There are in the Headquarters, Marine Corps, not more than [five] six Deputy Commandants, detailed by the Secretary of the Navy from officers on the active-duty list of the Marine Corps.

* * * * * * *

CHAPTER 513--BUREAUS; OFFICE OF THE JUDGE ADVOCATE GENERAL

Sec. 5143. Office of Naval Reserve: appointment of Chief

(a) * * *
(b) Appointment.--(1) * * *

* * * * * * *

(4) Until [October 1, 2003] December 31, 2004, the Secretary of Defense may waive subparagraph (B) of paragraph (2) with respect to the appointment of an officer as Chief of Naval Reserve if the Secretary of the Navy requests the waiver and, in the judgment of the Secretary of Defense--

(A) the officer is qualified for service in the position; and

(B) the waiver is necessary for the good of the service.

Any such waiver shall be made on a case-by-case basis.

* * * * * * *

Sec. 5144. Office of Marine Forces Reserve: appointment of Commander

(a) * * *
(b) Appointment.--(1) * * *

* * * * * * *

(4) Until [October 1, 2003] December 31, 2004, the Secretary of Defense may waive subparagraph (B) of paragraph (2) with respect to the appointment of an officer as Commander, Marine Forces Reserve, if the Secretary of the Navy requests the waiver and, in the judgment of the Secretary of Defense--

(A) * * *

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PART II--PERSONNEL

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CHAPTER 544--TEMPORARY APPOINTMENTS

* * * * * * *

Sec. 5721. Temporary promotions of certain Navy lieutenants

(a) * * *

* * * * * * *

(f) Limitation on Number of Eligible Positions.--[(1)] An appointment under this section may only be made for service in a position designated by the Secretary of the Navy for purposes of this section. The number of positions so designated may not exceed 325.

[(2) Whenever the Secretary makes a change to the positions designated under paragraph (1), the Secretary shall submit notice of the change in writing to Congress.]

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PART III--EDUCATION AND TRAINING

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CHAPTER 603--UNITED STATES NAVAL ACADEMY

* * * * * * *

Sec. 6954. Midshipmen: number

(a) The authorized strength of the Brigade of Midshipmen (determined for any year as of the day before the last day of the academic year) is 4,000 or such higher number as may be prescribed by the Secretary of the Navy under subsection (h). Subject to that limitation, midshipmen are selected as follows:

(1) * * *

* * * * * * *

(h)(1) Beginning with the 2003-2004 academic year, the Secretary of the Navy may prescribe annual increases in the midshipmen strength limit in effect under subsection (a). For any academic year, any such increase shall be by no more than 100 midshipmen or such lesser number as applies under paragraph (3) for that year. Such annual increases may be prescribed until the midshipmen strength limit is 4,400. However, no increase may be prescribed for any academic year after the 2007-2008 academic year.

(2) Any increase in the midshipmen strength limit under paragraph (1) with respect to an academic year shall be prescribed not later than the date on which the budget of the

President is submitted to Congress under section 1105 of title 31 for the fiscal year beginning in the same year as the year in which that academic year begins. Whenever the Secretary prescribes such an increase, the Secretary shall submit to Congress a notice in writing of the increase. The notice shall state the amount of the increase in the midshipmen strength limit and the new midshipmen strength limit, as so increased, and the amount of the increase in Senior Navy Reserve Officers' Training Corps enrollment under each of sections 2104 and 2107 of this title.

(3) The amount of an increase under paragraph (1) in the midshipmen strength limit for an academic year may not exceed the increase (if any) for the preceding academic year in the total number of midshipmen enrolled in the Navy Senior Reserve Officers' Training Corps program under chapter 103 of this title who have entered into an agreement under section 2104 or 2107 of this title.

(4) In this subsection, the term ``midshipmen strength limit'' means the authorized maximum strength of the Brigade of Midshipmen.

* * * * * * *

Sec. 6975. Acceptance of guarantees with gifts for major projects

(a) Acceptance Authority.--[Subject to subsection (c), the Secretary] The Secretary of the Navy may accept from a donor or donors a qualified guarantee for the completion of a major project for the benefit of the Naval Academy.

* * * * * * *

[(c) Notice of Proposed Acceptance.--The Secretary of the Navy may not accept a qualified guarantee under this section for the completion of a major project until after the expiration of 30 days following the date upon which a report of the facts concerning the proposed guarantee is submitted to Congress.]

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Subtitle D--Air Force

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PART I--ORGANIZATION

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CHAPTER 805--THE AIR STAFF

* * * * * * *

Sec. 8038. Office of Air Force Reserve: appointment of Chief

(a) * * *
(b) Appointment.--(1) * * *

* * * * * * *

(4) Until [October 1, 2003] December 31, 2004, the Secretary of Defense may waive subparagraph (B) of paragraph (2) with respect to the appointment of an officer as Chief of Air Force Reserve if the Secretary of the Air Force requests the waiver and, in the judgment of the Secretary of Defense--

(A) the officer is qualified for service in the position; and

(B) the waiver is necessary for the good of the service.

Any such waiver shall be made on a case-by-case basis.

* * * * * * *

PART III--TRAINING

* * * * * * *

CHAPTER 903--UNITED STATES AIR FORCE ACADEMY

* * * * * * *

Sec. 9342. Cadets: appointment; numbers, territorial distribution

(a) The authorized strength of Air Force Cadets of the Academy (determined for any year as of the day before the last day of the academic year) is 4,000 or such higher number as may be prescribed by the Secretary of the Air Force under subsection (j). Subject to that limitation, Air Force Cadets are selected as follows:

(1) * * *

* * * * * * *

(j)(1) Beginning with the 2003-2004 academic year, the Secretary of the Air Force may prescribe annual increases in the cadet strength limit in effect under subsection (a). For any academic year, any such increase shall be by no more than 100 cadets or such lesser number as applies under paragraph (3) for that year. Such annual increases may be prescribed until the cadet strength limit is 4,400. However, no increase may be prescribed for any academic year after the 2007-2008 academic year.

(2) Any increase in the cadet strength limit under paragraph (1) with respect to an academic year shall be prescribed not later than the date on which the budget of the President is submitted to Congress under sections 1105 of title 31 for the fiscal year beginning in the same year as the year in which that academic year begins. Whenever the Secretary prescribes such an increase, the Secretary shall submit to Congress a notice in writing of the increase. The notice shall state the amount of the increase in the cadet strength limit and the new cadet strength limit, as so increased, and the amount of the

increase in Senior Air Force Reserve Officers' Training Corps enrollment under each of sections 2104 and 2107 of this title.

(3) The amount of an increase under paragraph (1) in the cadet strength limit for an academic year may not exceed the increase (if any) for the preceding academic year in the total number of cadets enrolled in the Air Force Senior Reserve Officers' Training Corps program under chapter 103 of this title who have entered into an agreement under section 2104 or 2107 of this title.

(4) In this subsection, the term ``cadet strength limit'' means the authorized maximum strength of Air Force Cadets of the Academy.

* * * * * * *

Sec. 9356. Acceptance of guarantees with gifts for major projects

(a) Acceptance Authority.--[Subject to subsection (c), the Secretary] The Secretary of the Air Force may accept from a donor or donors a qualified guarantee for the completion of a major project for the benefit of the Academy.

* * * * * * *

[(c) Notice of Proposed Acceptance.--The Secretary of the Air Force may not accept a qualified guarantee under this section for the completion of a major project until after the expiration of 30 days following the date upon which a report of the facts concerning the proposed guarantee is submitted to Congress.]

* * * * * * *

PART IV--SERVICE, SUPPLY, AND PROCUREMENT

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CHAPTER 953--ACCOUNTABILITY AND RESPONSIBILITY

Sec.
9831. Custody of departmental records and property.
* * * * * * *
[9835. Reports of survey.]
* * * * * * *

[Sec. 9835. Reports of survey

[(a) Under such regulations as the Secretary of the Air Force may prescribe, any officer of the Air Force designated by him may act upon reports of surveys and vouchers pertaining to the loss, spoilage, unserviceability, unsuitability, or destruction of or damage to property of the United States under the control of the Department of the Air Force.

[(b) Action taken under subsection (a) is final, except that action holding a person pecuniarily liable for loss, spoilage, destruction, or damage is not final until approved by the Secretary or an officer of the Air Force designated by him.]

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Subtitle E--Reserve Components

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PART I--ORGANIZATION AND ADMINISTRATION

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CHAPTER 1007--ADMINISTRATION OF RESERVE COMPONENTS

* * * * * * *

Sec. 10217. Non-dual status technicians

(a) * * *

* * * * * * *

(c) Permanent Limitations on Number.--(1) * * *
(2) [Effective October 1, 2002, the] The total number of non-dual status technicians employed by the National Guard may not exceed 1,950. If at any time [after the preceding sentence takes effect] the number of non-dual status technicians employed by the National Guard exceeds the number specified in the limitation in the preceding sentence, the Secretary of Defense shall require that the Secretary of the Army or the Secretary of the Air Force, or both, take immediate steps to reduce the number of such technicians in order to comply with such limitation.

* * * * * * *

CHAPTER 1011--NATIONAL GUARD BUREAU

* * * * * * *

Sec. 10506. Other senior National Guard Bureau officers

(a) Additional General Officers.--(1) * * *

* * * * * * *

(3)(A) * * *

* * * * * * *

(D) Until [October 1, 2003] December 31, 2004, the Secretary of Defense may waive clause (ii) of subparagraph (B) with respect to the appointment of an officer as Director, Army National Guard, or as Director, Air National Guard, if the Secretary of the military department concerned requests the

waiver and, in the judgment of the Secretary of Defense--

(i) the officer is qualified for service in the position; and

(ii) the waiver is necessary for the good of the service.

Any such waiver shall be made on a case-by-case basis.

* * * * * * *

PART II--PERSONNEL GENERALLY

* * * * * * *

CHAPTER 1201--AUTHORIZED STRENGTHS AND DISTRIBUTION IN GRADE

* * * * * * *

Sec. 12004. Strength in grade: reserve general and flag officers in an active status

(a) * * *

* * * * * * *

(f)(1) A general or flag officer who is on active duty but who is not counted under section 526(a) of this title by reason of section 526(b)(2)(B) of this title shall also be excluded from being counted under subsection (a).

(2) This subsection shall cease to be effective on the date specified in section 526(b)(3) of this title.

* * * * * * *

CHAPTER 1203--ENLISTED MEMBERS

* * * * * * *

Sec. 12103. Reserve components: terms

(a) * * *

* * * * * * *

(d) Under regulations to be prescribed by the Secretary of Defense, or the Secretary of Transportation with respect to the Coast Guard when it is not operating as a service in the Navy, a non-prior-service person who is qualified for induction for active duty in an armed force and who is not under orders to report for induction into an armed force under the Military Selective Service Act (50 U.S.C. App. 451 et seq.), except as provided in section 6(c)(2)(A)(ii) and (iii) of such Act, may be enlisted in the Army National Guard or the Air National Guard, or as a Reserve for service in the Army Reserve, Naval Reserve, Air Force Reserve, Marine Corps Reserve, or Coast Guard Reserve, for a term of not less than six years nor more

than eight years. Each person enlisted under this subsection shall perform an initial period of active duty for training of not less than twelve weeks to commence insofar as practicable within [270 days] one year after the date of that enlistment.

* * * * * * *

CHAPTER 1209--ACTIVE DUTY

* * * * * * *

Sec. 12302. Ready Reserve

(a) * * *
(b) To achieve fair treatment as between members in the Ready Reserve who are being considered for recall to duty without their consent, consideration shall be given to--
(1) * * *

* * * * * * *

The Secretary of Defense shall prescribe such policies and procedures as he considers necessary to carry out this subsection. [He shall report on those policies and procedures at least once a year to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives.]

* * * * * * *

[(d) Whenever one or more units of the Ready Reserve are ordered to active duty, the President shall, on the first day of the second fiscal year quarter immediately following the quarter in which the first unit or units are ordered to active duty and on the first day of each succeeding six-month period thereafter, so long as such unit is retained on active duty, submit a report to the Congress regarding the necessity for such unit or units being ordered to and retained on active duty. The President shall include in each such report a statement of the mission of each such unit ordered to active duty, an evaluation of such unit's performance of that mission, where each such unit is being deployed at the time of the report, and such other information regarding each unit as the President deems appropriate.]

* * * * * * *

Sec. 12310. Reserves: for organizing, administering, etc., reserve components

(a) * * *

* * * * * * *

(c) Duties Relating to Defense Against Weapons of Mass Destruction.--(1) * * *

* * * * * * *

(3) A Reserve may perform duties described in paragraph (1) [only--

[(A) while assigned to the Department of Defense Consequence Management Program Integration Office; or

[(B) while assigned] only while assigned to a reserve component rapid assessment element team and performing those duties within the geographical limits of the United States, its territories and possessions, the District of Columbia, and the Commonwealth of Puerto Rico.

* * * * * * *

CHAPTER 1223--RETIRED PAY FOR NON-REGULAR SERVICE

* * * * * * *

Sec. 12731. Age and service requirements

(a) Except as provided in subsection (c), a person is entitled, upon application, to retired pay computed under section 12739 of this title, if the person--

(1) * * *

* * * * * * *

(3) performed the last [eight] six years of qualifying service while a member of any category named in section 12732(a)(1) of this title, but not while a member of a regular component, the Fleet Reserve, or the Fleet Marine Corps Reserve; and

* * * * * * *

PART III--PROMOTION AND RETENTION OF OFFICERS ON THE RESERVE ACTIVE-STATUS LIST

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CHAPTER 1405--PROMOTIONS

* * * * * * *

Sec. 14301. Eligibility for consideration for promotion: general rules

(a) * * *

* * * * * * *

[(g) A reserve component brigadier general of the Army or the Air Force who is in an inactive status is eligible (notwithstanding subsection (a)) for consideration for promotion to major general by a promotion board convened under

section 14101(a) of this title if the officer--

[(1) has been in an inactive status for less than one year as of the date of the convening of the promotion board; and

[(2) had continuously served for at least one year on the reserve active status list or the active duty list (or a combination of both) immediately before the officer's most recent transfer to an inactive status.]

(g) Brigadier Generals.--(1) An officer who is a reserve component brigadier general of the Army or the Air Force who is not eligible for consideration for promotion under subsection (a) because the officer is not on the reserve active status list (as required by paragraph (1) of that subsection for such eligibility) is nevertheless eligible for consideration for promotion to the grade of major general by a promotion board convened under section 14101(a) of this title if--

(A) as of the date of the convening of the promotion board, the officer has been in an inactive status for less than one year; and

(B) immediately before the date of the officer's most recent transfer to an inactive status, the officer had continuously served on the reserve active status list or the active-duty list (or a combination of the reserve active status list and the active-duty list) for at least one year.

(2) An officer who is a reserve component brigadier general of the Army or the Air Force who is on the reserve active status list but who is not eligible for consideration for promotion under subsection (a) because the officer's service does not meet the one-year-of-continuous-service requirement under paragraph (2) of that subsection is nevertheless eligible for consideration for promotion to the grade of major general by a promotion board convened under section 14101(a) of this title if--

(A) the officer was transferred from an inactive status to the reserve active status list during the one-year period preceding the date of the convening of the promotion board;

(B) immediately before the date of the officer's most recent transfer to an active status, the officer had been in an inactive status for less than one year; and

(C) immediately before the date of the officer's most recent transfer to an inactive status, the officer had continuously served for at least one year on the reserve active status list or the active-duty list (or a combination of the reserve active status list and the active-duty list).

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Sec. 14317. Officers in transition to and from the active-status list or active-duty list

(a) * * *

* * * * * * *

(f) Effect of Transfer of Officers in Pay Grade O-7 to Inactive Status.--Notwithstanding subsection (a), if a reserve

officer on the active-status list in the grade of brigadier general or rear admiral (lower half) is transferred to an inactive status after having been recommended for promotion to the grade of major general or rear admiral under this chapter, or after having been found qualified for Federal recognition in the grade of major general under title 32, but before being promoted, the officer shall retain promotion eligibility and, if otherwise qualified, may be promoted to the higher grade after returning to an active status.

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CHAPTER 1407--FAILURE OF SELECTION FOR PROMOTION AND INVOLUNTARY SEPARATION

Sec.
14501. Failure of selection for promotion.
* * * * * * *
14519. Deferment of retirement or separation for medical reasons.
* * * * * * *

Sec. 14519. Deferment of retirement or separation for medical reasons

(a) If the Secretary of the military department concerned determines that the evaluation of the physical condition of a Reserve officer and determination of the officer's entitlement to retirement or separation for physical disability require hospitalization or medical observation and that such hospitalization or medical observation cannot be completed with confidence in a manner consistent with the officer's well-being before the date on which the officer would otherwise be required to be separated, retired, or transferred to the Retired Reserve under this title, the Secretary may defer the separation, retirement, or transfer of the officer under this title.

(b) A deferral under subsection (a) of separation, retirement, or transfer to the Retired Reserve may not extend for more than 30 days after completion of the evaluation requiring hospitalization or medical observation.

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PART IV--TRAINING FOR RESERVE COMPONENTS AND EDUCATIONAL ASSISTANCE PROGRAMS

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CHAPTER 1606--EDUCATIONAL ASSISTANCE FOR MEMBERS OF THE SELECTED RESERVE

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Sec. 16133. Time limitation for use of entitlement

(a) Except as provided in subsection (b), the period during which a person entitled to educational assistance under this

chapter may use such person's entitlement expires (1) at the end of the [10-year] 14-year period beginning on the date on which such person becomes entitled to such assistance, or (2) on the date the person is separated from the Selected Reserve, whichever occurs first.

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CHAPTER 1609--EDUCATION LOAN REPAYMENT PROGRAMS

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Sec. 16302. Education loan repayment program: health professions officers serving in Selected Reserve with wartime critical medical skill shortages

(a) * * *

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(d) The authority provided in this section shall apply only in the case of a person first appointed as a commissioned officer before January 1, [2003] 2004.

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SECTION 216 OF THE NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEARS 1992 AND 1993

SEC. 216. MANAGEMENT OF NAVY MINE COUNTERMEASURES PROGRAMS.

(a) Responsibility.--Subject to the authority, direction, and control of the Secretary of Defense, the Under Secretary of Defense for Acquisition and Technology shall have the primary responsibility for developing and testing naval mine countermeasures systems during fiscal years 1996 [through 2003] through 2008.

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STROM THURMOND NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 1999

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DIVISION A--DEPARTMENT OF DEFENSE AUTHORIZATIONS

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TITLE II--RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

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Subtitle D--Other Matters

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SEC. 246. PILOT PROGRAM FOR REVITALIZING THE LABORATORIES AND TEST AND EVALUATION CENTERS OF THE DEPARTMENT OF DEFENSE.

(a) Pilot Program.--(1) The Secretary of Defense may carry out a pilot program to demonstrate improved cooperative relationships with universities and other private sector entities for the performance of research and development functions, and to demonstrate improved efficiency in the performance of the research, development, test, and evaluation functions of the Department of Defense.

* * * * * * *

(4) The Secretary may carry out the pilot program at each selected laboratory and center [for a period of three years beginning not later than March 1, 1999.] until March 1, 2008.

(b) Reports.--(1) * * *

(2) [Promptly after the expiration of the period for participation of a laboratory or center in the pilot program, the Secretary of Defense shall submit to Congress a final report on the participation of the laboratory or center in the pilot program. The report shall contain] Not later than December 31 of each year, the Secretary of Defense shall submit to the congressional defense committees a report on the activities of the pilot program during the preceding fiscal year. Each such report shall contain, for each laboratory or center in the pilot program, the following:

(A) * * *

* * * * * * *

(3) Not later than March 1, 2007, the Secretary of Defense shall submit to the committees referred to in paragraph (2) the Secretary's recommendation as to whether, and to what extent, the authority to carry out the pilot program should be extended.

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DIVISION B--MILITARY CONSTRUCTION AUTHORIZATIONS

SEC. 2001. SHORT TITLE.

This division may be cited as the ``Military Construction Authorization Act for Fiscal Year 1999''.

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TITLE XXIV--DEFENSE AGENCIES

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SEC. 2401. AUTHORIZED DEFENSE AGENCIES CONSTRUCTION AND LAND ACQUISITION PROJECTS.

(a) Inside the United States.--Using amounts appropriated pursuant to the authorization of appropriations in section 2404(a)(1), the Secretary of Defense may acquire real property and carry out military construction projects for the installations and locations inside the United States, and in the amounts, set forth in the following table:

Defense Agencies: Inside the United States

Agency	Installation or location	Amount
Chemical Demilitarization.....	Aberdeen Proving Ground, Maryland...	$223,950,000
	Newport Army Depot, Indiana.....	[$191,550,000] $293,853,000
Total.....		[$727,616,000] $829,919,000

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SEC. 2404. AUTHORIZATION OF APPROPRIATIONS, DEFENSE AGENCIES.

(a) * * *

(b) Limitation of Total Cost of Construction Projects.--Notwithstanding the cost variation authorized by section 2853 of title 10, United States Code, and any other cost variation authorized by law, the total cost of all projects carried out under section 2401 of this Act may not exceed--

(1) * * *

(2) [$162,050,000] $264,353,000 (the balance of the amount authorized under section 2401(a) for the construction of the Ammunition Demilitarization Facility at Newport Army Depot, Indiana); and

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TITLE XXVIII--GENERAL PROVISIONS

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Subtitle D--Land Conveyances

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PART II--NAVY CONVEYANCES

SEC. 2851. CONVEYANCE OF EASEMENT, MARINE CORPS BASE, CAMP PENDLETON, CALIFORNIA.

(a) Easement Authorized.--The Secretary of the Navy may grant an easement, in perpetuity, to the Foothill/Eastern Transportation Corridor Agency (in this section referred to as the ``Agency'') over a parcel of real property at Marine Corps Base, Camp Pendleton, California, consisting of approximately 340 acres to permit the recipient of the [easement to construct, operate, and maintain, notwithstanding any provision of State law to the contrary, a restricted access highway.] easement to construct, operate, and maintain a restricted access highway, notwithstanding any provision of State law that would otherwise prevent the Secretary from granting the easement or the Agency from constructing, operating, or maintaining the restricted access highway. The area covered by the easement shall include slopes and all necessary incidents thereto.

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DIVISION C--DEPARTMENT OF ENERGY NATIONAL SECURITY AUTHORIZATIONS AND OTHER AUTHORIZATIONS

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TITLE XXXI--DEPARTMENT OF ENERGY NATIONAL SECURITY PROGRAMS

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Subtitle D--Other Matters

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SEC. 3159. PANEL TO ASSESS THE RELIABILITY, SAFETY, AND SECURITY OF THE UNITED STATES NUCLEAR STOCKPILE.

(a) * * *

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(d) Report.--Not later than October 1 of 1999 and 2000, and not later than [February 1, 2002,] February 1 of 2002 and 2003, the panel shall submit to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives a report setting forth its findings and conclusions resulting from the review and assessment carried out for the year covered by the report. The report shall be submitted in classified and unclassified form.

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(g) Termination of Panel.--The panel shall terminate [three years after the date of the appointment of the member designated as chairman of the panel.] April 1, 2003.

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NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2002

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DIVISION A--DEPARTMENT OF DEFENSE AUTHORIZATIONS

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TITLE II--RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

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Subtitle C--Ballistic Missile Defense

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[SEC. 232. PROGRAM ELEMENTS FOR BALLISTIC MISSILE DEFENSE ORGANIZATION.]

SEC. 232. PROGRAM ELEMENTS FOR MISSILE DEFENSE AGENCY.

(a) * * *

* * * * * * *

(e) Internal DOD Reviews.--(1) The officials and elements of the Department of Defense specified in paragraph (2) shall on an ongoing basis--

(A) * * *

(B) provide to the Secretary of Defense and the Director of the [Ballistic Missile Defense Organization] Missile Defense Agency any comments on such matters as considered appropriate.

* * * * * * *

(f) Demonstration of Critical Technologies.--(1) The Director of the [Ballistic Missile Defense Organization] Missile Defense Agency shall develop a plan for ensuring that each critical technology for a missile defense program is successfully demonstrated in an appropriate environment before that technology enters into operational service as part of a missile defense program.

(2) The Director of Operational Test and Evaluation of the Department of Defense shall monitor the development of the plan

under paragraph (1) and shall submit to the Director of the [Ballistic Missile Defense Organization] Missile Defense Agency any comments regarding that plan that the Director of Operational Test and Evaluation considers appropriate.

(g) Comptroller General Assessment.--(1) At the conclusion of each of fiscal years 2002 and 2003, the Comptroller General of the United States shall assess the extent to which the [Ballistic Missile Defense Organization] Missile Defense Agency achieved the goals established under subsection (c) for such fiscal year.

* * * * * * *

(h) Annual OT&E Assessment of Test Program.--(1) The Director of Operational Test and Evaluation shall each year assess the adequacy and sufficiency of the [Ballistic Missile Defense Organization] Missile Defense Agency test program during the preceding fiscal year.

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TITLE VI--COMPENSATION AND OTHER PERSONNEL BENEFITS

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Subtitle A--Pay and Allowances

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SEC. 602. BASIC PAY RATE FOR CERTAIN RESERVE COMMISSIONED OFFICERS WITH PRIOR SERVICE AS AN ENLISTED MEMBER OR WARRANT OFFICER.

(a) Service Credit.--Section 203(d) of title 37, United States Code, is amended--

(1) * * *

(2) by striking ``active service as a warrant officer or as a warrant officer and [an] enlisted member'' and inserting ``service described in paragraph (2)''; and

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TITLE XIV--ARMED FORCES RETIREMENT HOME

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SEC. 1410. CONFORMING AND CLERICAL AMENDMENTS AND REPEALS OF OBSOLETE PROVISIONS.

(a) Conforming Amendments.--(1) * * *

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(3) Section 1520 (24 U.S.C. 420), relating to disposition of effects of deceased persons and unclaimed property, is

amended--

(A) * * *

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(C) in subsection (e), by striking ``Directors'' both places it appears and inserting ``Director of the facility''.

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DIVISION B--MILITARY CONSTRUCTION AUTHORIZATIONS

SEC. 2001. SHORT TITLE; DEFINITION.

(a) Short Title.--This division may be cited as the ``Military Construction Authorization Act for Fiscal Year 2002''.

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TITLE XXI--ARMY

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SEC. 2101. AUTHORIZED ARMY CONSTRUCTION AND LAND ACQUISITION PROJECTS.

(a) Inside the United States.--Using amounts appropriated pursuant to the authorization of appropriations in section 2104(a)(1), the Secretary of the Army may acquire real property and carry out military construction projects for the installations and locations inside the United States, and in the amounts, set forth in the following table:

Army: Inside the United States

State	Installation or location	Amount
Alabama.....	Anniston Army Depot.....	$5,150,000
*	*	*
Colorado.....	Fort Carson.....	[$66,000,000] $67,000,000
*	*	*
South Carolina.....	Fort Jackson.....	[$65,650,000] $68,650,000
*	*	*

* * * * * * *

SEC. 2104. AUTHORIZATION OF APPROPRIATIONS, ARMY.

(a) * * *

(b) Limitation on Total Cost of Construction Projects.--Notwithstanding the cost variations authorized by section 2853

of title 10, United States Code, and any other cost variation authorized by law, the total cost of all projects carried out under section 2101 of this Act may not exceed--

(1) * * *

* * * * * * *

(3) [$41,000,000] $42,000,000 (the balance of the amount authorized under section 2201(a) for construction of phase 1 of a barracks complex, Nelson Boulevard, at Fort Carson, Colorado);

(4) [$36,000,000] $39,000,000 (the balance of the amount authorized under section 2201(a) for construction of phase 1 of a basic combat training complex at Fort Jackson, South Carolina); and

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TITLE XXII--NAVY

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SEC. 2201. AUTHORIZED NAVY CONSTRUCTION AND LAND ACQUISITION PROJECTS.

(a) Inside the United States.--Using amounts appropriated pursuant to the authorization of appropriations in section 2204(a)(1), the Secretary of the Navy may acquire real property and carry out military construction projects for the installations and locations inside the United States, and in the amounts, set forth in the following table:

Navy: Inside the United States

State	Installation or location	Amount
Arizona	Marine Corps Air Station, Yuma	$22,570,000
*	*	*
	Naval Station, Norfolk	[$139,270,000] $139,550,000
*	*	*
	Total:	[$1,058,750,000] $1,059,030,000

* * * * * * *

SEC. 2204. AUTHORIZATION OF APPROPRIATIONS, NAVY.

(a) * * *

(b) Limitation on Total Cost of Construction Projects.--Notwithstanding the cost variations authorized by section 2853 of title 10, United States Code, and any other cost variation authorized by law, the total cost of all projects carried out under section 2201 of this Act may not exceed--

(1) * * *

(2) [$33,240,000] $33,520,000 (the balance of the amount authorized under section 2201(a) for replacement of a pier, increment I, at Naval Station, Norfolk, Virginia); and

* * * * * * *

TITLE XXVIII--GENERAL PROVISIONS

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Subtitle B--Real Property and Facilities Administration

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SEC. 2814. DEMONSTRATION PROGRAM ON REDUCTION IN LONG-TERM FACILITY MAINTENANCE COSTS.

(a) * * *

* * * * * * *

[(d) Reporting Requirements.--Not later than January 31, 2005, the Secretary of the Army shall submit to Congress a report on the demonstration program, including the following:

[(1) A description of all contracts that contain requirements referred to in subsection (a) for the purpose of the demonstration program.

[(2) An evaluation of the demonstration program and a description of the experience of the Secretary with respect to such contracts.

[(3) Any recommendations, including recommendations for the termination, continuation, or expansion of the demonstration program, that the Secretary considers appropriate.]

[(e)] (d) Expiration.--The authority under subsection (a) to include requirements referred to in that subsection in contracts under the demonstration program shall expire on September 30, 2006.

[(f)] (e) Funding.--Amounts authorized to be appropriated for the Army for a fiscal year for military construction shall be available for the demonstration program under this section in such fiscal year.

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TITLE XXX--REALIGNMENT AND CLOSURE OF MILITARY INSTALLATIONS AND PREPARATION OF INFRASTRUCTURE PLAN FOR THE NUCLEAR WEAPONS COMPLEX

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SEC. 3007. TECHNICAL AND CLARIFYING AMENDMENTS.

(a) * * *

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(d) Other Clarifying Amendments.--(1) That Act is further amended by inserting ``or realignment'' after ``closure'' each place it appears in the following provisions:

(A) Section 2905(b)(3).
(B) Section 2905(b)(5).
(C) Section [2905(b)(7)(B)(iv)] 2905(b)(7)(C)(iv).

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FLOYD D. SPENCE NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2001

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DIVISION A--DEPARTMENT OF DEFENSE AUTHORIZATIONS

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TITLE III--OPERATION AND MAINTENANCE

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Subtitle D--Department of Defense Industrial Facilities

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SEC. 343. ARSENAL SUPPORT PROGRAM INITIATIVE.

(a) Demonstration Program Required.--To help maintain the viability of the Army manufacturing arsenals and the unique capabilities of these arsenals to support the national security interests of the United States, the Secretary of the Army shall carry out a demonstration program under this section during fiscal years 2001 [and 2002] through 2004 at each manufacturing arsenal of the Department of the Army.

* * * * * * *

(g) Reporting Requirements.--(1) Not later than July 1 of each year in which a guarantee issued under subsection (d) is in effect, the Secretary of the Army shall submit to Congress a report specifying the amounts of loans guaranteed under such subsection during the preceding calendar year. No report is required after fiscal year [2002] 2004.

(2) [Not later than July 1, 2001, the Secretary of the Army shall submit to the congressional defense committees a report on the implementation of the demonstration program.] Not later than July 1, 2003, the Secretary of the Army shall submit to the congressional defense committees a report on the results of the demonstration program since its implementation, including the Secretary's views regarding the benefits of the program for Army manufacturing arsenals and the Department of the Army and the success of the program in achieving the purposes specified in subsection (b). The report shall contain a comprehensive review of contracting at the Army manufacturing arsenals covered by the program and such recommendations as the Secretary considers appropriate regarding changes to the program.

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TITLE V--MILITARY PERSONNEL POLICY

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Subtitle G--Other Matters

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SEC. 577. NATIONAL GUARD CHALLENGE PROGRAM.

(a) * * *

(b) Sources of Federal Support.--Subsection (b) of such section is amended--

(1) * * *

(2) by striking ``, except that [Federal] Department of Defense expenditures under the program may not exceed $62,500,000 for any fiscal year''; and

* * * * * * *

TITLE VI--COMPENSATION AND OTHER PERSONNEL BENEFITS

* * * * * * *

Subtitle A--Pay and Allowances

* * * * * * *

SEC. 612. INCREASE IN MONTHLY SUBSISTENCE ALLOWANCE FOR MEMBERS OF PRECOMMISSIONING PROGRAMS.

(a) * * *

* * * * * * *

(c) Conforming and Stylistic Amendments.--Section 209 of such title is further amended--

(1) * * *

* * * * * * *

(4) in subsection (d)--

(A) * * *

(B) by striking ``the same rate as that prescribed by subsection (a)[,]'' and inserting ``a monthly rate prescribed under subsection (a)''.

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TITLE VIII--ACQUISITION POLICY, ACQUISITION MANAGEMENT, AND RELATED MATTERS

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Subtitle B--Information Technology

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SEC. 814. NAVY-MARINE CORPS INTRANET.

(a) * * *

(b) Phased Implementation.--(1) * * *

(2) Not more than 15 percent of the total number of work stations to be [provided] ordered under the Navy-Marine Corps Intranet program may be [provided] ordered in the first increment of implementation of the Navy-Marine Corps Intranet contract.

(3) No work stations in excess of the number permitted by paragraph (2) may be [provided] ordered under the program until--

(A) * * *

* * * * * * *

(i) Duration of Navy-Marine Corps Intranet Contract.--Notwithstanding section 2306c of title 10, United States Code, the Navy-Marine Corps Intranet contract may have a term in excess of five years, but not more than seven years.

[(i)] (j) Definitions.--(1) In this section, the term ``Navy-Marine Corps Intranet contract'' means a contract providing for a long-term arrangement of the Department of the Navy with the commercial sector that imposes on the contractor a responsibility for, and transfers to the contractor the risk of, providing and managing the significant majority of desktop, server, infrastructure, and communication assets and services of the Department of the Navy.

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TITLE XIII--COOPERATIVE THREAT REDUCTION WITH STATES OF THE FORMER SOVIET UNION

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SEC. 1308. REPORTS ON ACTIVITIES AND ASSISTANCE UNDER COOPERATIVE THREAT REDUCTION PROGRAMS.

(a) * * *

* * * * * * *

(c) Matters To Be Included.--The report under subsection (a) in a year shall set forth the following:

(1) * * *

* * * * * * *

(6) To the maximum extent practicable, a description of how revenue generated by activities carried out under Cooperative Threat Reduction programs in recipient States is being utilized, monitored, and accounted for.

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DIVISION C--DEPARTMENT OF ENERGY NATIONAL SECURITY AUTHORIZATIONS AND OTHER AUTHORIZATIONS

TITLE XXXI--DEPARTMENT OF ENERGY NATIONAL SECURITY PROGRAMS

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Subtitle C--Program Authorizations, Restrictions, and Limitations

* * * * * * *

[SEC. 3132. ENHANCED COOPERATION BETWEEN NATIONAL NUCLEAR SECURITY ADMINISTRATION AND BALLISTIC MISSILE DEFENSE ORGANIZATION.]

SEC. 3132. ENHANCED COOPERATION BETWEEN NATIONAL NUCLEAR SECURITY ADMINISTRATION AND MISSILE DEFENSE AGENCY.

(a) * * *

(b) Requirements for Projects.--The projects referred to in subsection (a) shall--

(1) be carried out by the National Nuclear Security Administration and the [Ballistic Missile Defense Organization] Missile Defense Agency; and

* * * * * * *

(c) Participation by NNSA in Certain [BMDO] MDA Activities.--The Administrator for Nuclear Security and the Director of the [Ballistic Missile Defense Organization] Missile Defense Agency shall implement mechanisms that increase the cooperative relationship between those organizations. Those mechanisms may include participation by personnel of the National Nuclear

Security Administration in the following activities of the [Ballistic Missile Defense Organization] Missile Defense Agency:

(1) Peer reviews of technical efforts.

(2) Activities of so-called ``red teams''.

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NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 1998

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DIVISION A--DEPARTMENT OF DEFENSE AUTHORIZATIONS

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TITLE II--RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

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Subtitle C--Ballistic Missile Defense Programs

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SEC. 233. COOPERATIVE BALLISTIC MISSILE DEFENSE PROGRAM.

(a) Requirement for New Program Element.--The Secretary of Defense shall establish a program element for the [Ballistic Missile Defense Organization] Missile Defense Agency, to be referred to as the ``Cooperative Ballistic Missile Defense Program'', to support technical and analytical cooperative efforts between the United States and other nations that contribute to United States ballistic missile defense capabilities. Except as provided in subsection (b), all international cooperative ballistic missile defense programs of the Department of Defense shall be budgeted and administered through that program element.

* * * * * * *

(c) Relationship to Other Program Elements.--The program element established pursuant to subsection (a) is in addition to the program elements for activities of the [Ballistic Missile Defense Organization] Missile Defense Agency required under section 251 of the National Defense Authorization Act for Fiscal Year 1996 (Public Law 104-106; 110 Stat. 233; 10 U.S.C. 221 note).

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TITLE VI--COMPENSATION AND OTHER PERSONNEL BENEFITS

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Subtitle D--Retired Pay, Survivor Benefits, and Related Matters

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SEC. 644. ANNUITIES FOR CERTAIN MILITARY SURVIVING SPOUSES.

(a) Survivor Annuity.--(1) The Secretary concerned shall pay an annuity to the qualified surviving spouse of each member of the uniformed services who--

(A) became entitled to retired or retainer pay before September 21, 1972, died before March 21, 1974, and was entitled to retired or retainer pay on the date of death; or

(B) [was a member of a reserve component of the Armed Forces] died before October 1, 1978, and at the time of his death would have been entitled to retired pay under chapter 67 of title 10, United States Code (as in effect before December 1, 1994), but for the fact that he was under 60 years of age.

(2) A qualified surviving spouse for purposes of this section is a surviving spouse who has not remarried [and who is not eligible for an annuity under section 4 of Public Law 92-425 (10 U.S.C. 1448 note)].

(b) Amount of Annuity.--(1) An annuity under this section shall be paid at the rate of [$165] $185.58 per month, as adjusted from time to time under paragraph (3).

[(2) An annuity paid to a surviving spouse under this section shall be reduced by the amount of any dependency and indemnity compensation (DIC) to which the surviving spouse is entitled under section 1311(a) of title 38, United States Code.]

(2) The amount of an annuity to which a surviving spouse is entitled under this section for any period shall be reduced (but not below zero) by any amount paid to that surviving spouse for the same period under any of the following provisions of law:

(A) Section 1311(a) of title 38, United States Code (relating to dependency and indemnity compensation payable by the Secretary of Veterans Affairs).

(B) Chapter 73 of title 10, United States Code.

(C) Section 4 of Public Law 92-425 (10 U.S.C. 1448 note).

(3) Whenever after [the date of the enactment of this Act] May 1, 2002, retired or retainer pay is increased under section 1401a(b)(2) of title 10, United States Code, each annuity that is payable under this section shall be increased at the same time and by the same total percent. [The amount of the increase shall be based on the amount of the monthly annuity payable before any reduction under this section.]

* * * * * * *

(d) Definitions.--For purposes of this section:

(1) * * *

(2) The term ``surviving spouse'' has the meaning given [the terms ``widow'' and ``widower'' in paragraphs (7) and (8)] such term in paragraph (9) of

section 1447 of title 10, United States Code.

(e) Prospective Applicability.--(1) Annuities under this section shall be paid for months beginning after [the month in which this Act is enacted] November 1997.

(2) No benefit shall accrue to any person by reason of the enactment of this section for any period before [the first month that begins after the month in which this Act is enacted] December 1997.

(3) In the case of a person entitled to an annuity under this section who applies for the annuity after the date of the enactment of this paragraph, such annuity shall be paid only for months beginning after the date on which such application is submitted.

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NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 1996

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DIVISION A--DEPARTMENT OF DEFENSE AUTHORIZATIONS

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TITLE II--RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

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Subtitle C--Ballistic Missile Defense Act of 1995

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SEC. 234. THEATER MISSILE DEFENSE ARCHITECTURE.

(a) * * *

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(e) Program Accountability Report.--(1) As part of the annual report of the [Ballistic Missile Defense Organization] Missile Defense Agency required by section 224 of Public Law 101-189 (10 U.S.C. 2431 note), the Secretary of Defense shall describe the technical milestones, the schedule, and the cost of each phase of development and acquisition (together with total estimated program costs) for each core and follow-on theater missile defense program.

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DIVISION C--DEPARTMENT OF ENERGY NATIONAL SECURITY AUTHORIZATIONS AND OTHER AUTHORIZATIONS

TITLE XXXI--DEPARTMENT OF ENERGY NATIONAL SECURITY PROGRAMS

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Subtitle C--Program Authorizations, Restrictions, and Limitations

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SEC. 3131. AUTHORITY TO CONDUCT PROGRAM RELATING TO FISSILE MATERIALS.

[(a) Authority.--]The Secretary of Energy may conduct programs designed to improve the protection, control, and accountability of fissile materials in Russia.

[(b) Semi-Annual Reports on Obligation of Funds.--(1) Not later than 30 days after the date of the enactment of this Act, and thereafter not later than April 1 and October 1 of each year, the Secretary of Energy shall submit to Congress a report on each obligation during the preceding six months of funds appropriated for a program described in subsection (a).

[(2) Each such report shall specify--

[(A) the activities and forms of assistance for which the Secretary of Energy has obligated funds;

[(B) the amount of the obligation;

[(C) the activities and forms of assistance for which the Secretary anticipates obligating funds during the six months immediately following the report, and the amount of each such anticipated obligation; and

[(D) the projected involvement (if any) of any department or agency of the United States (in addition to the Department of Energy) and of the private sector of the United States in the activities and forms of assistance for which the Secretary of Energy has obligated funds referred to in subparagraph (A).]

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NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 1994

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DIVISION A--DEPARTMENT OF DEFENSE AUTHORIZATIONS

* * * * * * *

TITLE II--RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

* * * * * * *

Subtitle C--Missile Defense Programs

* * * * * * *

SEC. 235. THEATER MISSILE DEFENSE MASTER PLAN.

(a) * * *

(b) TMD Master Plan.--The Secretary of Defense shall submit to Congress a report (which shall constitute the TMD master plan) containing a thorough and complete analysis of the future of theater missile defense programs. The report shall include the following:

(1) * * *

* * * * * * *

(4) An evaluation of the cost and relative effectiveness of each interceptor and sensor under development as part of a Theater Missile Defense system by the [Ballistic Missile Defense Organization] Missile Defense Agency.

* * * * * * *

SEC. 243. TRANSFER OF FOLLOW-ON TECHNOLOGY PROGRAMS.

(a) * * *

(b) Waiver Authority.--The Secretary may waive the provisions of subsection (a) in the case of a particular program, project, or activity if the Secretary certifies to the congressional defense committees that it is in the national security interest of the United States to provide management and budget responsibility for that program, project, or activity through the [Ballistic Missile Defense Organization] Missile Defense Agency.

(c) Report Required.--As a part of the report required by section 231(e), the Secretary shall submit to the congressional defense committees a report identifying--

(1) each program, project, and activity with respect to which the Secretary has transferred management and budget responsibility from the [Ballistic Missile Defense Organization] Missile Defense Agency in accordance with subsection (a);

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SECTION 3 OF THE MIGRATORY BIRD TREATY ACT

Sec. 3. (a) * * *

* * * * * * *

(c)(1) Section 2 shall not apply to the incidental taking of a migratory bird by a member of the Armed Forces during a military readiness activity authorized by the Secretary of Defense or the Secretary of the military department concerned.

(2)(A) In this subsection, the term ``military readiness activity'' includes--

(i) all training and operations of the Armed Forces

that relate to combat; and

(ii) the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use.

(B) The term does not include--

(i) the routine operation of installation operating support functions, such as administrative offices, military exchanges, commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, laundries, morale, welfare, and recreation activities, shops, and mess halls;

(ii) the operation of industrial activities; or

(iii) the construction or demolition of facilities used for a purpose described in clause (i) or (ii).

SECTION 4 OF THE ENDANGERED SPECIES ACT OF 1973

determination of endangered species and threatened species

Sec. 4. (a) General.--(1) * * *

* * * * * * *

(3)(A) The Secretary, by regulation promulgated in accordance with subsection (b) and to the maximum extent prudent and determinable--

[(A)] (i) shall, concurrently with making a determination under paragraph (1) that a species is an endangered species or a threatened species, designate any habitat of such species which is then considered to be critical habitat; and

[(B)] (ii) may, from time-to-time thereafter as appropriate, revise such designation.

(B)(i) The Secretary may not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines that such plan addresses special management considerations or protection (as those terms are used in section 3(5)(A)(i)).

(ii) Nothing in this subparagraph affects the requirement to consult under section 7(a)(2) with respect to an agency action (as that term is defined in that section).

(iii) Nothing in this subparagraph affects the obligation of the Department of Defense to comply with section 9 of the Endangered Species Act of 1973, including the prohibition preventing extinction and taking of endangered species and threatened species.

(b) Basis for Determinations.--(1) * * *

(2) The Secretary shall designate critical habitat, and make revisions thereto, under subsection (a)(3) on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweight the benefits of specifying

such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

* * * * * * *

SECTION 7 OF THE DEFENSE DEPARTMENT OVERSEAS TEACHERS PAY AND PERSONNEL PRACTICES ACT

quarters, quarters allowances, and storage

Sec. 7. (a) * * *

(b) Each teacher (other than a teacher employed in a substitute capacity) shall be entitled, for each school year for which he performs services as a teacher, to quarters or a quarters allowance equal to those authorized by [the Act of June 26, 1930 (5 U.S.C. 118a)] section 5912 of title 5, United States Code. If the teacher is unaccompanied by dependents and is required to reside on a United States military installation in an overseas area, the teacher may receive a quarters allowance to reside in excess family housing at the installation notwithstanding the availability single room housing at the installation.

(c) Each teacher (other than a teacher employed in a substitute capacity) who is performing services as a teacher at the close of a school year and agrees in writing to serve as a teacher for the next school year may be authorized, for the recess period immediately preceding such next school year--

(1) quarters or a quarters allowance equal to those authorized by [the Act of June 26, 1930 (5 U.S.C. 118a)] section 5912 of title 5, United States Code, or

* * * * * * *

SECTION 1402 OF THE DEFENSE DEPENDENTS' EDUCATION ACT OF 1978

establishment of defense dependents' education system

Sec. 1402. (a) * * *

* * * * * * *

(d)(1) The Secretary of Defense may provide optional summer school programs in the defense dependents' education system.

[(2) The Secretary shall provide in regulations for fees to be charged for the students enrolling in a summer school program under this subsection in amounts determined on the basis of family income.]

(2) Individuals eligible to receive a free public education under subsection (a) may enroll without charge in a summer school program offered under this subsection. Students who are required under section 1404 to pay tuition to enroll in a school of the defense dependents' education system shall also

be charged a fee, at a rate established by the Secretary, to attend a course offered as part of the summer school program.

* * * * * * *

TITLE 37, UNITED STATES CODE

* * * * * * *

CHAPTER 1--DEFINITIONS

Sec. 101. Definitions

In addition to the definitions in sections 1-5 of title 1, the following definitions apply in this title:

(1) The term ``United States'', in a geographical sense, means the States and the District of Columbia. The term ``continental United States'' means the 48 contiguous States and the District of Columbia.

* * * * * * *

CHAPTER 5--SPECIAL AND INCENTIVE PAYS

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Sec. 301b. Special pay: aviation career officers extending period of active duty

(a) Bonus Authorized.--An aviation officer described in subsection (b) who, during the period beginning on January 1, 1989, and ending on December 31, [2002] 2003, executes a written agreement to remain on active duty in aviation service for at least one year may, upon the acceptance of the agreement by the Secretary concerned, be paid a retention bonus as provided in this section.

* * * * * * *

Sec. 302d. Special pay: accession bonus for registered nurses

(a) Accession Bonus Authorized.--(1) A person who is a registered nurse and who, during the period beginning on November 29, 1989, and ending on December 31, [2002] 2003, executes a written agreement described in subsection (c) to accept a commission as an officer and remain on active duty for a period of not less than four years may, upon the acceptance of the agreement by the Secretary concerned, be paid an accession bonus in an amount determined by the Secretary concerned.

* * * * * * *

Sec. 302e. Special pay: nurse anesthetists

(a) Special Pay Authorized.--(1) An officer described in subsection (b)(1) who, during the period beginning on November 29, 1989, and ending on December 31, [2002] 2003, executes a written agreement to remain on active duty for a period of one year or more may, upon the acceptance of the agreement by the Secretary concerned, be paid incentive special pay in an amount not to exceed $15,000 for any 12-month period.

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Sec. 302g. Special pay: Selected Reserve health care professionals in critically short wartime specialties

(a) * * *

* * * * * * *

(f) Termination of Agreement Authority.--No agreement under this section may be entered into after December 31, [2002] 2003.

Sec. 302h. Special pay: accession bonus for dental officers

(a) Accession Bonus Authorized.--(1) A person who is a graduate of an accredited dental school and who, during the period beginning on September 23, 1996, and ending on December 31, [2002] 2003, executes a written agreement described in subsection (c) to accept a commission as an officer of the armed forces and remain on active duty for a period of not less than four years may, upon the acceptance of the agreement by the Secretary concerned, be paid an accession bonus in an amount determined by the Secretary concerned.

* * * * * * *

Sec. 302j. Special pay: accession bonus for pharmacy officers

(a) Accession Bonus Authorized.--A person who is a graduate of an accredited pharmacy school and who, during the period beginning on the date of the enactment of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 and ending on September 30, 2004, executes a written agreement described in subsection [(c)] (d) to accept a commission as an officer of a uniformed service and remain on active duty for a period of not less than 4 years may, upon acceptance of the agreement by the Secretary concerned, be paid an accession bonus in an amount determined by the Secretary concerned.

* * * * * * *

Sec. 305. Special pay: hardship duty pay

(a) * * *
(b) Duty in Certain Locations.--(1) In the case of duty at a

location described in paragraph (2) at any time during a month, the member of a uniformed service performing that duty is entitled to special pay under this section at a monthly rate of not less than $240, but not to exceed the monthly rate specified in subsection (a). For each day of that duty during the month, the member shall receive an amount equal to \1/30\ of the monthly rate prescribed under this subsection.

(2) Paragraph (1) applies with respect to duty performed on the ground in Antarctica or on the Arctic icepack.

[(b)] (c) Regulations.--The Secretary of Defense shall prescribe regulations for the provision of hardship duty pay under subsection (a), including the specific monthly rates at which the special pay will be available.

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Sec. 308. Special pay: reenlistment bonus

(a) * * *

* * * * * * *

(g) No bonus shall be paid under this section with respect to any reenlistment, or voluntary extension of an active-duty reenlistment, in the armed forces entered into after December 31, [2002] 2003.

* * * * * * *

Sec. 308b. Special pay: reenlistment bonus for members of the Selected Reserve

(a) * * *

* * * * * * *

(f) Termination of Authority.--No bonus may be paid under this section to any enlisted member who, after December 31, [2002] 2003, reenlists or voluntarily extends his enlistment in a reserve component.

Sec. 308c. Special pay: bonus for enlistment in the Selected Reserve

(a) * * *

* * * * * * *

(e) No bonus may be paid under this section to any enlisted member who, after December 31, [2002] 2003, enlists in the Selected Reserve of the Ready Reserve of an armed force.

* * * * * * *

Sec. 308d. Special pay: enlisted members of the Selected Reserve assigned to certain high priority units

(a) * * *

* * * * * * *

(c) Additional compensation may not be paid under this section for inactive duty performed after December 31, [2002] 2003.

Sec. 308e. Special pay: bonus for reserve affiliation agreement

(a) * * *

* * * * * * *

(e) No bonus may be paid under this section to any person for a reserve obligation agreement entered into after December 31, [2002] 2003.

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Sec. 308h. Special pay: bonus for reenlistment, enlistment, or voluntary extension of enlistment in elements of the Ready Reserve other than the Selected Reserve

(a) * * *

* * * * * * *

(g) Termination of Authority.--A bonus may not be paid under this section to any person for a reenlistment, enlistment, or voluntary extension of an enlistment after December 31, [2002] 2003.

Sec. 308i. Special pay: prior service enlistment bonus

(a) * * *

(b) Bonus Amounts; Payment.--(1) The amount of a bonus under this section may not exceed--

(A) [$5,000] $8,000, in the case of a person who enlists for a period of six years;

(B) [$2,500] $4,000, in the case of a person who, having never received a bonus under this section, enlists for a period of three years; and

(C) [$2,000] $3,500, in the case of a person who, having received a bonus under this section for a previous three-year enlistment, reenlists or extends the enlistment for an additional period of three years.

* * * * * * *

(f) Termination of Authority.--No bonus may be paid under this section to any person for an enlistment after December 31, [2002] 2003.

Sec. 309. Special pay: enlistment bonus

(a) * * *

* * * * * * *

(e) Duration of Authority.--No bonus shall be paid under this section with respect to any enlistment in the armed forces made after December 31, [2002] 2003.

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Sec. 312. Special pay: nuclear-qualified officers extending period of active duty

(a) * * *

* * * * * * *

(e) The provisions of this section shall be effective only in the case of officers who, on or before December 31, [2002] 2003, execute the required written agreement to remain in active service.

* * * * * * *

Sec. 312b. Special pay: nuclear career accession bonus

(a) * * *

* * * * * * *

(c) The provisions of this section shall be effective only in the case of officers who, on or before December 31, [2002] 2003, have been accepted for training for duty in connection with the supervision, operation, and maintenance of naval nuclear propulsion plants.

Sec. 312c. Special pay: nuclear career annual incentive bonus

(a) * * *

* * * * * * *

(d) For the purposes of this section, a ``nuclear service year'' is any fiscal year beginning before December 31, [2002] 2003.

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Sec. 314. Special pay or bonus: qualified enlisted members extending duty at designated locations overseas

(a) Covered Members.--This section applies with respect to an enlisted member of an armed force who--

(1) * * *

* * * * * * *

(3) has completed a tour of duty (as defined in accordance with regulations prescribed by the Secretary concerned) at a location outside [the 48 contiguous States and the District of Columbia] the continental

United States that is designated by the Secretary concerned for the purposes of this section; and

* * * * * * *

Sec. 323. Special pay: retention incentives for members qualified in a critical military skill

(a) * * *

* * * * * * *

(d) Maximum Bonus Amount.--(1) A member may enter into an agreement under this section, or reenlist or voluntarily extend the member's enlistment, more than once to receive a bonus under this section. However, a member may not receive a total of more than $200,000 in payments under this section.

(2) The limitation in paragraph (1) on the total bonus payments that a member may receive under this section does not apply with respect to an officer who is assigned duties as a health care provider.

(e) Certain Members Ineligible.--(1) A retention bonus may not be provided under subsection (a) to a member of the armed forces who--

[(1)] (A) has completed more than 25 years of active duty; or

[(2)] (B) will complete the member's twenty-fifth year of active duty before the end of the period of active duty for which the bonus is being offered.

(2) The limitations in paragraph (1) do not apply with respect to an officer who is assigned duties as a health care provider during the period of active duty for which the bonus is being offered.

* * * * * * *

(i) Termination of Bonus Authority.--No bonus may be paid under this section with respect to any reenlistment, or voluntary extension of an enlistment, in the armed forces entered into after December 31, [2002] 2003, and no agreement under this section may be entered into after that date.

Sec. 324. Special pay: accession bonus for new officers in critical skills

(a) * * *

(b) Designation of Critical Officer Skills.--[(1)] The Secretary concerned shall designate the critical officer skills for the purposes of this section. A skill may be designated as a critical officer skill for an armed force under this subsection if--

(1) * * *

* * * * * * *

(g) Termination of Authority.--No agreement under this section may be entered into after December 31, [2002] 2003.

* * * * * * *

CHAPTER 7--ALLOWANCES

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Sec. 403. Basic allowance for housing

(a) * * *

* * * * * * *

(c) Basic Allowance for Housing Outside the United States.--
(1) * * *

* * * * * * *

(4) In the case of a member who is assigned to duty outside of the United States, the location or the circumstances of which make it necessary that the member be reassigned under the conditions of low-cost or no-cost permanent change of station or permanent change of assignment, the member may be treated as if the member were not reassigned if the Secretary concerned determines that it would be inequitable to base the member's entitlement to, and amount of, a basic allowance for housing on the cost of housing in the area to which the member is reassigned.

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Sec. 403b. Cost-of-living allowance in the continental United States

(a) * * *

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(i) Other Definitions.--In this section:
(1) * * *

* * * * * * *

[(6) The term ``continental United States'' means the 48 contiguous States and the District of Columbia.]

* * * * * * *

Sec. 409. Travel and transportation allowances: house trailers and mobile homes

(a) * * *

* * * * * * *

[(e) In this section, the term ``continental United States'' means the 48 contiguous States and the District of Columbia.]

* * * * * * *

Sec. 411b. Travel and transportation allowances: travel performed in connection with leave between consecutive overseas tours

[(a)(1)] (a) Allowances Authorized.--Under uniform regulations prescribed by the Secretaries concerned, a member of a uniformed service stationed outside [the 48 contiguous States and the District of Columbia] the continental United States who is ordered to a consecutive tour of duty at the same duty station or who is ordered to make a change of permanent station to another duty station outside [the 48 contiguous States and the District of Columbia] the continental United States may be paid travel and transportation allowances in connection with authorized leave from his last duty station to a place approved by the Secretary concerned, and from that place to his designated post of duty. Such allowances may be paid for the member and for the dependents of the member who are authorized to, and do, accompany him at his duty stations.

[(2) Under the regulations referred to in paragraph (1), a member may defer the travel for which the member is paid travel and transportation allowances under such paragraph until not more than one year after the date on which the member begins the consecutive tour of duty at the same duty station or reports to another duty station under the order involved, as the case may be. If the member is unable to undertake the travel before the end of such one-year period as a result of duty in connection with a contingency operation, the member may defer the travel for one additional year beginning on the date the duty of the member in connection with the contingency operation ends.]

(b) Authority to Defer Travel; Limitations.--(1) Under the regulations referred to subsection (a), a member may defer the travel for which the member is paid travel and transportation allowances under this section until anytime before the completion of the consecutive tour at the same duty station or the completion of the tour of duty at the new duty station under the order involved, as the case may be.

(2) If a member is unable to undertake the travel before expiration of the deferral period under paragraph (1) because of duty in connection with a contingency operation, the member may defer the travel until not more than one year after the date on which the member's duty in connection with the contingency operation ends.

[(b) The allowances] (c) Limitation on Allowance Rate.--prescribed under this section may not exceed the rate authorized under section 404(d) of this title. Authorized travel under this section is performed in a duty status.

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Sec. 411d. Travel and transportation allowances: transportation incident to personal emergencies for certain members and dependents

(a) * * *

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[(d) In this section, the term ``continental United States'' means the 48 contiguous States and the District of Columbia.]

* * * * * * *

Sec. 430. Travel and transportation: dependent children of members stationed overseas

(a) * * *

* * * * * * *

[(f) Definitions.--In this section:

[(1) The term ``continental United States'' means the 48 contiguous States and the District of Columbia.

[(2) The term ``formal education'' means the following:

[(A) A secondary education.

[(B) An undergraduate college education.

[(C) A graduate education pursued on a full-time basis at an institution of higher education (as defined in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001)).

[(D) Vocational education pursued on a full-time basis at a post-secondary vocational institution (as defined in section 102(c) of the Higher Education Act of 1965 (20 U.S.C. 1002(c))).]

(f) Definitions.--In this section:

(1) The term ``formal education'' means the following:

(A) A secondary education.

(B) An undergraduate college education.

(C) A graduate education pursued on a full-time basis at an institution of higher education.

(D) Vocational education pursued on a full-time basis at a postsecondary vocational institution.

(2) The term ``institution of higher education'' has the meaning given that term in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001).

(3) The term ``postsecondary vocational institution'' has the meaning given that term in section 102(c) of the Higher Education Act of 1965 (20 U.S.C. 1002(c)).

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CHAPTER 19--ADMINISTRATION

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Sec. 1007. Deductions from pay

(a) * * *

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(e) The amount of any damage, or cost of repairs, to arms or equipment caused by the abuse or negligence of a member of the [Army or the Air Force] Army, Navy, Air Force, or Marine Corps, as the case may be, who had the care of, or was using, the property when it was damaged, shall be deducted from his pay.

* * * * * * *

(i)(1) There shall be deducted each month from the pay of each enlisted member, warrant officer, and limited duty officer of the armed forces on active duty [an amount (determined under paragraph (3)) not to exceed $1.00.] an amount equal to $1.00 and such additional amount as may be determined under paragraph (3).

* * * * * * *

(3) The Secretary of Defense, after consultation with the Armed Forces Retirement Home Board, shall determine from time to time [the amount] the additional amount to be deducted under paragraph (1) from the pay of enlisted members, warrant officers, and limited duty officers on the basis of the financial needs of the Armed Forces Retirement Home. [The amount] The additional amount to be deducted may be fixed at different amounts on the basis of grade or length of service, or both.

* * * * * * *

SECTION 8003 OF THE ELEMENTARY AND SECONDARY EDUCATION ACT OF 1965

SEC. 8003. PAYMENTS FOR ELIGIBLE FEDERALLY CONNECTED CHILDREN.

(a) * * *

(b) Basic Support Payments and Payments With Respect to Fiscal Years in Which Insufficient Funds Are Appropriated.--

(1) * * *

(2) Basic Support Payments for Heavily Impacted Local Educational Agencies.--

(A) * * *

* * * * * * *

(H) Eligibility for heavily impacted local educational agencies affected by privatization of military housing.--

(i) Eligibility.--For any fiscal year beginning with fiscal year 2003, a heavily impacted local educational agency that received a basic support payment under subparagraph (A) for the prior fiscal year, but is ineligible for such payment for the current fiscal year under subparagraph (B) or (C), as the case may be, by reason of the

conversion of military housing units to private housing described in clause (iii), shall be deemed to meet the eligibility requirements under subparagraph (B) or (C), as the case may be, for the period during which the housing units are undergoing such conversion.

(ii) Amount of payment.--The amount of a payment to a heavily impacted local educational agency for a fiscal year by reason of the application of clause (i), and calculated in accordance with subparagraph (D) or (E) (as the case may be), shall be based on the number of children in average daily attendance in the schools of such agency for the fiscal year.

(iii) Conversion of military housing units to private housing described.--For purposes of clause (i), ``conversion of military housing units to private housing'' means the conversion of military housing units to private housing units pursuant to subchapter IV of chapter 169 of title 10, United States Code, or pursuant to any other related provision of law.

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SECTION 9 OF THE RICHARD B. RUSSELL NATIONAL SCHOOL LUNCH ACT

NUTRITIONAL AND OTHER PROGRAM REQUIREMENTS

Sec. 9. (a) * * *
(b)(1) * * *

* * * * * * *

(3) Any child who is a member of a household whose income, at the time the application is submitted, is at an annual rate which does not exceed the applicable family size income level of the income eligibility guidelines for free lunches, as determined under paragraph (1), shall be served a free lunch. Any child who is a member of a household whose income, at the time the application is submitted, is at an annual rate greater than the applicable family size income level of the income eligibility guidelines for free lunches, as determined under paragraph (1), but less than or equal to the applicable family size income level of the income eligibility guidelines for reduced price lunches, as determined under paragraph (1), shall be served a reduced price lunch. The price charged for a reduced price lunch shall not exceed 40 cents. For the one-year period beginning on the date of the enactment of this sentence, the amount of a basic allowance provided under section 403 of title 37, United States Code, on behalf of an individual who is

a member of the uniformed services for housing that is acquired or constructed under the authority of subchapter IV of chapter 169 of title 10, United States Code, or any other related provision of law, shall not be considered to be income for purposes of determining the eligibility of a child of the individual for free or reduced price lunches under this Act.

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TITLE 32, UNITED STATES CODE

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CHAPTER 3--PERSONNEL

Sec.
301. Federal recognition of enlisted members.
* * * * * * *
[327. General courts-martial of National Guard not in Federal service.
[328. Special courts-martial of National Guard not in Federal service.
[329. Summary courts-martial of National Guard not in Federal service.
[330. Confinement instead of fine.
[331. Dismissal or dishonorable discharge.
[332. Compelling attendance of accused and witnesses.
[333. Execution of process and sentence.]
327. Courts-martial of National Guard not in Federal service: convening authority.
* * * * * * *

Sec. 326. Courts-martial of National Guard not in Federal service: composition, jurisdiction, and procedures

In the National Guard not in Federal service, there are general, special, and summary courts-martial constituted like similar courts of the Army and the Air Force. They have the jurisdiction and powers, except as to punishments, and shall follow the forms and procedures, provided for those courts. Punishments shall be as provided by the laws of the respective States and Territories, Puerto Rico, and the District of Columbia.

[Sec. 327. General courts-martial of National Guard not in Federal service

[(a) In the National Guard not in Federal service, general courts-martial may be convened by the President or by the governor of a State or Territory, Puerto Rico or by the commanding general of the National Guard of the District of Columbia.

[(b) A general court-martial may sentence to--

[(1) a fine of not more than $200;

[(2) forfeiture of pay and allowances;

[(3) a reprimand;

[(4) dismissal or dishonorable discharge;

[(5) reduction of a noncommissioned officer to the ranks; or

[(6) any combination of these punishments.

[Sec. 328. Special courts-martial of National Guard not in Federal service

[(a) In the National Guard not in Federal service, the commanding officer of a garrison, fort, post, camp, air base, auxiliary air base, or other place where troops are on duty, or of a brigade, regiment, wing, group, detached battalion, separate squadron, or other detached command, may convene special courts-martial. Special courts-martial may also be convened by superior authority.

[(b) A special court-martial may not try a commissioned officer.

[(c) A special court-martial has the same powers of punishment as a general court-martial, except that a fine imposed by a special court-martial may not be more than $100 for a single offense.

[Sec. 329. Summary courts-martial of National Guard not in Federal service

[(a) In the National Guard not in Federal service, the commanding officer of a garrison, fort, post, camp, air base, auxiliary air base, or other place where troops are on duty, or of a regiment, wing, group, detached battalion, detached squadron, detached company, or other detachment, may convene a summary court-martial consisting of one commissioned officer. The proceedings shall be informal.

[(b) A summary court-martial may sentence to a fine of not more than $25 for a single offense, to forfeiture of pay and allowances, and to reduction of a noncommissioned officer to the ranks.

[Sec. 330. Confinement instead of fine

[In the National Guard not in Federal service, a court-martial may, instead of imposing a fine, sentence to confinement for not more than one day for each dollar of the authorized fine.

[Sec. 331. Dismissal or dishonorable discharge

[In the National Guard not in Federal service, no sentence of dismissal or dishonorable discharge may be executed until it is approved by the governor of the State or Territory, Puerto Rico, or whichever is concerned, or, in the case of the National Guard of the District of Columbia, by its commanding general.

[Sec. 332. Compelling attendance of accused and witnesses

[In the National Guard not in Federal service, the president of a court-martial or a summary court officer may--

[(1) issue a warrant for the arrest of any accused person who, having been served with a warrant and a copy of the charges, disobeys a written order by the convening authority to appear before the court;

[(2) issue subpenas duces tecum and other subpenas;

[(3) enforce by attachment the attendance or

witnesses and the production of books and papers; and

[(4) sentence for refusal to be sworn or to answer, as provided in actions before civil courts.

[Sec. 333. Execution of process and sentence

[In the National Guard not in Federal service, the processes and sentences of its courts-martial shall be executed by the civil officers prescribed by the laws of the States concerned. In a State where no provision is made for executing those processes and sentences, and in the Territories, Puerto Rico and the District of Columbia, the process or sentence shall be executed by a United States marshal or deputy marshal, who shall make a return to the military officer issuing the process or the court imposing the sentence.]

Sec. 327. Courts-martial of National Guard not in Federal service: convening authority

(a) In the National Guard not in Federal service, general, special, and summary courts-martial may be convened as provided by the laws of the States and Territories, Puerto Rico, and the District of Columbia.

(b) In addition to convening authorities as provided under subsection (a), in the National Guard not in Federal service--

(1) general courts-martial may be convened by the President;

(2) special courts-martial may be convened--

(A) by the commanding officer of a garrison, fort, post, camp, air base, auxiliary air base, or other place where troops are on duty; or

(B) by the commanding officer of a division, brigade, regiment, wing, group, detached battalion, separate squadron, or other detached command; and

(3) summary courts-martial may be convened--

(A) by the commanding officer of a garrison, fort, post, camp, air base, auxiliary air base, or other place where troops are on duty; or

(B) by the commanding officer of a division, brigade, regiment, wing, group, detached battalion, detached squadron, detached company, or other detachment.

* * * * * * *

CHAPTER 5--TRAINING

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Sec. 509. National Guard Challenge Program of opportunities for civilian youth

(a) * * *

* * * * * * *

[(d) Matching Funds Required.--The amount of assistance

provided under this section to a State program of the National Guard Challenge Program may not exceed--

[(1) for fiscal year 1998, 75 percent of the costs of operating the State program during that year;

[(2) for fiscal year 1999, 70 percent of the costs of operating the State program during that year;

[(3) for fiscal year 2000, 65 percent of the costs of operating the State program during that year; and

[(4) for fiscal year 2001 and each subsequent fiscal year, 60 percent of the costs of operating the State program during that year.]

(d) Matching Funds Required.--The amount of assistance provided under this section to a State program of the National Guard Challenge Program for a fiscal year may not exceed 75 percent of the costs of operating the State program during that fiscal year.

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SECTION 1896 OF THE SOCIAL SECURITY ACT

MEDICARE SUBVENTION DEMONSTRATION PROJECT FOR MILITARY RETIREES

Sec. 1896. (a) * * *

* * * * * * *

(k) Evaluation and Reports.--

(1) * * *

[(2) Report on extension and expansion of demonstration project.--Not later than 6 months after the date of the submission of the final report by the Comptroller General of the United States under paragraph (1), the administering Secretaries shall submit to Congress a report containing their recommendation as to--

[(A) whether there is a cost to the health care program under this title in conducting the demonstration project, and whether the demonstration project could be expanded without there being a cost to such health care program or to the Federal Government;

[(B) whether to extend the demonstration project or make the project permanent; and

[(C) whether the terms and conditions of the project should be continued (or modified) if the project is extended or expanded.]

SECTION 4202 OF THE CLINGER-COHEN ACT OF 1996

SEC. 4202. APPLICATION OF SIMPLIFIED PROCEDURES TO CERTAIN COMMERCIAL ITEMS.

(a) * * *

* * * * * * *

(e) Effective Date.--The authority to issue solicitations for purchases of commercial items in excess of the simplified acquisition threshold pursuant to the special simplified procedures authorized by section 2304(g)(1) of title 10, United States Code, section 303(g)(1) of the Federal Property and Administrative Services Act of 1949, and section 31(a) of the Office of Federal Procurement Policy Act, as amended by this section, shall expire January 1, [2003] 2004. Contracts may be awarded pursuant to solicitations that have been issued before such authority expires, notwithstanding the expiration of such authority.

SECTION 4 OF THE OFFICE OF FEDERAL PROCUREMENT POLICY ACT

SEC. 4. DEFINITIONS.

As used in this Act:

(1) * * *

* * * * * * *

(11) The term ``simplified acquisition threshold'' means $100,000, except that such amount may be adjusted by the Administrator every five years to the amount equal to $100,000 in constant fiscal year 2002 dollars (rounded to the nearest $10,000).

* * * * * * *

SECTION 553 OF THE NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 1995

SEC. 553. PROHIBITION ON IMPOSITION OF ADDITIONAL CHARGES OR FEES FOR ATTENDANCE AT CERTAIN ACADEMIES.

(a) * * *

(b) Exception.--The prohibition specified in subsection (a) shall not apply with respect to any item or service provided to cadets or midshipmen at an academy named in subsection (c) for which a charge or fee is imposed as of the date of the enactment of this Act. [The Secretary of Defense or the Secretary of Transportation, as the case shall be, shall notify Congress of any change made by an academy in the amount of a charge or fee authorized under this subsection.]

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NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2000

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TITLE V--MILITARY PERSONNEL POLICY

* * * * * * *

Subtitle H--Matters Relating to Recruiting

* * * * * * *

SEC. 573. ARMY COLLEGE FIRST PILOT PROGRAM.

(a) * * *

(b) Delayed Entry With Allowance for Higher Education.--Under the pilot program, the Secretary may--

(1) * * *

(2) subject to paragraph (2) of subsection (d) and except as provided in paragraph (3) of that subsection, pay an allowance to a person accepted for enlistment under paragraph (1)(A) for each month of the period during which that person is enrolled in and pursuing a program described in paragraph (1)(B).

* * * * * * *

TITLE XIII--COOPERATIVE THREAT REDUCTION WITH STATES OF THE FORMER SOVIET UNION

* * * * * * *

SEC. 1305. LIMITATION ON USE OF FUNDS FOR CHEMICAL WEAPONS DESTRUCTION.

No fiscal year 2000 Cooperative Threat Reduction funds, and no funds appropriated for Cooperative Threat Reduction programs after the date of the enactment of this Act, may be obligated or expended for planning, design, or construction of a chemical weapons destruction facility in Russia until the Secretary of Defense submits to Congress a certification that there has been--

(1) * * *

* * * * * * *

(6) a demonstrated commitment from the international community to fund and build infrastructure needed to support and operate the facility[.].

* * * * * * *

TITLE XXIV--DEFENSE AGENCIES

* * * * * * *

SEC. 2401. AUTHORIZED DEFENSE AGENCIES CONSTRUCTION AND LAND

ACQUISITION PROJECTS.

(a) Inside the United States.--Using amounts appropriated pursuant to the authorization of appropriations in section 2403(a)(1), the Secretary of Defense may acquire real property and carry out military construction projects for the installations and locations inside the United States, and in the amounts, set forth in the following table:

Defense Agencies: Inside the United States

Agency	Installation or location	Amount
Chemical Demilitarization.....	Blue Grass Army Depot, Kentucky..	[$254,030,000] $290,325,000
* * *	* * *	* *
	Total.....	[$711,950,000] $748,245,000

* * * * * * *

SEC. 2405. MODIFICATION OF AUTHORITY TO CARRY OUT CERTAIN FISCAL YEAR 2000 PROJECTS.

(a) * * *

(b) Limitation of Total Cost of Construction Projects.--Notwithstanding the cost variation authorized by section 2853 of title 10, United States Code, and any other cost variations authorized by law, the total cost of all projects carried out under section 2401 of this Act may not exceed--

(1) * * *

* * * * * * *

(3) [$231,230,000] $267,525,000 (the balance of the amount authorized under section 2401(a) for the construction of a chemical demilitarization facility at Blue Grass Army Depot, Kentucky).

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SECTION 516 OF TITLE 14, UNITED STATES CODE

Sec. 516. Presentation of United States flag upon retirement

(a) * * *

* * * * * * *

(c) No Cost to Recipient.--The presentation of a flag under [his section] this section shall be at no cost to the recipient.

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MERCHANT MARINE ACT, 1936

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TITLE XI--FEDERAL SHIP MORTGAGE INSURANCE

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Sec. 1104A. (a) * * *

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(d)(1) * * *

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(4) The Secretary may obtain independent analysis of an application for a guarantee or commitment to guarantee under this title.

* * * * * * *

(f) The Secretary shall charge and collect from the obligor such amounts as he may deem reasonable for the investigation of applications for a guarantee (including for obtaining independent analysis under subsection (d)(4)), for the appraisal of properties offered as security for a guarantee, for the issuance of commitments, for services in connection with the escrow fund authorized by section 1108 and for the inspection of such properties during construction, reconstruction, or reconditioning: Provided, That such charges shall not aggregate more than one-half of 1 per centum of the original principal amount of the obligations to be guaranteed.

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TITLE XII--WAR RISK INSURANCE

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Sec. 1205. (a) * * *

* * * * * * *

(c) Insurance of Vessels in Support of NATO-Approved Operations.--(1) Upon request made under subsection (b), the Secretary may provide insurance for a vessel, regardless of the country in which the vessel is registered and the citizenship of its owners, that is supporting a military operation approved by the North Atlantic Council, including a vessel that is not

operating under contract with a department or agency of the United States.

(2) If a vessel is insured under paragraph (1) in response to a request made pursuant to an international agreement providing for the sharing among nations of the risks involved in mutual or joint operations, the Secretary of Transportation, with the concurrence of the Secretary of State, may seek from another nation that is a party to such agreement a commitment to indemnify the United States for any amounts paid by the United States for claims against such insurance.

(3) Amounts received by the United States as indemnity from a nation pursuant to paragraph (2) shall be deposited into the insurance fund created under section 1208.

(4) Any obligation of a department or agency of the United States to indemnify the Secretary or the insurance fund for any claim against insurance provided under this subsection is extinguished to the extent of any indemnification received from a nation pursuant to paragraph (2) with respect to the claim.

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TITLE 5, UNITED STATES CODE

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PART III--EMPLOYEES

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Subpart D--Pay and Allowances

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CHAPTER 53--PAY RATES AND SYSTEMS

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SUBCHAPTER IV--PREVAILING RATE SYSTEMS

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Sec. 5343. Prevailing rate determinations; wage schedules; night differentials

(a) * * *

(b) The Office of Personnel Management shall schedule full-scale wage surveys every [2 years] 3 years and shall schedule interim surveys to be conducted between each 2 consecutive full-scale wage surveys. The Office may schedule more frequent surveys when conditions so suggest[.], based on criteria developed by the Office.

(c) The Office of Personnel Management, by regulation, shall

prescribe practices and procedures for conducting wage surveys, analyzing wage survey data, developing and establishing wage schedules and rates, and administering the prevailing rate system. The regulations shall provide--

(1) * * *

* * * * * * *

(4) for proper differentials, as determined by the Office, for duty involving unusually severe working conditions or unusually severe hazards, and for any hardship or hazard related to asbestos, such differentials shall be determined by applying occupational safety and health standards consistent with the permissible exposure limit promulgated by the Secretary of Labor under the Occupational Safety and Health Act of 1970;

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CHAPTER 55--PAY ADMINISTRATION

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SUBCHAPTER V--PREMIUM PAY

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Sec. 5545. Night, standby, irregular, and hazardous duty differential

(a) * * *

* * * * * * *

(d) The Office shall establish a schedule or schedules of pay differentials for duty involving unusual physical hardship or hazard, and for any hardship or hazard related to asbestos, such differentials shall be determined by applying occupational safety and health standards consistent with the permissible exposure limit promulgated by the Secretary of Labor under the Occupational Safety and Health Act of 1970. Under such regulations as the Office may prescribe, and for such minimum periods as it determines appropriate, an employee to whom chapter 51 and subchapter III of chapter 53 of this title applies is entitled to be paid the appropriate differential for any period in which he is subjected to physical hardship or hazard not usually involved in carrying out the duties of his position. However, the pay differential--

(1) * * *

* * * * * * *

SUBCHAPTER IX--SEVERANCE PAY AND BACK PAY

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Sec. 5595. Severance pay

(a) * * *

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(i)(1) * * *

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(4) This subsection applies with respect to severance pay payable under this section for separations taking effect on or after February 10, 1996, and before October 1, [2003] 2006.

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Subpart G--Insurance and Annuities

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CHAPTER 89--HEALTH INSURANCE

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Sec. 8905a. Continued coverage

(a) * * *

* * * * * * *

(d)(1) * * *

* * * * * * *

(4)(A) * * *

(B) This paragraph shall apply with respect to any individual whose continued coverage is based on a separation occurring on or after the date of enactment of this paragraph and before--

(i) October 1, [2003] 2006; or

(ii) February 1, [2004] 2007, if specific notice of such separation was given to such individual before October 1, [2003] 2006.

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CHAPTER 90--LONG-TERM CARE INSURANCE

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Sec. 9001. Definitions

For purposes of this chapter:

(1) Employee.--The term ``employee'' means--

(A) * * *

(B) an individual described in section 2105(e); [and]

(C) an individual employed by the Tennessee Valley Authority[,]; and

(D) an employee of a nonappropriated fund instrumentality of the Department of Defense described in section 2105(c),

but does not include an individual employed by the government of the District of Columbia.

* * * * * * *

Sec. 9002. Availability of insurance

(a) * * *

(b) Discretionary Authority Regarding Nonappropriated Fund Instrumentalities.--The Secretary of Defense may determine that a nonappropriated fund instrumentality of the Department of Defense is covered under this chapter or is covered under an alternative long-term care insurance program.

[(b)] (c) General Requirements.--Long-term care insurance may not be offered under this chapter unless--

(1) * * *

* * * * * * *

[(c)] (d) Documentation Requirement.--As a condition for obtaining long-term care insurance coverage under this chapter based on one's status as a qualified relative, an applicant shall provide documentation to demonstrate the relationship, as prescribed by the Office.

[(d)] (e) Underwriting Standards.--

(1) * * *

* * * * * * *

[(e)] (f) Guaranteed Renewability.--The benefits and coverage made available to eligible individuals under any insurance contract under this chapter shall be guaranteed renewable (as defined by section 7A(2) of the model regulations described in section 7702B(g)(2) of the Internal Revenue Code of 1986), including the right to have insurance remain in effect so long as premiums continue to be timely made. However, the authority to revise premiums under this chapter shall be available only on a class basis and only to the extent otherwise allowable under section 9003(b).

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SECTION 1505 OF THE WEAPONS OF MASS DESTRUCTION CONTROL ACT OF 1992

SEC. 1505. INTERNATIONAL NONPROLIFERATION INITIATIVE.

(a) * * *

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(f) Termination of Authority.--The authority of the Secretary of Defense to provide assistance under this section terminates at the close of fiscal year [2002] 2003.

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MILITARY CONSTRUCTION AUTHORIZATION ACT FOR FISCAL YEAR 1997

* * * * * * *

DIVISION B--MILITARY CONSTRUCTION AUTHORIZATIONS

* * * * * * *

TITLE XXIV--DEFENSE AGENCIES

SEC. 2401. AUTHORIZED DEFENSE AGENCIES CONSTRUCTION AND LAND ACQUISITION PROJECTS.

(a) Inside the United States.--Using amounts appropriated pursuant to the authorization of appropriations in section 2406(a)(1), and, in the case of the projects described in paragraphs (2) and (3) of section 2406(b), other amounts appropriated pursuant to authorizations enacted after this Act for the projects, the Secretary of Defense may acquire real property and carry out military construction projects for the installations and locations inside the United States, and in the amounts, set forth in the following table:

Defense Agencies: Inside the United States

Agency	Installation or location	Amount
Chemical Demilitarization Program.....	Pueblo Chemical Activity, Colorado.....	[$203,500,000] $261,000,000
Defense Finance & Accounting Service.....	Charleston, South Carolina.....	$6,200,000
	Total:.....	[$549,954,000] $607,454,000

* * * * * * *

SEC. 2406. AUTHORIZATION OF APPROPRIATIONS, DEFENSE AGENCIES.

(a) * * *

(b) Limitation on Total Cost of Construction Projects.--Notwithstanding the cost variation authorized by section 2853 of title 10, United States Code, and any other cost variations authorized by law, the total cost of all projects carried out under section 2401 of this Act may not exceed--

(1) * * *

(2) [$203,500,000] $261,000,000 (the balance of the amount authorized under section 2401(a) of this Act for the construction of a chemical demilitarization facility at Pueblo Army Depot, Colorado); and

* * * * * * *

SECTION 501 OF THE MCKINNEY-VENTO HOMELESS ASSISTANCE ACT

SEC. 501. USE OF UNUTILIZED AND UNDERUTILIZED PUBLIC BUILDINGS AND REAL PROPERTY TO ASSIST THE HOMELESS.

(a) * * *

* * * * * * *

(i) Applicability to Certain Property During Emergencies.--The screening requirements and other provisions of this section shall not apply to any property that is excess property or surplus property or that is described as unutilized or underutilized property if the property is subject to a request for conveyance or use for the purpose of directly supporting activities in response to--

(1) a war or national emergency declared in accordance with the National Emergencies Act (50 U.S.C. 1601 et seq.); or

(2) an emergency or major disaster declared in accordance with the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.).

[(i)] (j) Definitions.--For purposes of this section--

(1) * * *

* * * * * * *

SECTION 204 OF THE DEFENSE AUTHORIZATION AMENDMENTS AND BASE CLOSURE AND REALIGNMENT ACT

SEC. 204. IMPLEMENTATION

(a) * * *

* * * * * * *

(e) Transfer Authority in Connection With Construction or Provision of Military Family Housing.--(1) Subject to paragraph (2), the Secretary may enter into an agreement to transfer by deed real property or facilities located at or near an installation closed or to be closed under this title with any

person who agrees, in exchange for the real property or facilities, to transfer to the Secretary housing units that are constructed or provided by the person and located at or near a military installation at which there is a shortage of suitable housing to meet the requirements of members of the Armed Forces and their dependents. [The Secretary may not select real property for transfer under this paragraph if the property is identified in the redevelopment plan for the installation as items essential to the reuse or redevelopment of the installation.]

* * * * * * *

SECTION 2914 OF THE DEFENSE BASE CLOSURE AND REALIGNMENT ACT OF 1990

SEC. 2914. SPECIAL PROCEDURES FOR MAKING RECOMMENDATIONS FOR REALIGNMENTS AND CLOSURES FOR 2005 ROUND; COMMISSION CONSIDERATION OF RECOMMENDATIONS.

(a) * * *

* * * * * * *

(d) Commission Review and Recommendations.--

(1) * * *

* * * * * * *

(4) Limitation on authority to recommend additional installation for closure.--Notwithstanding paragraph (3), the decision of the Commission to add a military installation to the Secretary's list of installations recommended for closure must be unanimous, and at least two members of the Commission must have visited the installation during the period of the Commission's review of the list.

[(4)] (5) Testimony by secretary.--The Commission shall invite the Secretary to testify at a public hearing, or a closed hearing if classified information is involved, on any proposed change by the Commission to the Secretary's recommendations.

[(5)] (6) Comptroller general report.--The Comptroller General report required by section 2903(d)(5)(B) analyzing the recommendations of the Secretary and the selection process in 2005 shall be transmitted to the congressional defense committees not later than July 1, 2005.

* * * * * * *

ACT OF AUGUST 22, 1972

(Public Law 92-402)

AN ACT To authorize appropriations for the fiscal year 1973 for certain maritime programs of the Department of Commerce, and for related purposes.

* * * * * * *

Sec. 4. If, after consideration of such comments and views as are received pursuant to section 3(c), the Secretary finds that the use of Liberty ships proposed by a State will not violate any Federal law, contribute to degradation of the marine environment, create undue interference with commercial fishing or navigation, and is not frivolous, he may transfer without consideration to the State all right, title, and interest of the United States in and to any Liberty ships which are available for transfer under this Act if--

(1) * * *

* * * * * * *

(4) the transfer would be at no cost to the Government (except for any financial assistance provided under section 7) with the State taking delivery of such obsolete ships at fleetside of the National Defense Reserve Fleet in an ``as is-where is'' condition.

* * * * * * *

SEC. 7. FINANCIAL ASSISTANCE TO STATE TO PREPARE TRANSFERRED SHIP.

(a) Assistance Authorized.--The Secretary, subject to the availability of appropriations, may provide, to any State to which an obsolete ship is transferred under this Act, financial assistance to prepare the ship for use as an artificial reef, including for--

(1) environmental remediation;

(2) towing; and

(3) sinking.

(b) Amount of Assistance.--The Secretary shall determine the amount of assistance under this section with respect to an obsolete ship based on--

(1) the total amount available for providing assistance under this section;

(2) the benefit achieved by providing assistance for that ship; and

(3) the cost effectiveness of disposing of the ship by transfer under this Act and provision of assistance under this section, compared to other disposal options for the vessel.

(c) Terms and Conditions.--The Secretary--

(1) shall require a State seeking assistance under this section to provide cost data and other information determined by the Secretary to be necessary to justify and document the assistance; and

(2) may require a State receiving such assistance to comply with terms and conditions necessary to protect the environment and the interests of the United States.

Sec. [7] 8. For purposes of sections 3, 4, 5, and 6, the term

``obsolete ship'' means any vessel owned by the Department of Transportation that has been determined to be of insufficient value for commercial or national defense purposes to warrant its maintenance and preservation in the national defense reserve fleet and has been designated as an artificial reef candidate.

* * * * * * *

ADDITIONAL VIEWS

While we strongly support the overall defense authorization bill, we would like to express our views on the wisdom of the nuclear policy that was adopted and some of the amendments on this subject that were not. We agree with the bill's provision requiring that the Department of Defense provide the detailed force structure plan that should have been part of the administration's Nuclear Posture Review. We also are pleased that two amendments offered by Mr. Allen were accepted by the committee. The National Academy of Sciences' studies called for by those amendments will help Congress and the Department of Defense understand the short- and long-term effects of the possible use of nuclear earth-penetrators and nuclear-tipped ballistic missile interceptors. Previous effect studies may not reflect all current information and any future decision about the utility of these weapons must take their effects into account.

We are disappointed, however, that the sense of congress contained in Section 1021 was not modified as proposed in the amendment by Mrs. Tauscher and Mr. Allen. Further, we believe the amendments offered by Mr. Spratt and Mr. Allen prohibiting the development or deployment of nuclear-tipped ballistic missile interceptors and by Mr. Spratt requiring Congressional notification in advance of any future underground nuclear test would have improved the quality of our nuclear policy and the strength of the U.S. negotiating position with Russia and others on security issues. We all agree that nuclear deterrence remains a critical component of U.S. national security and that the United States should maintain sufficient nuclear forces to execute its Single Integrated Operational Plan (SIOP). The amendments offered, however, would have improved the chairman's mark in three critical ways.

First, the Tauscher-Allen sense of Congress amendment would have retained the President's flexibility in his current negotiations with Russia by removing a minimum requirement of operationally-deployed weapons at 1,700. The amendment would have allowed him to go lower than that figure if he negotiated a bilateral agreement to that effect. U.S. security is enhanced by encouraging Russia to eliminate as many nuclear weapons as possible. For our own purposes, retaining a large ``responsive force'' of non-operationally deployed nuclear weapons well above the levels required by the SIOP is counter-productive and costly. It encourages Russia to retain larger stockpiles than it otherwise would and supports the rationale for nuclear build-up of other states like China which are assessing the appropriate size of their nuclear force.

Second, both the Tauscher-Allen amendment and the Spratt-Allen amendment speak to the need for caution in expanding applications of nuclear use. The Tauscher-Allen sense of

Congress would have focused our policy for countering the very real threat of hard and deeply-buried targets on advanced conventional weapons and enhanced intelligence. The amendment would not have ruled out the use of existing nuclear capabilities, but highlighted that the focus of scientific research and development should be on non-nuclear capabilities first, given the collateral damage involved and the destabilizing potential of using tactical nuclear options. Similarly, the Spratt prohibition of nuclear-tipped ballistic missile interceptors would have put Congress on record against an option dismissed twenty years ago when the Reagan administration launched the Strategic Defense Initiative. We don't believe the public would support such nuclear use and this is not an option we should be advocating in any missile defense program.

Finally, the Spratt amendment on Congressional notification before the conduct of any future underground nuclear test would have provided critical oversight of any potential change in administration policy. If the administration chooses to resume testing, Congress should have an opportunity to investigate why the test is necessary and the implications of conducting it. The twelve-month notification was designed to accommodate the authorization bill cycle and does not tie the administration's hands in any way, as the current test readiness posture is 24-36 months. DOE officials, in fact, indicate that it will cost tens of millions of dollars and take at least two years to reduce this to 18 months. Congress has a duty to oversee our deterrence and defense capability; this amendment would have strengthened our ability to do so.

We all agree on the need to maintain U.S. national security and the deterrent capability of our nuclear forces. These amendments would have enhanced both. We look forward to opportunities on the House floor and in the future to continue to advance these goals.

Ike Skelton.
John Spratt.
Lane Evans.
Neil Abercrombie.
Marty Meehan.
Tom Allen.
Loretta Sanchez.
Ellen O. Tauscher.
Robert A. Brady.
Robert E. Andrews.
Baron P. Hill.
Jim Langevin.
Rick Larsen.
Adam Smith.
Robert A. Underwood.

ADDITIONAL VIEWS

As the Committee marked up the National Defense Authorization Act for Fiscal Year 2003, the matters put before the members were appropriate for our consideration with one glaring exception, Title XIV concerning the Utah Test and Training Range.

We believe that every Member of the House has a stake in the committee process. If any issue under the jurisdiction of

the Armed Services Committee were to be added to the Chairman's mark in another committee, the Armed Services Committee members would be right to object in the most strenuous terms.

That's why we feel that the inclusion of title XIV in the chairman's mark was a procedural foul.

First, when this language was previously introduced as legislation (H.R. 3035-106th Congress and H.R. 2488-107th Congress), it was referred solely to the Resources Committee. Its lack of success there is not because it did not have a strong champion or lacked exposure. It had both but has not passed the House.

Second, language this important and comprehensive deserves one or more hearings in this committee. It has had none.

Third, the language was inserted into the Chairman's mark and not exposed to the regular amendment process. We all know bill language is more easily adopted when it is included in the mark, rather than when it is added by amendment.

As to the substance of this legislation, it is important to note that the proponents of Title XIV and the language of the title have created confusion as to just what is the Utah Test and Training Range (UTTR). The UTTR and the adjacent Dugway Proving Grounds encompass approximately 1.7 million acres withdrawn from public use and under the administration of the Department of Defense. Title XIV speaks to not only these 1.7 million acres but to an additional six million acres of public lands and national forests administered by the Departments of the Interior and Agriculture that underlie military airspace for the UTTR.

We believe the following point must be made perfectly clear. There is no designated or proposed wilderness within the boundaries of the UTTR and the Dugway Proving Grounds. There are however, 25,000 acres of designated wilderness and several hundred thousand acres of Wilderness Study Areas (WSAs) on national forests and public lands beneath military airspace in Utah, and it is these lands as well as the millions of acres of adjacent public lands that would be adversely affected by Title XIV.

Even more troubling than that inconsistency and the procedure used to include Title XIV are the provisions themselves. The military use language of Title XIV is unprecedented and not found in any other law. Ironically, these provisions set a standard for wilderness management that would provide less protection to the wilderness areas designated by Title XIV than the protections available to non-designated public lands. Millions of acres of designated wilderness and millions more acres of public land underlie military airspace across the United States. None of these lands have or need the restrictive language that Title XIV would apply to wilderness and public lands in Utah.

Language in Title XIV would strip the authority of the Secretary of the Interior to determine where and whether facilities and equipment are placed on public lands within wilderness areas. Another provision allows the Secretary of the Air Force to unilaterally close or restrict access to wilderness and WSAs outside the boundaries of the UTTR and the Dugway Proving Grounds. These provisions are unprecedented, and no clear rationale has been given to warrant this change from existing law. Moreover, Title XIV creates a different standard for access and military use for land in Utah than is applicable to all other public land areas of the United States.

Furthermore, Title XIV requires the Secretary of the Interior to gain the prior concurrence of the Secretary of the Air Force and the commander-in-chief of the military forces of the State of Utah before developing, maintaining, or revising land use plans required by Federal law for millions of acres of public lands in Utah. Is it unwise policy, to say the least, for a Cabinet secretary's role to be subordinate to a service secretary and a state military commander.

The bottom line is two fold. All House members have a stake in preserving the committee process. House rules on committee jurisdiction exist for a reason, and we should abide by them absent some compelling exceptional justification. None has been provided here.

Second, it is wrong to ram through any committee contentious provisions of sweeping scope and substantive import. This wrong has been exacerbated in this case by the absence of committee hearings and the legislative legerdemain of embedding a previously unseen title of the bill in the chairman's mark.

We cannot sanction procedural and substantive transgressions of this magnitude.

Ike Skelton.
Robert E. Andrews.
Lane Evans.
Ellen O. Tauscher.
Marty Meehan.
Vic Snyder.
John Spratt.
Susan A. Davis.
Rick Larsen.
Silvestre Reyes.
James H. Maloney.
John B. Larson.
Loretta Sanchez.
Baron P. Hill.
Tom Allen.
Robert A. Brady.
Cynthia McKinney.
Adam Smith.
Jim Langevin.
Ciro D. Rodriguez.

ADDITIONAL VIEWS OF REPRESENTATIVE W. TODD AKIN

The Committee's recently drafted Fiscal Year 2003 National Defense Authorization bill contains a number of provisions and initiatives that will greatly benefit our service men and women. These include initial funding for a joint replacement aircraft for the EA-6B ``Prowler'' and funding to initiate a T-45 multi-year procurement contract.

We cannot move quickly enough to replace the EA-6B. Though the Prowler has served us well for nearly 30 years, all indications are that 2008 is the target date by which a replacement aircraft must enter the fleet. If a decision is made this summer, an EA-18 could readily meet that timeline and at a developmental cost of approximately $1.6 billion. On the other hand, the years of development necessary to develop the already-accelerated JSF and then develop a follow-on EA-JSF design indicate that a JSF variant would not be available until

at least 2013, and only at much higher cost. Knowing this, and given the critical importance of our electronic warfare capabilities, we should not delay further a decision on replacing the Prowler.

Knowing this, the committee authorized $10 million to support preliminary risk reduction engineering for an EA-6B replacement. Given the sustained high operational tempo, and ongoing deterioration, of the Prowler fleet, we cannot move quickly enough toward a joint follow-on aircraft.

In addition, the committee included $10 million to support a possible multi-year procurement of the Navy's T-45 ``Goshawk'' jet trainer. This is an excellent idea. Given the need to complete modernization of the Navy's training fleet and the anticipated future-years funding shortfall in the Navy aviation budget, which becomes particular difficult beginning in fiscal year 2007, it makes excellent sense to initiate a three-year procurement contract for T-45s for fiscal years 2004-06. This would allow us to complete the Navy's requirement for 234 T-45s before 2007 and in the process purchase these aircraft at approximately 25 percent less per unit than if we did so through the annual budgeting process at eight aircraft per year.

W. Todd Akin.

DISSENTING VIEW OF CONGRESSWOMAN CYNTHIA McKINNEY

The National Defense Authorization Act of 2002, H.R. 4546, represents the largest real increase to defense spending since 1966. This bill contains over $40 billion more spending than last year's defense authorization, which too was egregiously large. H.R. 4546 provides for over $383 billion in spending for the Department of Defense and the weapons programs of the Department of Energy. Unfortunately this new spending comes at the expense of many valuable and effective government programs. As the Bush Administration's tax cut enacted last year has reduced the ability of the federal government to fully fund many important programs, the massive increase in defense spending is accompanied by cuts to programs for job training, drug elimination in public housing, prescription drug benefits, conservation spending, and much more. Such one-sided spending indicates a misdirected view of our nation's true national security reflecting a belief that relies on warfighting capabilities and which neglects the domestic issues and quality of life that are also essential to a secure nation.

In addition to the singular focus of our national security attention, there are problems within the Pentagon that raise questions about such immense spending. On September 10, 2001, Defense Secretary Rumsfeld stated that ``[a]ccording to some estimates, we cannot track $2.3 trillion in transactions.'' Such a lack of financial accountability not only undermines the integrity of the Pentagon, it causes severe inefficiencies that cause further financial loss, and undoubtedly leads to wasteful spending. If there were ever to be activities obscured from the public's eye, projects pursued without authorization, or other questionable action or spending, how could it ever be discovered when the level of unaccounted transactions is so high? In any other arena, either private sector or public, financial accountability would be insured prior to increasing expenditures, not the opposite.

Yet the basis for such a large increase in spending is

wholly unjustified. The events of September 11, 2001 were a tragedy to the entire nation. However, the attacks in New York, Pennsylvania, and Virginia were not prompted by any failure of the United States military, but instead were the result of a breakdown in our intelligence community. In fact, just this week Yahoo News reported that CIA Deputy Director of Operation James Pavitt ``dismissed charges the CIA was caught unaware by September 11 suicide attacks in the United States'' and that ``[t]he CIA knew the network led by Saudi-born militant Osama bin Laden was planning a major strike.''

Similarly, a Washington Post article dated May 3, 2002 stated ``[t]wo months before the suicide hijackings, an FBI agent in Arizona alerted Washington headquarters that several Middle Easterners were training at a U.S. aviation school and recommended contacting other schools nationwide,'' and further that ``[l]aw enforcement officials said in retrospect the FBI believes it should have accelerated the suggested check of U.S. flight schools.'' The intelligence community has received substantial increases in resources in order to address these shortcomings. As there was no apparent defense shortcoming, it appears that the increases contained in the defense authorization serve to increase the armed forces' ability to wage war in foreign nations, replace regimes such as Iraq, and accelerate the expansion of war on a worldwide scale.

The increased defense authorization also permits prodigal, unneeded, and archaic projects and weapons systems to proceed. One such weapons system is the Crusader, an artillery system originally intended to defeat Soviet tanks on a large battlefield. Though it is widely assumed that the U.S. will not confront such a battle environment, the Army has continued its drive to develop and procure this weapon. Logistically, this artillery system has been found to be difficult to transport, and at 40 tons for each the artillery system and the adjoining resupply vehicle, the Crusader would be difficult to adhere to the Army's evolving mobility goals. In considering the continued pursuit of the Crusader, it is important to note that the prime contractor for this weapon system, United Defense, is owned by the Carlyle Group, which in turn is chaired by Frank Carlucci, former Secretary of Defense under President Ronald Reagan, and which also employs former President George H.W. Bush.

Nonetheless, Deputy Secretary of Defense Paul Wolfowitz has been reported to be planning to cut this expensive and unnecessary weapon, thus saving the $475 million earmarked for the Crusader to be used for other expenditures. I would welcome such an announcement. However, contrary to reports, this defense authorization leads me to believe that the Crusader program will survive. Included in H.R. 4546 is language that ``directs that there be no change to the Crusader development schedule, funding or procurement requirements, to include termination.'' It is unfortunate that, even when the Pentagon seeks to shelve needless and wasteful programs, this defense authorization and the defense industry are capable of keeping the Crusader and other questionable projects alive.

Furthermore, this defense authorization charts the course toward dangerous waters in terms of our nation's nuclear weapons policy, the development of missile defense, and environmental stewardship.

Section 1021 of the defense authorization bill details the proposed nuclear policy of the United States, which aptly calls

for sharp reductions in the nation's nuclear weapons stock. However, the value of those reductions is lost on the fact that the policy also calls for the U.S. to ``maintain a responsive force of non-deployed nuclear weapons for potential contingencies.'' It is difficult to conceive a contingency where the 1,700 nuclear weapons to which our stock would be reduced would be insufficient. The maintenance of such a ready reserve also provokes international concern and would incur significant future costs to the U.S. in terms of maintenance, stockpile stewardship and security. Sec. 1021 also encourages the development of new nuclear weapons for the purpose of defeating hardened and deeply buried targets. This language is an affront to the Non-Proliferation Treaty that the U.S. has ratified. This provocative section also neglects the physical science that nuclear weapons would not serve to defeat such buried targets, would have significant radioactive fallouts, and would hinder U.S. personnel from conducting damage assessments. It was unfortunate that the Committee did not pass an amendment offered by Representatives Ellen Tauscher and Tom Allen that would have improved and removed this dangerous language.

Additionally, Section 1021 urges the Administration to develop a plan to be able to resume underground nuclear testing within one year of a decision to conduct such tests. Underground nuclear tests have not been conducted in the U.S. since September 1992, and when they have been conducted in other nations, the U.S. has responded with strong rebukes and sanctions. The development of such a resumption plan is unnecessary, is internationally inflammatory, and is likely not the desire of a majority of Americans. In sum, Section 1021 sets forth a nuclear weapons policy that is unlikely to insure greater safety for Americans and could result in encouraging other nations to further their own nuclear weapons programs.

With regard to missile defense, H.R. 4546 continues the road to development of this dangerous and unreliable system. This authorization provides $7.8 billion for missile defense, following on the nearly $8 billion that was authorized for missile defense last year. Not only is this an unusually high amount of money to be devoting to a weapon system of questionable reliability, the need for the missile shield being sought is not apparent. The CIA's own National Intelligence Estimate states that North Korea has the greatest and soonest likelihood of attacking the U.S. with a missile, but that they will be unable to do so before 2015; the same NIE states that attacks are much more likely using weapons of mass destruction (WMD) via other untraditional routes such as trucks, ships, or airplanes.

Rather than relying on a missile defense system, which may well lead America to a false sense of security, missile defense should be re-shelved, as it was in 1976. Cooperative international arms control and disarmament agreements will be far more effective in advancing peace and security in the years ahead and will cost far less than a Star Wars type missile shield.

Evidently, the current prevailing concept for missile defense, known as hit-to-kill, which had garnered the support of many in this Committee, is not as reliable as had been thought. It was reported a few weeks ago that the Secretary of Defense had given approval to proceed with the study of nuclear-tipped missile defense. Despite the fact that this

concept had already been pursued in the 1960s and 1970s and correctly cancelled, nuclear-tipped missile defense has apparently risen from the dead. An amendment offered by Representative John Spratt would have prohibited the development of such a missile defense concept. However, the Committee unfortunately defeated this amendment. While debate in opposition to the amendment noted the need to provide the Pentagon as much latitude in pursuing missile defense options, the fact that the atmospheric nuclear explosion would cause enormously destructive electro-magnetic pulses to wreak havoc on both domestic and space-based electronics, not to mention the horrible human health impacts from the ensuing radiological fallout, were evidently ignored by a majority of the Committee. Nuclear tipped missile defense was pursued once, and was then cast aside when financial and other costs were observed to be greater than the benefits. The Committee should have considered this history when voting on the amendment, and I find it inevitable that nuclear-tipped missile defense will again find a similar fate.

For a multitude of reasons, the environmental provisions of this bill are inappropriate and disappointing. The Readiness Subcommittee included in their mark, language that will carve out special exemptions so that the Department of Defense will not have to adhere to the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA). First, when the Subcommittee conducted hearings on these issues, only Administration officials were permitted to testify, and local and state officials and environmental organizations were not provided similar opportunities to share their viewpoints. With such contentious, wide-ranging, and important issues under consideration, these stakeholders should have been given an opportunity to be heard. Second, with regard to the Endangered Species Act, a provision already exists within the law that would permit the Secretary of Defense to request a waiver from compliance with the ESA for purposes of national security. The Defense Department has never made use of this provision, and with such an avenue for relief currently available, there is no reason that the law should be amended.

Finally, parliamentary rules of Congress provide for sequential referral to multiple committees for issues that span the jurisdiction of more than one committee for good reason. In this case, the Resources Committee has jurisdiction over these important environmental laws, and the opportunity for this committee to conduct hearings on these law changes should not have been circumvented.

In addition to the exemptions of these two important wildlife protection laws, Title XIV of the Chairman's mark is a very disappointing foray of the Armed Services Committee into the arena of public lands management. The Committee never conducted hearings on this specific provision. This section releases hundreds of thousands of acres from Wilderness Study Areas designation, permits unprecedented entry and activity in wilderness areas, cedes management authority of public lands to the Secretary of the Air Force and again denies the appropriate jurisdictional oversight of the Resources Committee. If the intent of Title XIV was to protect public land and insure emergency access for the military, there is undoubtedly a more democratic and comprehensive approach that could have been taken.

In an issue that was addressed by an amendment offered, and

then withdrawn, by Representative Lindsey Graham, the Department of Energy has dangerously discarded the idea of immobilizing plutonium obtained through the dismantling of Russian and American nuclear weapons. The pursuit of the mixed-oxide (MOX) alternative, whereby the excess plutonium is not encased in a non-reactive, immobile matrix, but instead is processed into a fuel that energy companies can use in nuclear power generation is unwise. The safer and more sensible approach to this issue would have been for the DOE and the Savannah River Site to pursue the immobilization alternative, maintain a set of alternatives in case any proposed solution proves technically unfeasible, and not to provide a subsidy to the nuclear industry in the form of this MOX fuel.

As was the case with last year's authorization consideration, Representative Loretta Sanchez offered an amendment to permit service women and female military dependents to obtain privately funded abortions in overseas military hospitals. In this amendment medical practitioners in these hospitals who choose not to conduct such procedures would not have been required to conduct them. Though the Supreme Court has affirmed a woman's right to obtain an abortion, the Committee sees fit to maintain its own discretion of this constitutional right, and did not approve of this amendment. It is unfortunate that service women and female dependents must now choose between seeking abortions that can be unsafe or illegal in foreign nations, or otherwise forfeit their rights to privacy by the necessity of informing superior officers when seeking military transport to a location suitable for abortion procedures.

Though it deeply troubles me that one of the first acts of our President after declaring this War On Terrorism was to sign an Executive Order denying promised high deployment overtime pay to our service men and women, the overall mark that was reported from the Personnel Subcommittee is commendable. The bill provides for a 4.1 percent across-the-board pay raise that aptly recognizes the hard work and dedication of our nation's service personnel. This pay raise will also serve to aid in the recruitment and retention of personnel, as the increase is consistently above private sector pay increases. Additionally, the Personnel mark provides for higher raises for certain specialties and for non-commissioned officers, thereby improving force strength in essential fields and compensating many of tomorrow's leaders. Though I have dissented in this Act, I greatly respect the individual members of our armed services for their service and sacrifice in the name of our nation.

Additionally, the Personnel Subcommittee included language that will permit the payment of concurrent receipt for some retired military personnel who are also disabled veterans. For too long disabled veterans have been forced to choose between their retirement pay and their well-deserved disability benefits. Though H.R. 4546 provides only for immediate concurrent receipt to veterans who are rated 60 percent disabled or greater, I believe that the Committee has made an improvement from the previous ban on concurrent receipt and I hope that the program will continue to be expanded to provide concurrent receipt to all retired military personnel who are also disabled veterans. I doubt anyone would question that they have earned it.

Cynthia McKinney.

<all>
<all>

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2d Session

SENATE

REPORT
107–151

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2003

REPORT

[TO ACCOMPANY S. 2514]

ON

AUTHORIZING APPROPRIATIONS FOR FISCAL YEAR 2003 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR FOR THE ARMED FORCES, AND FOR OTHER PURPOSES

TOGETHER WITH

ADDITIONAL AND MINORITY VIEWS

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

MAY 15 (legislative day, MAY 9), 2002.—Ordered to be printed

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(107th Congress, 2d Session)

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Calendar No. 370

107TH CONGRESS, 2d Session | SENATE | REPORT 107–151

AUTHORIZING APPROPRIATIONS FOR FISCAL YEAR 2003 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR FOR THE ARMED FORCES, AND FOR OTHER PURPOSES

MAY 15 (legislative day, MAY 9), 2002.—Ordered to be printed

Mr. LEVIN, from the Committee on Armed Services, submitted the following

R E P O R T

together with

ADDITIONAL AND MINORITY VIEWS

[To accompany S. 2514]

The Committee on Armed Services reports favorably an original bill to authorize appropriations during the fiscal year 2003 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe personnel strengths for such fiscal year for the Armed Forces, and for other purposes, and recommends that the bill do pass.

PURPOSE OF THE BILL

This bill would:

(1) authorize appropriations for (a) procurement, (b) research, development, test and evaluation, (c) operation and maintenance and the revolving and management funds of the Department of Defense for fiscal year 2003;

(2) authorize the personnel end strengths for each military active duty component of the Armed Forces for fiscal year 2003;

(3) authorize the personnel end strengths for the Selected Reserve of each of the reserve components of the Armed Forces for fiscal year 2003;

(4) impose certain reporting requirements;

(5) impose certain limitations with regard to specific procurement and research, development, test and evaluation actions and manpower strengths; provide certain additional legislative authority, and make certain changes to existing law;

(6) authorize appropriations for military construction programs of the Department of Defense for fiscal year 2003; and

(7) authorize appropriations for national security programs of the Department of Energy for fiscal year 2003.

Committee overview and recommendations

The events following September 11, 2001, have once again shown that the U.S. military is the most capable fighting force in the world. The success of our forces in Afghanistan has been remarkable. Osama bin Laden—if he is alive at all—is on the run and in hiding. Many of his al Qaeda terrorists have been captured or killed. The Taliban regime that harbored them is no more, and a new government is in place. Nations around the world have been put on notice: America is determined to protect itself from more attacks and to bring terrorists to justice.

The excellence behind that success was not built in months. The success of our forces in Afghanistan is a tribute to the men and women of the Armed Forces and the investments in national defense that Congress and the Department of Defense have made over many years. Future success on the battlefield will likewise depend upon the success of Congress and the Department in preparing, training, and equipping our military for tomorrow's missions.

The administration's fiscal year 2003 budget request of $396.8 billion for national security activities includes an increase of $48.0 billion over the fiscal year 2002 level, the largest increase in defense spending in two decades. The committee will do all in its power, as it has done in the past, to ensure that our forces have the resources, tools and technologies that they need to deter and, if necessary, prevail in future conflicts.

At the same time, the committee has a responsibility to ensure that the resources our taxpayers provide for the national defense are spent wisely. More than a year into office, the administration has completed a Quadrennial Defense Review as required by law, but still has not complied with the statutory requirements to provide Congress with a National Security Strategy and an Annual Report outlining detailed plans for the size, structure, shape, or transformation of our military. In the absence of such planning, the committee is concerned that the Department of Defense will have difficulty establishing a clear vision for the future of our Armed Forces.

In the first 41 days of congressional session this year, the committee held 41 hearings to examine the administration's budget request and related issues. During the course of these hearings, the committee identified five priorities to guide its actions in developing the National Defense Authorization Act for Fiscal Year 2003:

(1) Continue the improvements in the compensation and quality of life of the men and women in the Armed Forces, retirees and their families.

(2) Sustain the readiness of the military services to conduct the full range of their assigned missions, including current and future operations against international terrorism.

(3) Improve the efficiency of Defense Department programs and operations and apply the savings toward high-priority programs.

(4) Improve the ability of the Armed Forces to meet nontraditional threats, including terrorism and weapons of mass destruction.

(5) Promote the transformation of the Armed Forces to meet the threats of the 21st century.

First and foremost, the committee recommendations would improve the compensation of our men and women in uniform by authorizing a 4.1 percent pay raise, with an additional targeted pay raise for the mid-career force. The committee recommendations would improve the conditions in which members of the Armed Forces live and work by authorizing $640.0 million above the budget request to improve and replace military facilities. In accordance with the Budget Resolution reported by the Senate Budget Committee, the committee also recommends a provision that would address a longstanding inequity in the compensation of military retirees by authorizing the concurrent receipt of military retired pay and veterans disability compensation by certain military retirees. Finally, the committee recommendations would authorize a new assignment incentive pay of up to $1,500 per month to reward military members who agree to serve in difficult-to-fill assignments.

The committee recommendations would take an important step to ensure the readiness of our military forces by setting aside $10.0 billion, as requested by the administration, to fund ongoing operations in the war against international terrorism during fiscal year 2003. The committee recommendations would also add funding to address shortfalls in a number of key readiness accounts. These funding increases include: $126.0 million for the improvement of military training ranges; $228.6 million for aircraft, ship, and Navy gun depot maintenance; $176.2 million for maintenance of Air Force flight line facilities and Army buildings; $45.0 million for ammunition to meet new training requirements and supplement war reserve stocks; and $55.0 million to address the Army's aviation training backlog. The committee recommendations would also help lessen the burden on some of the Department's high demand, low density assets by authorizing $110.0 million for the purchase of an additional EC–130J Commando Solo aircraft and $114.0 million for modifications to EA–6B electronic warfare aircraft.

Legislation enacted by the committee last year set a goal for the Department to achieve an additional $1.7 billion of savings in fiscal year 2003 by implementing improved management practices for the $50.0 billion spent annually on services contracts. The committee has built on this initiative by recommending a provision that would establish additional goals for increased competition and increased use of performance-based services contracting, a change which should result in additional savings in the future. The committee also recommends provisions that would improve the efficiency of DOD programs and operations by requiring the Department to develop a comprehensive financial management enterprise architecture; establishing a framework for the Department to develop a disciplined approach to evolutionary acquisition programs; addressing

recurring problems with the abuse of purchase cards and travel cards by military and civilian personnel; and requiring the Department to address longstanding problems in the development and acquisition of software.

The committee recommendations would take a significant step toward addressing nontraditional threats by providing in excess of $10.0 billion for combating terrorism initiatives, as requested by the Department. In addition, the committee recommendations include an increase of $199.7 million to enhance the security of our nuclear materials and nuclear weapons; an increase of $42.7 million in funding for the U.S. Special Operations Command; and an increase of $30.5 million for defense against chemical and biological weapons and other efforts to combat weapons of mass destruction (WMD). The committee also recommends legislative provisions that would require DOD to take a more comprehensive approach to installation preparedness for WMD attacks; authorize the Secretary to expand cooperative threat reduction activities beyond the countries of the Former Soviet Union; and authorize the use of National Guard personnel in State status to assist in border security.

Finally, the committee continued its effort to promote the transformation of the Armed Forces to meet the threats of the 21st century by adding more than $1.1 billion to the Navy's shipbuilding accounts to refuel a nuclear submarine and pay for advance procurement of an aircraft carrier, a *Virginia*-class submarine, a DDG–51 class destroyer, and an LPD–17 class amphibious transport dock. The committee recommendations would promote the transformation of the Army by adding $105.0 million of funding for research and development on the Army Future Combat System, adding more than $100.0 million for science and technology needed to help the Army achieve its Objective Force, and by providing $96.3 million for nine additional Blackhawk helicopters. The committee recommendations would advance the transformation of the Air Force by fully funding the $5.2 billion requested by the Department for the F–22, the $3.5 billion requested for continued research and development on the Joint Strike Fighter, and the more than $1.0 billion requested for unmanned aerial vehicles.

The committee also recommends a number of legislative initiatives to promote military transformation. These include: an initiative to address major shortcomings in the Department's test and evaluation infrastructure that have led to inadequate testing of major weapons systems; a technology transition initiative to ensure that new technologies developed in the Department's science and technology programs are rapidly fielded in weapons systems for our warfighters; and a nanotechnology initiative to ensure that the Department has a focused approach to this emerging area of technology. The committee recommendations would also add more than $170.0 million to the Department's science and technology budget, bringing the Department closer to the Secretary's goal of devoting 3 percent of all defense funds to the programs that promise to bring us the revolutionary technologies that will be needed to prevail in future conflicts.

Today, America's Armed Forces are capable and ready to help keep the peace, deter traditional and nontraditional threats to our security and our vital interests around the world, and win any conflict decisively. Working together, Congress and the executive

branch must build on the considerable strengths of our military forces and their record of success by preserving a high quality of life for U.S. forces and their families, sustaining readiness, and transforming the Armed Forces to meet the threats and challenges of tomorrow. The committee believes that the National Defense Authorization Act for Fiscal Year 2003 would take an important step in that direction.

Explanation of funding summary

The administration's budget request for the national defense function of the federal budget for fiscal year 2003 was $396.8 billion, of which $300.4 billion was for programs that require specific funding authorization. According to the estimating procedures used by the Congressional Budget Office (CBO), the amount requested was $396.3 billion. The funding summary table that follows uses the budget authority as calculated by CBO.

The following table summarizes both the direct authorizations and equivalent budget authority levels for fiscal year 2003 defense programs. The columns relating to the authorization request do not include funding for the following items: pay and benefits for military personnel, military construction authorizations provided in prior years, and other small portions of the defense budget that are not within the jurisdiction of this committee or that do not require an annual authorization.

Funding for all programs authorized in the bill is reflected in the columns related to the budget authority request and the total budget authority implication of the authorizations in this bill. The committee recommends funding authorizations totaling $393.3 billion in budget authority for fiscal year 2003.

The funding level recommended by the committee is within the budget authority level of $393.4 billion for the national defense function recommended in the Concurrent Resolution on the Budget for Fiscal Year 2003 reported by the Senate Committee on the Budget.

This funding level is $3.1 billion below the level requested by the administration in the fiscal year 2003 budget request using the CBO budget authority levels that were incorporated into the Concurrent Resolution on the Budget for Fiscal Year 2003 reported by the Senate Committee on the Budget.

This $3.0 billion adjustment reflects an increase of $516.0 million in mandatory spending to increase the military retirement benefits of retirees who also receive veterans disability benefits, and a decrease of $3.5 billion to reflect the proper accounting for civilian retirement and health benefits under current law. Both of these are discussed in detail elsewhere in this report.

SUMMARY OF NATIONAL DEFENSE AUTHORIZATIONS FOR FISCAL YEAR 2003
In Thousands of Dollars

			BUDGET AUTHORITY IMPLICATION		
	Authorization Request	Senate Authorization	FY 2003 Request	Senate Change to Request	Senate Authorization
DIVISION A					
Title I -- PROCUREMENT					
Aircraft Procurement, Army	2,061,027	2,146,386	2,061,027	85,359	2,146,386
Missile Procurement, Army	1,642,296	1,653,150	1,642,296	10,854	1,653,150
Procurement of W&TCV, Army	2,248,558	2,242,882	2,248,558	-5,676	2,242,882
Procurement of Ammunition, Army	1,159,426	1,204,499	1,159,426	45,073	1,204,499
Other Procurement, Army	5,168,453	5,513,679	5,168,453	345,226	5,513,679
Aircraft Procurement, Navy	8,203,955	9,037,209	8,203,955	833,254	9,037,209
Weapons Procurement, Navy	1,832,617	2,505,820	1,832,617	673,203	2,505,820
Shipbuilding & Conversion, Navy	8,191,194	8,624,160	8,191,194	432,966	8,624,160
Procurement of Ammunition, Navy & Marine Corps	1,015,153	1,173,157	1,015,153	158,004	1,173,157
Other Procurement, Navy	4,347,024	4,516,500	4,347,024	169,476	4,516,500
Procurement, Marine Corps	1,288,383	1,341,219	1,288,383	52,836	1,341,219
Aircraft Procurement, Air Force	12,067,405	12,613,605	12,067,405	546,200	12,613,605
Missile Procurement, Air Force	3,575,162	3,258,162	3,575,162	-317,000	3,258,162
Proc. of Ammunition, Air Force	1,133,864	1,275,864	1,133,864	142,000	1,275,864
Other Procurement, Air Force	10,523,946	10,476,340	10,523,946	-47,606	10,476,340
Procurement, Defense-Wide	2,688,515	3,054,943	2,688,515	366,428	3,054,943
National Guard & Reserve Equipment	0	0	0		0
Defense Production Act Purchases	0	0	73,057		73,057
Coastal Defense Augmentation	0	0	0		0
Chemical Agents & Munitions Destruction, Army	1,490,199	0	1,490,199	-1,490,199	0
Chemical Agents & Munitions Destruction, Defense	0	1,490,199	0	1,490,199	1,490,199
Office of the Inspector General	2,000	2,000			0
Defense Health Program	278,742	278,742			0
Total PROCUREMENT	**68,917,919**	**72,408,516**	**68,710,234**	**3,490,597**	**72,200,831**

SUMMARY OF NATIONAL DEFENSE AUTHORIZATIONS FOR FISCAL YEAR 2003
In Thousands of Dollars

	Authorization Request	Senate Authorization	BUDGET AUTHORITY IMPLICATION FY 2003 Request	Senate Change to Request	Senate Authorization
Title II -- RESEARCH, DEVELOPMENT, TEST & EVALUATION					
RDT&E, Army	6,918,494	7,300,533	6,918,494	382,039	7,300,533
RDT&E, Navy	12,501,630	12,929,135	12,501,630	427,505	12,929,135
RDT&E, Air Force	17,601,233	18,603,684	17,601,233	1,002,451	18,603,684
RDT&E, Defense-Wide	16,613,551	17,181,373	16,613,551	567,822	17,181,373
Operational Test & Evaluation, Defense	222,054	361,554	222,054	139,500	361,554
Defense Health Program	67,214	67,214			0
Total RESEARCH, DEV, TEST & EVALUATION	**53,924,176**	**56,443,493**	**53,856,962**	**2,519,317**	**56,376,279**
Title III -- OPERATION AND MAINTENANCE					
Operation and Maintenance, Army	24,581,055	24,195,242	24,581,055	-385,813	24,195,242
Operation and Maintenance, Navy	29,028,813	29,368,961	29,028,813	340,148	29,368,961
Operation and Maintenance, Marine Corps	3,357,952	3,558,732	3,357,952	200,780	3,558,732
Operation and Maintenance, Air Force	27,304,623	27,448,764	27,304,623	144,141	27,448,764
Operation and Maintenance, Defense-Wide	14,515,304	14,492,266	14,515,304	-23,038	14,492,266
Operation and Maintenance, Army Reserve	1,923,330	1,962,610	1,923,330	39,280	1,962,610
Operation and Maintenance, Navy Reserve	1,165,961	1,233,759	1,165,961	67,798	1,233,759
Operation and Maintenance, Marine Corps Reserve	185,532	190,532	185,532	5,000	190,532
Operation and Maintenance, Air Force Reserve	2,190,917	2,165,004	2,190,917	-25,913	2,165,004
Operation and Maintenance, Army National Guard	4,136,822	4,506,267	4,136,822	369,445	4,506,267
Operation and Maintenance, Air National Guard	4,150,961	4,114,910	4,150,961	-36,051	4,114,910
Office of the Inspector General	163,440	155,165	165,440	-8,275	157,165
US Court of Appeals,Armed Forces	9,925	9,614	9,925	-311	9,614
Environmental Restoration, Army	395,900	395,900	395,900		395,900
Environmental Restoration, Navy	256,948	256,948	256,948		256,948
Environmental Restoration, Air Force	389,773	389,773	389,773		389,773

SUMMARY OF NATIONAL DEFENSE AUTHORIZATIONS FOR FISCAL YEAR 2003
In Thousands of Dollars

	Authorization Request	Senate Authorization	BUDGET AUTHORITY IMPLICATION FY 2003 Request	Senate Change to Request	Senate Authorization
Environmental Restoration, Defense	23,498	23,498	23,498		23,498
Environmental Restoration, Formerly Used Defense Sites	212,102	252,102	212,102	40,000	252,102
Overseas Humanitarian, Disaster & Civic Aid	58,400	58,400	58,400		58,400
Drug Interdiction & Counter-Drug Activities, Defense	848,907	873,907	848,907	25,000	873,907
Payment to Kaho'olawe Island Func	25,000	25,000	25,000		25,000
Defense Health Program	14,360,271	14,202,441	14,706,227	-157,830	14,548,397
Cooperative Threat Reduction	416,700	416,700	416,700		416,700
Overseas Contingency Operations Transfer Fund	50,000	50,000	50,000		50,000
Support for International Sporting Competitions	19,000	19,000	19,000		19,000
Department of Defense Travel	0	-159,790		-159,790	-159,790
Foreign Currency Fluctuations	0	-615,200		-615,200	-615,200
Kaho'olawe Island Conv, Rm Env Re:	0	0	25,000		25,000
Restoration of Rocky Mountain Arsenal	0	0	4,000		4,000
Disposal of DoD Real Property	0	0	16,000		16,000
Lease of DoD Real Property	0	0	13,700		13,700
National Science Center, Army	0	0	30		30
DoD Overseas Military Facility Investment Recovery	0	0	1,300		1,300
Defense Burdensharing - Allies/NATO	0	0	210,000		210,000
Counter-Terrorism/WMD Defense	0	0	0		0
Subtotal OPERATION AND MAINTENANCE	**129,771,134**	**129,590,505**	**130,389,120**	**-180,629**	**130,208,491**
Defense Emergency Response Fund	20,055,000	0	20,055,000	-20,055,000	0
TOTAL O&M and DERF	**149,826,134**	**129,590,505**	**150,444,120**	**-20,235,629**	**130,208,491**
REVOLVING AND MANAGEMENT FUNDS					
National Defense Stockpile Transaction Fund	0	0	-150,000		-150,000

SUMMARY OF NATIONAL DEFENSE AUTHORIZATIONS FOR FISCAL YEAR 2003
In Thousands of Dollars

	Authorization Request	Senate Authorization	BUDGET AUTHORITY IMPLICATION FY 2003 Request	Senate Change to Request	Senate Authorization
Pentagon Reservation Maintenance Rev. Fund	0	328,000	0	328,000	328,000
Defense Working Capital Funds	1,341,970	387,156	1,341,970	-954,814	387,156
National Defense Sealift Fund	934,129	934,129	934,129		934,129
Defense Commissary Working Capital Fund	996,789	969,200	996,789	-27,589	969,200
Total REVOLVING AND MGMT FUNDS	**3,272,888**	**2,618,485**	**3,122,888**	**-654,403**	**2,468,485**
MILITARY PERSONNEL	**0**	**94,352,208**	**94,295,658**	**56,550**	**94,352,208**
CONCURRENT RECEIPT (SEC. 641)	**0**	**356,000**	**0**	**356,000**	**356,000**
Title X -- GENERAL PROVISIONS					
Section 1003: Contingent Authorization, Cost of War	0	10,000,000	0	10,000,000	10,000,000
Section 1002: Transfer from Ballistic Missile Defense	0	-690,000		-690,000	-690,000
Section 1002: Transfer to shipbuilding programs	0	690,000		690,000	690,000
Total GENERAL PROVISIONS	**0**	**10,000,000**	**0**	**10,000,000**	**10,000,000**
DIVISION B					
MILITARY CONSTRUCTION					
Military Construction, Army	1,476,521	1,601,912	1,476,521	125,391	1,601,912
Military Construction, Navy	895,131	1,237,338	895,131	342,207	1,237,338
Military Construction, Air Force	644,090	1,055,310	644,090	411,220	1,055,310
Military Construction, Defense-Wide	687,535	721,959	740,535	34,424	774,959
Military Construction, Army National Guard	101,595	183,008	101,595	81,413	183,008
Military Construction, Air National Guard	53,473	204,059	53,473	150,586	204,059
Military Construction, Army Reserve	58,779	62,992	58,779	4,213	62,992
Military Construction, Naval Reserve	51,554	58,671	51,554	7,117	58,671

SUMMARY OF NATIONAL DEFENSE AUTHORIZATIONS FOR FISCAL YEAR 2003
In Thousands of Dollars

	Authorization Request	Senate Authorization	BUDGET AUTHORITY IMPLICATION FY 2003 Request	Senate Change to Request	Senate Authorization
Military Construction, Air Force Reserve	31,900	59,883	31,900	27,983	59,883
Base Realginment & Closure, Army	149,878	0	149,878	-149,878	0
Base Realignment & Closure, Navy	258,940	0	258,940	-258,940	0
Base Realignment & Closure, Air Force	136,320	0	136,320	-136,320	0
Base Realignment & Closure, Defense	0	545,138	0	545,138	545,138
NATO Security Investment Program	168,200	168,200	168,200	0	168,200
Total MILITARY CONSTRUCTION	**4,713,916**	**5,898,470**	**4,766,916**	**1,184,554**	**5,951,470**
FAMILY HOUSING					
Family Housing Construction, Army	283,346	283,346	283,346	0	283,346
Family Housing Operations and Debt, Army	1,122,274	1,114,087	1,122,274	-8,187	1,114,087
Family Housing Construction, Navy & Marine Corps	375,700	375,700	375,700	0	375,700
Family Housing Operations & Debt, Navy & Marine Corps	867,788	865,136	867,788	-2,652	865,136
Family Housing Construction, Air Force	676,694	676,694	676,694	0	676,694
Family Housing Operations & Debt, Air Force	844,419	865,268	844,419	20,849	865,268
Family Housing Construction, Defense-Wide	5,480	5,480	5,480	0	5,480
Family Housing Operations & Debt, Defense-Wide	42,432	42,395	42,432	-37	42,395
Homeowners Assistance Fund, Defense	0	0	0		0
DoD Family Housing Improvement Fund	2,000	2,000	2,000	0	2,000
Total FAMILY HOUSING	**4,220,133**	**4,230,106**	**4,220,133**	**9,973**	**4,230,106**
TOTAL DIVISION B	**8,934,049**	**10,128,576**	**8,987,049**	**1,194,527**	**10,181,576**
Mandatory Programs	**0**	**0**	**-1,174,870**	**0**	**-1,174,870**
TOTAL DEPARTMENT OF DEFENSE (051)	**284,875,166**	**375,897,783**	**378,242,041**	**-3,273,041**	**374,969,000**

SUMMARY OF NATIONAL DEFENSE AUTHORIZATIONS FOR FISCAL YEAR 2003
In Thousands of Dollars

	Authorization Request	Senate Authorization	BUDGET AUTHORITY IMPLICATION FY 2003 Request	Senate Change to Request	Senate Authorization
DIVISION C					
National Nuclear Security Administration					
Weapons Activities	5,869,379	5,988,188	5,869,379	118,809	5,988,188
Defense Nuclear Nonproliferation	1,113,630	1,129,130	1,113,630	15,500	1,129,130
Naval Reactors	708,020	707,020	708,020	-1,000	707,020
Office of the Administrator	347,705	335,705	347,705	-12,000	335,705
Total National Nuclear Security Adminstration	**8,038,734**	**8,160,043**	**8,038,734**	**121,309**	**8,160,043**
					0
Defense Environmental Restoration & Waste Management	4,558,360	4,601,460	4,558,360	43,100	4,601,460
Defense Environmental Cleanup Reform	800,000	1,000,000	800,000	200,000	1,000,000
Defense Facilities Closure Projects	1,091,314	1,109,314	1,091,314	18,000	1,109,314
Defense Environmental Management Privatization	158,399	158,399	158,399	0	158,399
Other Defense Activities	472,156	489,883	472,156	17,727	489,883
Defense Nuclear Waste Disposal	315,000	215,000	315,000	-100,000	215,000
Total DOE/NNSA Discretionary Authorizations	**15,433,963**	**15,734,099**	**15,433,963**	**300,136**	**15,734,099**
					0
Energy Employees Compensation Admin Expenses	0	-2,000	107,000	-2,000	105,000
Energy Employees Illness Compensation	0	0	662,000		662,000
Total Department of Energy/NNSA	**15,433,963**	**15,732,099**	**16,202,963**	**298,136**	**16,501,099**
Defense Nuclear Facilities Safety Board	19,494	19,494	19,494		19,494
Formerly Used Sites Remedial Action Program	141,000	140,000	141,000	-1,000	140,000
Total Atomic Energy Defense Activities (053)	**15,594,457**	**15,891,593**	**16,363,457**	**297,136**	**16,660,593**
TOTAL DIVISION C	**15,594,457**	**15,891,593**	**16,363,457**	**297,136**	**16,660,593**

SUMMARY OF NATIONAL DEFENSE AUTHORIZATIONS FOR FISCAL YEAR 2003
In Thousands of Dollars

	Authorization Request	Senate Authorization	BUDGET AUTHORITY IMPLICATION FY 2003 Request	Senate Change to Request	Senate Authorization
OTHER DEFENSE ACTIVITIES					
Discretionary Programs			1,227,000		1,227,000
Mandatory Programs			494,000	-142,107	351,893
DEFENSE RELATED ACTIVITIES (054)	**0**	**0**	**1,721,000**	**-142,107**	**1,578,893**
TOTAL NATIONAL DEFENSE FUNCTION (050)	**300,469,623**	**391,789,376**	**396,326,498**	**-3,118,012**	**393,208,486**
NON-DEFENSE AUTHORIZATIONS					
Armed Forces Retirement Home (Sec. 303)	69,921	69,921	69,921		69,921
TOTAL AUTHORIZATIONS	**300,539,544**	**391,859,297**	**396,396,419**	**-3,118,012**	**393,278,407**

Accrual funding of civilian personnel benefits

The President's budget proposed shifting the financing obligation of various federal civilian employee health and retirement benefits from the Office of Personnel Management to the federal departments and agencies employing those civilians, including the Department of Defense, on an accrual basis. Although this proposal would not have affected the benefits due to federal employees and would not have purchased any additional defense capabilities, it resulted in a $3.3 billion increase in the budget authority requested for the Department of Defense in fiscal year 2003 compared to the funding that would have been required to implement the same defense programs under current law. For the entire national defense function, the accounting increase in fiscal year budget authority levels was $3.5 billion.

Implementation of the President's proposal requires enactment of legislation that is not in the jurisdiction of this committee. Such legislation has not yet been enacted. In addition, the Concurrent Resolution on the Budget reported by the Senate Committee on the Budget rejected the proposed shift to accrual funding for future retirement and health benefits for current federal employees, and reduced the discretionary funding for the national defense function by $3.5 billion. Similar reductions were made to the discretionary funding requests of non-defense agencies.

Therefore, the bill reported by the committee has adjusted the funding requested by the President for the national defense function for fiscal year 2003 by $3.5 billion in order to comply with the Budget Resolution. This adjustment would not reduce the amount of funding requested and available for defense programs in fiscal year 2003 net of this proposed accounting change, nor would it result in any reduction in benefits available to federal civilian employees of the Department of Defense, the Department of Energy, or other agencies.

The following table summarizes the adjustments made to specific accounts throughout this bill to continue funding these benefits under the procedures contained in current law.

SUMMARY OF ACCRUAL ACCOUNTING ADJUSTMENTS
(Dollars in Thousands)

DIVISION A - DEPARTMENT OF DEFENSE

OPERATION AND MAINTENANCE	
Operation & Maintenance, Army	-612,382
Operation & Maintenance, Navy	-324,278
Oper. & Maint., Marine Corps	-47,210
Operation & Maintenance, Air Force	-531,055
Operation & Maintenance, Defense-Wide	-346,046
Office of the Inspector General	-8,275
Operation & Maintenance, Army Reserve	-43,220
Operation & Maintenance, Navy Reserve	-6,227
Operation & Maintenance, Air Force Reserve	-55,365
Operation & Maintenance, Army National Guard	-87,255
Operation & Maintenance, Air National Guard	-88,416
US Court of Appeals, Armed Forces	-311
Defense Health Program	-126,230
Total OPERATION AND MAINTENANCE	**-2,276,270**
RESEARCH, DEVELOPMENT, TEST & EVALUATION	
RDT&E, Army	-98,161
RDT&E, Navy	-5,565
RDT&E, Air Force	-36,249
RDT&E, Defense-Wide	-14,688
Total RESEARCH, DEVELOPMENT, TEST & EVALUATION	**-154,663**
MILITARY CONSTRUCTION	
Military Construction, Army	-26,083
Military Construction, Navy	-10,470
Total MILITARY CONSTRUCTION	**-36,553**
FAMILY HOUSING	
Family Housing Operations & Debt, Army	-3,267
Family Housing Operations & Debt, Defense-Wide	-37
Total FAMILY HOUSING	**-3,304**
REVOLVING AND MANAGEMENT FUNDS	
Defense Working Capital Fund, Army	-109,042
Defense Working Capital Fund, Navy	-373,228
Defense Working Capital Fund, Air Force	-122,365
Defense Working Capital Fund, Defense-Wide	-206,879
Defense Working Capital Fund, DECA	-27,589
Total REVOLVING AND MGMT FUNDS	**-839,103**
TOTAL DEPARTMENT OF DEFENSE	**-3,309,893**

DIVISION C -- ATOMIC ENERGY DEFENSE ACTIVITIES

National Nuclear Security Administration	
Weapons Activities	-2,000
Naval Reactors	-1,000
Office of the Administrator	-12,000
Total National Nuclear Security Adminstration	**-15,000**
Department of Energy	
Defense Environmental Restoration & Waste Management	-14,000
Other Defense Activities	-3,000
Energy Employees Compensation Administrative Expenses	-2,000
Total Department of Energy	**-19,000**
Formerly Used Sites Remedial Action Program	-1,000
Total Atomic Energy Defense Activities	**-35,000**
Total Armed Services Committee Jurisdiction	**-3,344,893**
CIA Retirement and Disability	-128,000
Mandatory Programs/Other Programs	-14,107
TOTAL NATIONAL DEFENSE FUNCTION (050)	**-3,487,000**

DIVISION A—DEPARTMENT OF DEFENSE AUTHORIZATIONS

TITLE I—PROCUREMENT

Explanation of tables

The following tables provide the program-level detailed guidance for the funding authorized in title I of this Act. The tables also display the funding requested by the administration in the fiscal year 2003 budget request for procurement programs and indicate those programs for which the committee either increased or decreased the requested amounts. As in the past, the administration may not exceed the authorized amounts (as set forth in the tables or, if unchanged from the administration request, as set forth in the Department of Defense's budget justification documents) without a reprogramming action in accordance with established procedures. Unless noted in the report, funding changes to the budget request are made without prejudice.

Funds transferred to the accounts in this title from the Defense Emergency Response Fund (DERF) are displayed on the tables that follow as increases to the amount requested for those programs in the procurement accounts. Programs for which funds were transferred from the DERF are annotated to indicate that funds were originally requested in the DERF.

SUBTITLE A—AUTHORIZATION OF APPROPRIATIONS

Chemical agents and munitions destruction, Defense (sec. 106)

The budget request for the Army included $1.5 billion for the Chemical Agents and Munitions Destruction program: $974.2 million for operation and maintenance; $302.7 million for research and development; and $213.3 million for procurement. The request also included $167.6 million for military construction described elsewhere in this report. These funds were requested in an Army account, contrary to the requirements of current law.

The committee recommends a provision that would authorize the total requested level of funding, although only in the account required by law: Chemical Agents and Munitions Destruction, Defense.

Section 1521(f) of title 50, United States Code, requires that funds for this program shall not be included in the budget accounts for any military department. The committee is concerned that funds for chemical demilitarization have been requested in the Army budget accounts, contrary to the requirements of current law. The committee expects the Department of Defense to comply with the law by requesting chemical demilitarization funds in a Department of Defense account.

SUBTITLE B—ARMY PROGRAMS

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	AIRCRAFT PROCUREMENT, ARMY						
1	UTILITY F/W (MR) AIRCRAFT	0	0	0	0	0	0
2	UH-60 BLACKHAWK (MYP)	12	153,361	9	96,300	21	249,661
3	ADVANCE PROCUREMENT (CY)	0	26,859	0	0	0	26,859
4	HELICOPTER NEW TRAINING	0	0	0	0	0	0
	MODIFICATION OF AIRCRAFT						
5	GUARDRAIL MODS (TIARA)	0	9,229	0	5,000	0	14,229
	Guardrail Mods (TIARA) (Transfer from DERF)				[5,000]		
6	ARL MODS (TIARA)	0	20,873	0	0	0	20,873
7	AH-64 MODS	0	93,622	0	0	0	93,622
8	CH-47 CARGO HELICOPTER MODS	0	382,061	0	4,000	0	386,061
	COTS crashworthy crew seats				[4,000]		
9	ADVANCE PROCUREMENT (CY)	0	21,185	0	0	0	21,185
10	CH-47 ICH	0	0	0	0	0	0
11	UTILITY/CARGO AIRPLANE MODS	0	16,954	0	0	0	16,954
12	OH-58 MODS	0	460	0	0	0	460
13	AIRCRAFT LONG RANGE MODS	0	744	0	0	0	744
14	LONGBOW	0	865,781	0	0	0	865,781
15	ADVANCE PROCUREMENT (CY)	0	29,713	0	0	0	29,713
16	UH-1 MODS	0	0	0	0	0	0
17	UH-60 MODS	0	41,863	0	0	0	41,863
18	KIOWA WARRIOR	0	42,406	0	0	0	42,406

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
19	AIRBORNE AVIONICS	0	97,003	0	0	0	97,003
20	ASE MODS (SIRFC)	0	0	0	0	0	0
21	GATM	0	0	0	0	0	0
22	GATM ROLLUP	0	70,414	0	0	0	70,414
23	SPARE PARTS (AIR)	0	7,697	0	0	0	7,697
24	AIRCRAFT SURVIVABILITY EQUIPMENT	0	0	0	8,000	0	8,000
	Laser detecting sets				[8,000]		
25	ASE INFRARED CM	0	0	0	0	0	0
26	AIRBORNE COMMAND & CONTROL	0	27,738	0	-27,738	0	0
	Transfer to PE 64818A				[-10,000]		
	Reduction: system not ready for LRIP				[-17,738]		
27	AVIONICS SUPPORT EQUIPMENT	0	7,494	0	0	0	7,494
28	COMMON GROUND EQUIPMENT	0	18,091	0	5,000	0	23,091
	Aviator night vision system				[5,000]		
29	AIRCREW INTEGRATED SYSTEMS	0	15,215	0	0	0	15,215
30	AIR TRAFFIC CONTROL	0	64,410	0	0	0	64,410
31	INDUSTRIAL FACILITIES	0	704	0	0	0	704
32	LAUNCHER, 2.75 ROCKET	0	2,677	0	0	0	2,677
33	AIRBORNE COMMUNICATIONS	0	44,473	0	0	0	44,473
34	CLOSED ACCOUNT ADJUSTMENT	0	0	0	0	0	0

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
34a	Contract services savings				-5,203	0	-5,203
	TOTAL AIRCRAFT PROCUREMENT, ARMY		**2,061,027**		**85,359**		**2,146,386**
	MISSILE PROCUREMENT, ARMY						
1	PATRIOT SYSTEM SUMMARY	72	471,670	0	0	72	471,670
2	STINGER SYSTEM SUMMARY	160	30,893	0	0	160	30,893
3	AVENGER SYSTEM SUMMARY	0	0	0	0	0	0
4	HELLFIRE SYS SUMMARY	1,797	184,396	0	0	1,797	184,396
5	JAVELIN (AAWS-M) SYSTEM SUMMARY	1,725	250,506	0	0	1,725	250,506
6	LINE OF SIGHT ANTI-TANK (LOSAT) SYSTEM SUM	144	17,937	0	0	144	17,937
7	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
8	MLRS ROCKET	0	0	0	0	0	0
9	GUIDED MLRS ROCKET (GMLRS)	108	29,698	0	15,000	108	44,698
10	MLRS REDUCED RANGE PRACTICE ROCKETS (RRPR)	5,646	15,924	0	0	5,646	15,924
11	MLRS LAUNCHER SYSTEMS	35	141,131	0	0	35	141,131
12	HIMARS LAUNCHER	34	128,402	0	0	34	128,402
13	ARMY TACTICAL MSL SYS (ATACMS) - SYS SUM	0	9,050	0	0	0	9,050
14	ATACMS BLKII SYSTEM SUMMARY	0	49,687	0	0	0	49,687
	MODIFICATION OF MISSILES			0	0	0	0
15	PATRIOT MODS	0	151,307	0	0	0	151,307

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
16	STINGER MODS	0	1,492	0	0	0	1,492
17	AVENGER MODS	0	0	0	0	0	0
18	ITAS/TOW MODS	0	59,962	0	0	0	59,962
19	MLRS MODS	0	31,734	0	0	0	31,734
20	SPARES AND REPAIR PARTS	0	55,924	0	0	0	55,924
21	AIR DEFENSE TARGETS	0	3,408	0	0	0	3,408
22	ITEMS LESS THAN $5.0M (MISSILES)	0	907	0	0	0	907
23	MISSILE DEMILITARIZATION	0	4,895	0	0	0	4,895
24	PRODUCTION BASE SUPPORT	0	3,373	0	0	0	3,373
24a	Contract services savings				-4,146		-4,146
	TOTAL MISSILE PROCUREMENT, ARMY		**1,642,296**		**10,854**		**1,653,150**
	PROCUREMENT OF W&TCV, ARMY			0	0	0	0
1	ABRAMS TRNG DEV MOD	0	5,504	0	0	0	5,504
2	BRADLEY BASE SUSTAINMENT	0	397,053	0	0	0	397,053
3	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
4	BRADLEY FVS TRAINING DEVICES	0	0	0	0	0	0
5	HAB TRAINING DEVICES	0	0	0	0	0	0
6	BRADLEY FVS TRAINING DEVICES (MOD)	0	8,532	0	0	0	8,532
7	ABRAMS TANK TRAINING DEVICES	0	12,061	0	0	0	12,061
8	INTERIM ARMORED VEHICLE (IAV) FAMILY	332	811,831	0	0	332	811,831
9	COMMAND & CONTROL VEHICLE	0	0	0	0	0	0

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	MODIFICATION OF TRACKED COMBAT VEHICLES						
10	CARRIER, MOD	0	60,305	0	0	0	60,305
11	FIST VEHICLE (MOD)	0	6,966	0	0	0	6,966
12	MOD OF IN-SVC EQUIP, FIST VEHICLE	0	692	0	0	0	692
13	BFVS SERIES (MOD)	0	35,033	0	0	0	35,033
14	HOWITZER, MED SP FT 155MM M109A6 (MOD)	0	17,361	0	0	0	17,361
15	FAASV PIP TO FLEET	0	2,944	0	0	0	2,944
16	IMPROVED RECOVERY VEHICLE (M88 MOD)	16	50,311	0	0	16	50,311
17	HEAVY ASSAULT BRIDGE (HAB) SYS (MOD)	0	0	0	0	0	0
18	ARMORED VEH LAUNCH BRIDGE (AVLB) (MOD)	0	10,021	0	0	0	10,021
19	M1 ABRAMS TANK (MOD)	0	191,413	0	0	0	191,413
20	M1A1D RETROFIT	0	0	0	0	0	0
21	SYSTEM ENHANCEMENT PGM: SEP M1A2	31	123,697	0	0	31	123,697
22	ABRAMS UPGRADE PROGRAM	0	376,268	0	0	0	376,268
23	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
24	ITEMS LESS THAN $5.0M (TCV-WTCV)	0	146	0	0	0	146
25	PRODUCTION BASE SUPPORT (TCV-WTCV)	0	9,900	0	0	0	9,900
26	ARMOR MACHINE GUN, 7.62MM M240 SERIES	2,217	21,334	0	0	2,217	21,334
27	MACHINE GUN, 5.56MM (SAW)	0	0	0	0	0	0
28	GRENADE LAUNCHER, AUTO, 40MM, MK19-3	669	16,663	0	0	669	16,663
29	81MM MORTAR (ROLL)	138	9,821	0	0	138	9,821
30	M16 RIFLE	5,631	3,104	0	0	5,631	3,104

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
31	XM107, CAL. 50, SNIPER RIFLE	600	8,913	0	0	600	8,913
32	5.56 CARBINE M4	12,505	9,155	0	0	12,505	9,155
33	HOWITZER LT WT 155MM (T)	0	0	0	0	0	0
	MOD OF WEAPONS AND OTHER COMBAT VEH						
34	MARK-19 MODIFICATIONS	0	2,743	0	0	0	2,743
35	M4 CARBINE MODS	0	9,267	0	0	0	9,267
36	SQUAD AUTOMATIC WEAPON (MOD)	0	4,119	0	0	0	4,119
37	MEDIUM MACHINE GUNS (MODS)	0	0	0	0	0	0
38	HOWITZER, TOWED, 155MM, M198 (MODS)	0	0	0	0	0	0
39	M119 MODIFICATIONS	0	4,852	0	0	0	4,852
40	M16 RIFLE MODS	0	0	0	0	0	0
41	MODIFICATIONS LESS THAN $5.0M (WOCV-WTCV)	0	817	0	0	0	817
42	ITEMS LESS THAN $5.0M (WOCV-WTCV)	0	1,265	0	0	0	1,265
43	PRODUCTION BASE SUPPORT (WOCV-WTCV)	0	5,832	0	0	0	5,832
44	INDUSTRIAL PREPAREDNESS	0	3,246	0	0	0	3,246
45	SMALL ARMS (SOLDIER ENH PROG)	0	1,954	0	0	0	1,954
46	CLOSED ACCOUNT ADJUSTMENTS	0	0	0	0	0	0
47	SPARES AND REPAIR PARTS (WTCV)	0	25,435	0	0	0	25,435
47a	Contract services savings				-5,676		-5,676
	TOTAL PROCUREMENT OF W&TCV, ARMY		**2,248,558**		**-5,676**		**2,242,882**

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	PROCUREMENT OF AMMUNITION, ARMY			0	0	0	0
1	CTG, 5.56MM, ALL TYPES	0	89,870	0	9,305	0	99,175
	CTG, 5.56MM, All Types (Transfer from DERF)				[9,305]		
2	CTG, 7.62MM, ALL TYPES	0	15,975	0	2,199	0	18,174
	CTG, 7.62MM, All Types (Transfer from DERF)				[2,199]		
3	CTG, 9MM, ALL TYPES	0	13,508	0	0	0	13,508
4	CTG, .50 CAL, ALL TYPES	0	50,575	0	8,021	0	58,596
	.50 CAL SLAP				[4,000]		
	CTG, .50 CAL, All Types (Transfer from DERF)				[4,021]		
5	CTG, 20MM, ALL TYPES	0	0	0	0	0	0
6	CTG, 25MM, ALL TYPES	0	33,087	0	0	0	33,087
7	CTG, 30MM, ALL TYPES	0	9,795	0	0	0	9,795
8	CTG, 40MM, ALL TYPES	0	71,703	0	5,369	0	77,072
	CTG, 40MM, All Types (Transfer from DERF)				[5,369]		
9	60MM MORTAR, ALL TYPES	0	31,696	0	0	0	31,696
10	81MM MORTAR, ALL TYPES	0	3,582	0	0	0	3,582
11	CTG, MORTAR, 120MM, ALL TYPES	0	50,425	0	0	0	50,425
12	CTG TANK 105MM: ALL TYPES	0	14,100	0	0	0	14,100
13	120MM TANK TRAINING, ALL TYPES	0	154,963	0	0	0	154,963
14	CTG, TANK, 120MM TACTICAL, ALL TYPES	0	43,254	0	0	0	43,254
15	CTG ARTY 75MM BLANK M337A1	101	4,201	0	0	101	4,201

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
16	CTG ARTY 105MM DPICM M915	0	0	0	0	0	0
17	CTG ARTY 105MM M927	0	0	0	0	0	0
18	CTG ARTY 105MM ILLUM M314 SERIES	6	5,208	0	0	6	5,208
19	PROJ ARTY 155MM SMOKE WP M825	0	0	0	0	0	0
20	CTG ARTY 105MM HE M1 W/O FUZE	0	25,200	0	1,637	0	26,837
	CTG, ARTY 105MM HE M1 W/O Fuze (Transfer from DERF)				[1,637]		
21	PROJECTILE 155 MILLIMETER DP BASEBLED M864 P7	0	22,300	0	0	0	22,300
22	PROJ ARTY 155MM HE M795	0	0	0	0	0	0
23	REMOTE AREA DENIAL ARTILLERY MUNITION (RADAM)	0	0	0	0	0	0
24	PROJ ARTY 155MM HE M107	155	30,200	0	1,000	155	31,200
25	MODULAR ARTILLERY CHARGE SYSTEM (MACS), ALL T	0	122,411	0	0	0	122,411
26	ARTILLERY FUZES, ALL TYPES	0	69,180	0	0	0	69,180
27	MINE, TRAINING, ALL TYPES	0	12,661	0	0	0	12,661
28	MINE AT VOLCANO,: ALL TYPES	0	0	0	0	0	0
29	WIDE AREA MUNITIONS	0	12,466	0	-6,000	0	6,466
30	BUNKER DEFEATING MUNITION (BDM)	0	7,795	0	5,000	0	12,795
31	ROCKET, HYDRA 70, ALL TYPES	0	22,400	0	0	0	22,400
32	DEMOLITION MUNITIONS, ALL TYPES	0	28,001	0	4,000	0	32,001
	Modern demolition initiators				[4,000]		
33	GRENADES, ALL TYPES	0	37,552	0	3,221	0	40,773
	Grenades, All Types (Transfer from DERF)				[3,221]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
34	SIGNALS, ALL TYPES	0	11,935	0	946	0	12,881
	Signals, All Types (Transfer from DERF)				[946]		
35	SIMULATORS, ALL TYPES	0	3,942	0	0	0	3,942
36	AMMO COMPONENTS, ALL TYPES	0	7,953	0	0	0	7,953
37	NON-LETHAL AMMUNITION, ALL TYPES	0	5,890	0	0	0	5,890
38	CAD/PAD ALL TYPES	0	4,800	0	0	0	4,800
39	ITEMS LESS THAN $5 MILLION	0	8,739	0	302	0	9,041
	Items Less than $5 Million (Transfer from DERF)				[302]		
40	AMMUNITION PECULIAR EQUIPMENT	0	4,792	0	3,000	0	7,792
41	FIRST DESTINATION TRANSPORTATION (AMMO)	0	5,836	0	0	0	5,836
42	CLOSEOUT LIABILITIES	0	10,017	0	0	0	10,017
43	PROVISION OF INDUSTRIAL FACILITIES	0	42,655	0	0	0	42,655
44	LAYAWAY OF INDUSTRIAL FACILITIES	0	6,990	0	0	0	6,990
45	MAINTENANCE OF INACTIVE FACILITIES	0	9,082	0	0	0	9,082
46	CONVENTIONAL AMMO DEMILITARIZATION	0	50,030	0	10,000	0	60,030
47	ARMS INITIATIVE	0	4,657	0	0	0	4,657
47a	Contract services savings				-2,927		-2,927
	TOTAL PROCUREMENT OF AMMUNITION, ARMY		**1,159,426**		**45,073**		**1,204,499**

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	OTHER PROCUREMENT, ARMY						
	TACTICAL AND SUPPORT VEHICLES						
1	TACTICAL TRAILERS/DOLLY SETS	0	8,690	0	0	0	8,690
2	SEMITRAILERS, FLATBED:	0	39,095	0	0	0	39,095
3	SEMITRAILERS, TANKERS	0	7,862	0	0	0	7,862
4	SEMITRAILER VAN CGO SUPPLY 12T 4WHL M129A2C	0	0	0	0	0	0
5	HI MOB MULTI-PURP WHLD VEH (HMMWV)	0	196,783	0	0	0	196,783
6	TRUCK, DUMP, 20T (CCE)	70	17,079	0	0	70	17,079
7	FAMILY OF MEDIUM TACTICAL VEH (FMTV)	0	681,373	0	0	0	681,373
8	FIRETRUCKS & ASSOCIATED FIREFIGHTING EQUIPMEN	0	21,047	0	0	0	21,047
9	FAMILY OF HEAVY TACTICAL VEHICLES (FHTV)	0	242,768	0	9,000	0	251,768
	Movement tracking system				[9,000]		
10	ARMORED SECURITY VEHICLES (ASV)	20	14,438	0	0	20	14,438
11	TRUCK, TRACTOR, LINE HAUL, M915/M916	0	50,829	0	0	0	50,829
12	TOWING DEVICE, 5TH WHEEL	40	2,005	0	0	40	2,005
13	TRUCK, TRACTOR, YARD TYPE, M878 (C/S)	50	4,884	0	0	50	4,884
14	HVY EXPANDED MOBILE TACTICAL TRUCK EXT SERV P	652	119,854	0	0	652	119,854
15	LINE HAUL ESP	0	0	0	0	0	0
16	MODIFICATION OF IN SVC EQUIP	0	73,320	0	0	0	73,320
17	ITEMS LESS THAN $5.0M (TAC VEH)	0	4,979	0	0	0	4,979
18	HEAVY ARMORED SEDAN	6	581	0	8,300	6	8,881
	Heavy Armored Sedan (Transfer from DERF)				[8,300]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
19	PASSENGER CARRYING VEHICLES	0	295	0	0	0	295
20	NONTACTICAL VEHICLES, OTHER	27	1,753	0	0	27	1,753
	COMMUNICATIONS AND ELECTRONICS EQUIPMENT						
21	COMBAT IDENTIFICATION PROGRAM	0	0	0	0	0	0
22	JCSE EQUIPMENT (USREDCOM)	0	6,120	0	0	0	6,120
23	DEFENSE SATELLITE COMMUNICATIONS SYSTEM (SPAC	0	89,806	0	0	0	89,806
24	SHF TERM	0	33,166	0	0	0	33,166
25	SAT TERM, EMUT (SPACE)	0	2,641	0	0	0	2,641
26	NAVSTAR GLOBAL POSITIONING SYSTEM (SPACE)	0	27,510	0	0	0	27,510
27	SMART-T (SPACE)	0	24,467	0	0	0	24,467
28	SCAMP (SPACE)	0	1,559	0	0	0	1,559
29	GLOBAL BRDCST SVC - GBS	0	11,402	0	0	0	11,402
30	MOD OF IN-SVC EQUIP (TAC SAT)	0	11,002	0	0	0	11,002
31	ARMY GLOBAL CMD & CONTROL SYS (AGCCS)	0	21,149	0	0	0	21,149
32	ARMY DATA DISTRIBUTION SYSTEM (DATA RADIO)	0	74,835	0	10,000	0	84,835
	Enhanced position locating & reporting system (EPLRS)				[10,000]		
33	SINCGARS FAMILY	0	30,141	0	0	0	30,141
34	TRACTOR CAGE	0	4,112	0	0	0	4,112
35	JOINT TACTICAL AREA COMMAND SYSTEMS	0	869	0	0	0	869
36	ACUS MOD PROGRAM	0	75,905	0	25,000	0	100,905
	Warfighter information network (WIN-T)				[25,000]		
37	COMMS-ELEC EQUIP FIELDING	0	12,924	0	0	0	12,924

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
38	SOLDIER ENHANCEMENT PROGRAM COMM/ELECTRONICS	0	6,114	0	0	0	6,114
39	COMBAT SURVIVOR EVADER LOCATOR (CSEL)	1,186	16,879	0	0	1,186	16,879
40	MEDICAL COMM FOR CBT CASUALTY CARE (MC4)	0	4,975	0	0	0	4,975
41	CI AUTOMATION ARCHITECTURE	0	1,755	0	0	0	1,755
42	TSEC - ARMY KEY MGT SYS (AKMS)	0	10,150	0	0	0	10,150
43	INFORMATION SYSTEM SECURITY PROGRAM-ISSP	0	39,055	0	26,700	0	65,755
	Secure digital wireless devices (Transfer from DERF)				[3,000]		
	Intrusion Detection Systems (Transfer from DERF)				[1,700]		
	Firewalls and routers (Transfer from DERF)				[1,900]		
	Configuration management (Transfer from DERF)				[4,400]		
	COMSEC new equipment training (Transfer from DERF)				[15,700]		
44	TERRESTRIAL TRANSMISSION	0	2,040	0	0	0	2,040
45	BASE SUPPORT COMMUNICATIONS	0	36,725	0	0	0	36,725
46	ARMY DISN ROUTER	0	6,039	0	0	0	6,039
47	ELECTROMAG COMP PROG (EMCP)	0	461	0	0	0	461
48	WW TECH CON IMP PROG (WWTCIP)	0	2,991	0	0	0	2,991
49	INFORMATION SYSTEMS	0	279,592	0	215,000	0	494,592
	Alternate relocation sites (Transfer from DERF)				[215,000]		
50	DEFENSE MESSAGE SYSTEM (DMS)	0	26,829	0	0	0	26,829
51	LOCAL AREA NETWORK (LAN)	0	127,244	0	0	0	127,244
52	PENTAGON INFORMATION MGT AND TELECOM	0	14,501	0	0	0	14,501
53	FOREIGN COUNTERINTELLIGENCE PROG (FCI)	0	1,624	0	2,280	0	3,904

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
54	GENERAL DEFENSE INTELL PROG (GDIP)	0	20,258	0	5,994	0	26,252
	Classified (Transfer from DERF)				[5,994]		
55	ALL SOURCE ANALYSIS SYS (ASAS) (TIARA)	0	57,886	0	0	0	57,886
56	JTT/CIBS-M (TIARA)	13	4,824	0	0	13	4,824
57	PROPHET GROUND (TIARA)	46	20,226	0	15,000	46	35,226
	Prophet Ground (TIARA) (Transfer from DERF)				[15,000]		
58	TUAV	12	84,290	0	11,000	12	95,290
	TUAV shelters/trailers (Transfer from DERF)				[9,500]		
	Hunter upgrades/interoperability (Transfer from DERF)				[1,500]		
59	ARMY COMMON GROUND STATION (CGS)	0	8,620	0	0	0	8,620
60	DIGITAL TOPOGRAPHIC SPT SYS (DTSS) (TIARA)	0	14,089	0	0	0	14,089
61	DRUG INTERDICTION PROGRAM (DIP) (TIARA)	0	0	0	0	0	0
62	TACT EXPLOITATION OF NATL CAPABILITIES (TIARA	0	0	0	0	0	0
63	TACTICAL EXPLOITATION SYSTEM (TIARA)	0	17,576	0	0	0	17,576
64	DISTRIBUTED COMMON GRND SYSTEM (DCGS) (JMIP)	0	2,617	0	9,000	0	11,617
	Distributed Common Ground System (DCGS) (Transfer from DERF)				[9,000]		
65	TROJAN (TIARA)	0	4,873	0	0	0	4,873
66	MOD OF IN-SVC EQUIP (INTEL SPT) (TIARA)	0	1,655	0	0	0	1,655
67	CI HUMINT INFO MANAGEMENT SYSTEM (CHIMS) (TIA	0	9,735	0	0	0	9,735
68	ITEMS LESS THAN $5.0M (TIARA)	0	3,675	0	4,500	0	8,175
	Items Less than $5 Million (TIARA) (Transfer from DERF)				[2,000]		
	Items Less than $5.0M (TIARA) (Transfer from DERF)				[2,500]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
69	SHORTSTOP	0	0	0	0	0	0
70	COUNTERINTELLIGENCE/SECURITY COUNTERMEASURES	0	2,310	0	0	0	2,310
71	FAAD GBS	0	31	0	0	0	31
72	SENTINEL MODS	0	26,519	0	0	0	26,519
73	NIGHT VISION DEVICES	0	60,475	0	10,000	0	70,475
	AN / PVS-7				[10,000]		
74	LONG RANGE ADVANCED SCOUT SURVEILLANCE SYSTEM	105	49,927	0	0	105	49,927
75	LTWT VIDEO RECON SYSTEM (LWVRS)	476	14,318	0	0	476	14,318
76	NIGHT VISION, THERMAL WPN SIGHT	2,970	52,071	0	0	2,970	52,071
77	COMBAT IDENTIFICATION / AIMING LIGHT	0	0	0	0	0	0
78	ARTILLERY ACCURACY EQUIP	0	5,402	0	0	0	5,402
79	MOD OF IN-SVC EQUIP (MMS)	0	346	0	0	0	346
80	MOD OF IN-SVC EQUIP (MVS)	0	272	0	0	0	272
81	PROFILER	2	4,875	0	0	2	4,875
82	MOD OF IN-SVC EQUIP (TAC SURV)	0	33,283	0	0	0	33,283
83	FORCE XXI BATTLE CMD BRIGADE & BELOW (FBCB2)	1,783	65,294	0	0	1,783	65,294
84	LIGHTWEIGHT LASER DESIGNATOR/RANGEFINDER (LLD	35	8,962	0	0	35	8,962
85	COMPUTER BALLISTICS: MORTAR M-30	0	0	0	0	0	0
86	MORTAR FIRE CONTROL SYSTEM	113	29,794	0	0	113	29,794
87	INTEGRATED MET SYS SENSORS (IMETS) - TIARA	27	7,230	0	0	27	7,230
88	TACTICAL OPERATIONS CENTERS	0	42,332	0	0	0	42,332
89	ADV FA TAC DATA SYS / EFF CTRL SYS (AFATDS/EC	0	74,723	0	0	0	74,723

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
90	MOD OF IN-SVC EQUIP, AFATDS	0	2,976	0	0	0	2,976
91	LIGHT WEIGHT TECNICAL FIRE DIRECTION SYS (LWT	0	12,413	0	0	0	12,413
92	CMBT SVC SUPT CONTROL SYS (CSSCS)	139	24,989	0	0	139	24,989
93	FAAD C2	2	24,779	0	0	2	24,779
94	AIR & MSL DEFENSE PLANNING & CONTROL SYS (AMD	0	9,750	0	0	0	9,750
95	FORWARD ENTRY DEVICE / LIGHTWEIGHT FED (FED/L	0	15,125	0	0	0	15,125
96	STRIKER FAMILY	54	28,543	0	0	54	28,543
97	LIFE CYCLE SOFTWARE SUPPORT (LCSS)	0	924	0	0	0	924
98	LOGTECH	0	7,701	0	0	0	7,701
99	TC AIMS II	0	11,496	0	0	0	11,496
100	GUN LAYING AND POS SYS (GLPS)	0	159	0	0	0	159
101	ISYSCON EQUIPMENT	0	31,366	0	0	0	31,366
102	JOINT NETWORK MANAGEMENT SYSTEM (JNMS)	0	6,868	0	0	0	6,868
103	TACTICAL INTERNET MANAGER	0	11,842	0	0	0	11,842
104	MANEUVER CONTROL SYSTEM (MCS)	0	7,584	0	0	0	7,584
105	STAMIS TACTICAL COMPUTERS (STACOMP)	0	61,304	0	0	0	61,304
106	STANDARD INTEGRATED CMD POST SYSTEM	0	29,535	0	0	0	29,535
107	ARMY TRAINING MODERNIZATION	0	19,233	0	0	0	19,233
108	AUTOMATED DATA PROCESSING EQUIP	0	156,546	0	0	0	156,546
109	RESERVE COMPONENT AUTOMATION SYS (RCAS)	0	68,273	0	0	0	68,273
110	SPECIAL INFORMATION OPERATIONS (SIO) (TIARA)	0	0	0	0	0	0
111	AFRTS	0	2,523	0	0	0	2,523

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
112	ITEMS LESS THAN $5.0M (A/V)	0	5,756	0	0	0	5,756
113	ITEMS LESS THAN $5M (SURVEYING EQUIPMENT)	0	1,002	0	0	0	1,002
114	PRODUCTION BASE SUPPORT (C-E)	0	417	0	0	0	417
	OTHER SUPPORT EQUIPMENT						
115	SMOKE & OBSCURANT FAMILY: SOF (NON AAO ITEM)	0	25,953	0	0	0	25,953
116	TACTICAL BRIDGING	0	57,604	0	0	0	57,604
117	TACTICAL BRIDGE, FLOAT-RIBBON	0	51,237	0	0	0	51,237
118	DISPENSER, MINE M139	0	1,822	0	0	0	1,822
119	GRND STANDOFF MINE DETECTION SYSTEM (GSTAMIDS	0	17,425	0	0	0	17,425
120	WIDE AREA MUNITIONS (REMOTE CONTROL UNIT)	278	3,223	0	0	278	3,223
121	EXPLOSIVE ORDNANCE DISPOSAL EQPMT (EOD EQPMT)	0	10,965	0	0	0	10,965
122	ITEMS LESS THAN $5M, COUNTERMINE EQUIP	0	686	0	0	0	686
123	BN COUNTERMINE SIP	0	0	0	0	0	0
124	HEATERS AND ECU'S	0	14,824	0	0	0	14,824
125	LAUNDRIES, SHOWERS AND LATRINES	0	32,399	0	0	0	32,399
126	FLOODLIGHT SET, ELEC, TRL MTD, 3 LIGHTS	0	498	0	0	0	498
127	SOLDIER ENHANCEMENT	0	2,488	0	0	0	2,488
128	LIGHTWEIGHT MAINTENANCE ENCLOSURE (LME)	587	7,730	0	0	587	7,730
129	FORCE PROVIDER	0	0	0	0	0	0
130	AUTHORIZED STOCKAGE LIST MOBILITY SYSTEM (ASL	0	2,838	0	0	0	2,838
131	FIELD FEEDING EQUIPMENT	0	21,177	0	0	0	21,177
132	AIRDROP PROGRAM	0	0	0	0	0	0

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
133	CAMOUFLAGE: ULCANS	0	0	0	0	0	0
134	ITEMS LESS THAN $5.0M (ENG SPT EQ)	0	7,918	0	0	0	7,918
135	ITEMS LESS THAN $5.0M (CSS EQ)	0	0	0	0	0	0
136	FAMILY OF TANK ASSEMBLIES, FABRIC, COLLAPSIBL	0	0	0	0	0	0
137	QUALITY SURVEILLANCE EQUIPMENT	0	7,522	0	0	0	7,522
138	DISTRIBUTION SYSTEMS, PETROLEUM & WATER	0	35,280	0	0	0	35,280
139	INLAND PETROLEUM DISTRIBUTION SYSTEM	0	12,364	0	0	0	12,364
140	WATER PURIFICATION SYSTEMS	0	18,204	0	0	0	18,204
141	COMBAT SUPPORT MEDICAL	0	21,003	0	10,700	0	31,703
	Rapid intravenous infusion pumps				[5,700]		
	Deployable medical systems				[5,000]		
142	SHOP EQ CONTACT MAINTENANCE TRK MTD (MYP)	180	12,870	0	0	180	12,870
143	WELDING SHOP, TRAILER MTD	119	5,082	0	0	119	5,082
144	ITEMS LESS THAN $5.0M (MAINT EQ)	0	1,075	0	0	0	1,075
145	GRADER, ROAD MTZD, HVY, 6X4 (CCE)	0	3,854	0	0	0	3,854
146	SCRAPERS, EARTHMOVING	0	7,989	0	0	0	7,989
147	DISTR, WATER, SP MIN 2500G SEC/NON-SEC	0	0	0	0	0	0
148	MISSION MODULES - ENGINEERING	0	19,236	0	0	0	19,236
149	COMPACTOR	0	299	0	0	0	299
150	LOADERS	0	25,365	0	0	0	25,365
151	HYDRAULIC EXCAVATOR	0	300	0	0	0	300
152	DEPLOYABLE UNIVERSAL COMBAT EARTH MOVERS	0	299	0	0	0	299

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
153	TRACTOR, FULL TRACKED	0	14,950	0	0	0	14,950
154	CRANES	0	16,333	0	0	0	16,333
155	CRUSHING/SCREENING PLANT, 150 TPH	2	4,495	0	0	2	4,495
156	PLANT, ASPHALT MIXING	1	2,006	0	0	1	2,006
157	ARMORED COMBAT EARTHMOVER, M9 ACE	0	0	0	0	0	0
158	HIGH MOBILITY ENGINEER EXCAVATOR (HMEE)	16	5,014	0	0	16	5,014
159	CONST EQUIP ESP	0	9,567	0	0	0	9,567
160	ITEMS LESS THAN $5.0M (CONST EQUIP)	0	12,880	0	0	0	12,880
161	SMALL TUG	0	0	0	0	0	0
162	FLOATING CRANE, 100-250 TON	0	0	0	0	0	0
163	LOGISTIC SUPPORT VESSEL (LSV)	0	0	0	0	0	0
164	LOGISTICS SUPPORT VESSEL (ESP)	0	0	0	0	0	0
165	CAUSEWAY SYSTEMS	0	29,673	0	0	0	29,673
166	ITEMS LESS THAN $5.0M (FLOAT/RAIL)	0	3,563	0	0	0	3,563
167	GENERATORS AND ASSOCIATED EQUIP	0	79,180	0	0	0	79,180
168	ROUGH TERRAIN CONTAINER HANDLER (RTCH)	96	49,065	0	0	96	49,065
169	ALL TERRAIN LIFTING ARMY SYSTEM	148	21,963	0	0	148	21,963
170	MHE EXTENDED SERVICE PROGRAM (ESP)	12	2,304	0	0	12	2,304
171	ROUGH TERRAIN CONTAINER CRANE	0	0	0	0	0	0
172	ITEMS LESS THAN $5.0M (MHE)	0	495	0	0	0	495
173	COMBAT TRAINING CENTERS (CTC) SUPPORT	0	54,493	0	0	0	54,493

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
174	TRAINING DEVICES, NONSYSTEM	0	111,682	0	5,400	0	117,082
	Engagement skills trainer				[4,000]		
	Range instrumentation				[1,400]		
175	CLOSE COMBAT TACTICAL TRAINER	0	52,472	0	0	0	52,472
176	AVIATION COMBINED ARMS TACTICAL TRAINER (AVCA	0	35,915	0	0	0	35,915
177	FIRE SUPPORT COMBINED ARMS TACTICAL TRAINER	0	0	0	0	0	0
178	CALIBRATION SETS EQUIPMENT	0	16,366	0	0	0	16,366
179	INTEGRATED FAMILY OF TEST EQUIPMENT (IFTE)	0	59,596	0	0	0	59,596
180	TEST EQUIPMENT MODERNIZATION (TEMOD)	0	16,782	0	0	0	16,782
181	ARMY DIAGNOSTICS IMPROVEMENT PGM (ADIP)	0	7,982	0	0	0	7,982
182	RECONFIGURABLE SIMULATORS	0	0	0	0	0	0
183	PHYSICAL SECURITY SYSTEMS (OPA3)	0	227,402	0	4,500	0	231,902
	Physical Security System (Transfer from DERF)				[4,500]		
184	BASE LEVEL COM'L EQUIPMENT	0	12,297	0	0	0	12,297
185	MODIFICATION OF IN-SVC EQUIPMENT (OPA-3)	0	49,181	0	0	0	49,181
186	PRODUCTION BASE SUPPORT (OTH)	0	2,522	0	0	0	2,522
187	SPECIAL EQUIPMENT FOR USER TESTING	0	14,311	0	0	0	14,311
188	MA8975	0	4,256	0	39,100	0	43,356
	MA8975 (Transfer from DERF)				[39,100]		
189	CLOSED ACCOUNT ADJUSTMENTS	0	0	0	0	0	0
	SPARE AND REPAIR PARTS						
190	INITIAL SPARES - C&E	0	59,694	0	0	0	59,694

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
191	INITIAL SPARES - OTHER SUPPORT EQUIP	0	676	0	0	0	676
191a	Contract services savings				-13,048		-13,048
191b	Financial management savings				-53,200		-53,200
	TOTAL OTHER PROCUREMENT, ARMY		**5,168,453**		**345,226**		**5,513,679**
	CHEM AGENTS & MUNITIONS DESTRUCTION, ARMY						
1	CHEM DEMILITARIZATION - O&M	0	974,238	0	-974,238	0	0
2	CHEM DEMILITARIZATION - RDT&E	0	302,683	0	-302,683	0	0
3	CHEM DEMILITARIZATION - PROC	0	213,278	0	-213,278	0	0
	TOTAL CHEM AGENTS & MUNITIONS DESTRUCTION, ARMY		**1,490,199**		**-1,490,199**		**0**

Pilot program on sales of manufactured articles and services of certain Army industrial facilities without regard to availability from domestic sources (sec. 111)

The committee recommends a provision that would extend the authorization for a single Army industrial facility to sell manufactured articles and services to commercial contractors providing weapons systems to the Department of Defense. The provision extends this pilot program through fiscal year 2004.

The intent of the pilot program is to allow Army industrial facilities to contract and team for additional workload, even if the products are available from commercial services, in order to utilize more fully the existing capacity at Army Ammunition Plants (AAPs). The committee understands that the pilot program has resulted in some increased revenue for AAPs ($16.1 million as of March 2002). The committee believes, however, that as revenue from commercial sources rises, the need for the Army to continue a directly appropriated subsidy to AAPs for underutilized capacity should decline. Therefore, the provision also includes a requirement that, once annual revenues from the pilot program exceed $20.0 million, 0.05 percent of the AAPs' Underutilized Plant Capacity budget shall be transferred to the following fiscal year's funding for demilitarization of conventional ammunition. Finally, the provision directs the Department of Defense Inspector General to review the pilot program and report to Congress on its utility.

Army Aircraft

UH–60 Blackhawk (multiyear procurement)

The budget request included $153.4 million for 12 UH–60L Blackhawk helicopters. At planned acquisition rates, the Army will not meet its required number of 1,680 Blackhawk helicopters until fiscal year 2011. The committee recommends an increase of $96.3 million for nine additional UH–60L helicopters to be fielded in accordance with Army priorities, a total authorization of $249.7 million.

CH–47 cargo helicopter modifications

The budget request included $382.1 million for modifications to the CH–47 heavy lift helicopters. The CH–47 Chinook helicopter is the Army's only active heavy cargo helicopter and is a key element in the contingency corps. This program extends the CH–47F airframe service life, introduces an open electronic architecture, and upgrades the aircraft engines. The committee notes that the Army's fiscal year 2003 budget request for CH–47 helicopter modernization did not include funds for crew safety enhancements such as crashworthy rotating and transversing crew seats. The committee notes that there is commercially available, off-the-shelf equipment to fulfill this immediate requirement. The committee recommends an increase of $4.0 million for crash-worthy seats for CH–47 modifications, a total authorization of $386.1 million.

Aircraft survivability equipment

The budget request included no funds for aircraft survivability equipment. Without fiscal year 2003 funding, the production line

for the AN/AVR–2A, the only laser detecting set in production for the Department of Defense, will be closed. The Army has an approved operational requirement for over 3,000 laser detecting sets, but to date only 1,058 have been purchased. Failure to fund additional laser detecting sets will result in increased risk for loss of aircrew and aircraft to proliferating threat laser-aided systems. The committee therefore recommends $8.0 million for the production of AN/AVR–2A laser detecting sets.

Airborne command and control

The budget request included $27.7 million for the Army Airborne Command and Control System (A2C2S). With this funding the Army intended to accelerate this critical program to enter into low-rate initial production toward the end of fiscal year 2003. The committee now understands that development and testing requirements will prevent such an ambitious schedule. Accordingly, the Army has requested that funding be transferred from procurement to research and development to fund those activities. The committee recommends the transfer of $10.0 million from Aircraft Procurement, Army to PE 64818 and a decrease of the remaining $17.7 million to Aircraft Procurement, Army.

Avionics support equipment

The budget request included $7.5 million for the Aviator's Night Vision Imaging System (ANVIS). The ANVIS is critical to the aviators' ability to operate at night and in low-light conditions. The fiscal year 2003 budget request would procure 694 systems, only two-thirds of the quantity procured in fiscal year 2002 and less than half of the quantity planned for fiscal year 2004. The committee notes an outstanding requirement for nearly 2,500 ANVIS and believes that the safety and effectiveness of Army aviators demand a higher procurement rate. Therefore, the committee recommends an increase of $5.0 million, a total authorization of $12.5 million.

Army Missiles

Guided Multiple Launch Rocket System rocket

The budget request included $29.7 million for the procurement of 108 Guided Multiple Launch Rocket System (GMLRS) rockets. The GMLRS replaces the current Multiple Launch Rocket System (MLRS) rockets, integrating a guidance and control package and a new rocket motor to achieve greater range and precision. The committee recommends an increase of $15.0 million for additional GMLRS rockets, a total authorization of $44.7 million.

Army Ammunition

50-caliber Saboted Light Armor Penetrator

The budget request included $4.4 million to procure .50-caliber Saboted Light Armor Penetrators (SLAPs), $4.1 million for the Army and $265,000 for the Marine Corps. The committee recommends an increase of $4.3 million to procure additional .50-caliber SLAP rounds, $4.0 million to support the Army's trans-

formation plan, and $300,000 to complete the Marine Corps' full approved acquisition objective (AAO).

155mm high explosive projectiles

The budget request included $30.2 million for high explosive projectiles fired from 155mm howitzers. The committee recommends an increase of $1.0 million to purchase additional rounds to augment war reserve stocks.

Wide Area Munition

The budget request included $12.5 million for procurement of 383 Hornet munitions. In an October 2001 report, the Department of Defense Inspector General (IG) found that: (1) the Wide Area Munition (WAM) program has experienced cost increases of 330 percent and schedule slips of more than five years; (2) performance requirements have been lowered and no longer meet user needs; (3) operational effectiveness has not been demonstrated; (4) the Army did not perform tests to ensure safety before producing and deploying the WAM; and (5) requirements were built on past threat assessments that are no longer valid. The Army reviewed the program in response to the IG's report and revalidated the need for the planned WAM fielding requirement.

The committee believes that the Army has failed to exercise adequate oversight of the WAM program, especially over WAM performance requirements and demonstrated effectiveness. The committee therefore recommends a reduction of $6.0 million for the WAM.

Bunker Defeat Munition

The budget request included $7.8 million to procure the Bunker Defeat Munition (BDM), a single-shot, portable, disposable munition used against earth and timber field fortifications. The committee recommends an increase of $5.0 million to procure additional BDMs in support of contingency operations and training.

Modern demolition initiators

The budget request included $28.0 million for modern demolition initiators (MDIs). MDIs are non-electric detonators that are used to initiate munitions and explosives. MDIs provide a safer, more reliable detonation system while decreasing time on target. The committee recommends an increase of $4.0 million to procure additional MDIs.

Special equipment for ammunition depots

The budget request included $4.8 million for unique, low density equipment items specifically designed and manufactured for use in ammunition depots. This funding represents a $4.0 million decrease from fiscal year 2002 levels. The committee believes that continued support for ammunition depot operations, including specialized equipment, is important for the continuation of ammunition production and demilitarization efforts. Therefore, the committee recommends an increase of $3.0 million for Ammunition Peculiar Equipment, Army.

Conventional ammunition demilitarization

The budget request included $50.0 million for the demilitarization of ammunition. The committee is concerned about the sizeable backlog of ammunition that must be demilitarized and therefore recommends an increase of $10.0 million to Procurement of Ammunition, Army for additional demilitarization.

Other Army Procurement

Family of Heavy Tactical Vehicles

The budget request included $242.8 million for the Family of Heavy Tactical Vehicles (FHTV), of which $34.3 million was for the Movement Tracking System (MTS). The Army needs a capability to track the location of vehicles, communicate with vehicle operators, and redirect movements based on battlefield requirements. MTS provides that critical capability. The committee notes that MTS is required immediately by Army Reserve units supporting the digitized Counter-Attack Corps, but MTS for those units will not be fielded for several more years. In light of the recent mobilization of numerous Army Reserve units, the committee believes that the time line should be shortened and recommends an additional $9.0 million, a total of $43.3 million for MTS, and a total allocation of $251.8 million for FHTV.

Heavy armored sedan

The budget request for the Defense Emergency Response Fund (DERF), Counter-Terrorism and Force Protection Activity, included $10.7 million for procurement of heavy armored sedans, including Heavy Armored Vehicles (HAV) and Light Armored Vehicles (LAV). The budget request also included $581,000 for the same program, reflecting a total request of $11.3 million. The Army identified an overlap of six vehicles between the budget request and the DERF. In addition, the Army stated that 15 of the vehicles would be applied to "as yet unidentified force protection threats and vehicle replacements due to anticipated damage OCONUS." The committee, based on a systematic assessment of requirements, does not believe that the Army has justified funding these 21 additional vehicles. Once justified, the committee will consider authorizing additional funding for additional vehicles. The committee therefore recommends a decrease of $2.4 million in this activity to reflect the overlap and unjustified requirement. The committee recommends that the remaining $8.9 million be transferred to Other Procurement, Army, Line 18.

Army data distribution system (data radio)

The budget request included $74.8 million for the Enhanced Position Location Reporting System (EPLRS). EPLRS is the critical mobile data radio required to establish the Army's tactical Internet and is a key enabler for network-centric warfare. The committee recommends an increase of $10.0 million for additional EPLRS, a total authorization of $84.8 million.

Area common user modification program

The budget request included $75.9 million for modifications to the Area Common User System (ACUS) and its migration to the Army's Warfighting Information Network. This program supports the downsizing of ACUS legacy systems through the procurement and fielding of the Single Shelter Switch (SSS) and the High Mobility Digital Group Multiplexer Assemblage (HMDA) systems. The budget request funded no SSSs nor HMDAs, leaving the Army well short of its requirements for these systems. Therefore, the committee recommends an increase of $25.0 million for the procurement of additional SSS and HMDA systems, a total authorization of $100.9 million.

Night vision devices

The budget request included $60.5 million for night vision devices. Of this amount, $7.3 million is for the procurement of the AN/PVS–7 night vision device and the AN/PVS–14 monocular night vision device (MNVD). The AN/PVS–7 and the AN/PVS–14 systems enable the individual soldier to see, understand, and act first during night and low-light conditions. These systems will support Army counterterrorism and force protection efforts while continuing to provide current forces with continued nighttime dominance. The committee recommends an increase of $10.0 million for additional AN/PVS–7 and AN/PVS–14 night vision devices, a total authorization of $70.5 million.

Combat support medical

The budget request included $21.0 million for field medical equipment and Deployable Medical Systems (DEPMEDS). The committee supports the Army's initiative to modernize its combat support medical capability for combat casualty care.

The Army's $21.0 million request included $8.3 million for field medical equipment which would modernize the medical equipment components for clinical diagnostic treatment and prevention. However, the committee notes that the Army's request does not include funds for the rapid intravenous (IV) infusion pumps. The rapid IV infusion pump is a miniature, portable, lightweight pump specifically designed for life-saving intravenous fluid resuscitation by a medic in the field to restore blood pressure of victims with severe blood loss or dehydration. The committee notes that this type of device is critical to soldier battlefield survivability.

The Army's $21.0 million request for combat support medical also included $12.7 million for DEPMEDS. DEPMEDS modernizes non-medical equipment such as temper tents and shelters, environmental control units, and water distribution systems for hospital platforms. The committee notes that the Army's fiscal year 2003 budget request includes a $1.3 million request for surgical medical temper tents, a 45 percent reduction from the fiscal year 2002 level. Surgical medical temper tents offer medical personnel and surgical teams shelter to provide medical and trauma care to soldiers in forward deployed sites.

The committee recommends an increase of $5.7 million for additional rapid IV infusion pumps and $5.0 million for additional DEPMEDS, a total authorization of $31.7 million.

Training devices, non-system

The budget request included $111.7 million for the Non-System Training Devices (NSTD) program. The NSTD program introduces realistic and effective simulative training devices into the individual and unit training setting. NSTD items include the multiple integrated laser engagement system (MILES), enhanced tower simulator (ETOS), and the engagement skills trainer (EST).

The EST is a marksmanship trainer and individual and crew-served weapons simulator. It is particularly suited to the training of Army National Guard and Army Reserve soldiers with limited access to live firing ranges and is a high priority for those components.

Fort Knox has a requirement for an instrumentation system and automated after-action review capability to evaluate training proficiency in a military operations on urbanized terrain (MOUT) environment. The committee notes that the current training system requires a large number of military observer controllers (OC) to observe and evaluate training. A range instrumentation system would instead allow many of these personnel to return to their primary duties, helping to alleviate the stress on Army operating tempo. The committee, therefore, recommends $4.0 million for the engagement skills trainer and $1.4 million for Fort Knox range instrumentation, a total authorization of $117.1 million.

SUBTITLE C—NAVY PROGRAMS

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	AIRCRAFT PROCUREMENT, NAVY						
1	AV-8B (V/STOL)HARRIER (MYP)	0	5,953	0	0	0	5,953
2	F/A-18E/F (FIGHTER) HORNET (MYP)	44	3,073,233	4	240,000	48	3,313,233
3	ADVANCE PROCUREMENT (CY)	0	86,259	0	0	0	86,259
4	V-22 (MEDIUM LIFT)	11	1,045,660	0	0	11	1,045,660
5	ADVANCE PROCUREMENT (CY)	0	60,298	0	-9,200	0	51,098
	Buy advance procurement for 11 aircraft in FY 04				[-9,200]		
6	AH-1W (HELICOPTER) SEA COBRA	0	0	0	0	0	0
7	UH-1Y/AH-1Z	0	0	0	0	0	0
8	MH-60S (MYP)	15	284,155	0	0	15	284,155
9	ADVANCE PROCUREMENT (CY)	0	88,000	0	0	0	88,000
10	MH-60R	0	86,871	0	5,000	0	91,871
	Airborne low frequency sonar (ALFS) nonrecurring costs				[5,000]		
11	ADVANCE PROCUREMENT (CY)	0	29,341	0	0	0	29,341
12	E-2C (EARLY WARNING) HAWKEYE (MYP)	5	267,851	0	0	5	267,851
13	ADVANCE PROCUREMENT (CY)	0	27,600	0	0	0	27,600
14	MH-60S (MYP)	0	0	0	0	0	0
15	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
16	UC-35	0	0	0	0	0	0
17	C-40A	0	0	0	0	0	0
18	C-37	0	0	0	0	0	0
19	T-45TS (TRAINER) GOSHAWK	8	221,381	0	0	8	221,381

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
20	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
21	JPATS	0	0	6	46,000	6	46,000
	Additional aircraft				[39,000]		
	Operational flight trainers				[7,000]		
22	KC-130J	0	0	4	334,000	4	334,000
	KC-130J (Transfer from DERF)				[334,000]		
	MODIFICATION OF AIRCRAFT						
23	EA-6 SERIES	0	223,527	0	114,000	0	337,527
	Wing center sections				[40,000]		
	Band 9/10 transmitters				[37,000]		
	USQ-113 communications jammers / receivers				[37,000]		
24	AV-8 SERIES	0	32,232	0	55,000	0	87,232
	Litening II targeting pods				[55,000]		
25	F-14 SERIES	0	3,712	0	0	0	3,712
26	ADVERSARY	0	10,475	0	0	0	10,475
27	F-18 SERIES	0	421,704	0	25,000	0	446,704
	ECP-583 upgrade for USMC F/A-18A aircraft				[25,000]		
28	H-46 SERIES	0	67,193	0	0	0	67,193
29	AH-1W SERIES	0	10,211	0	0	0	10,211
30	H-53 SERIES	0	22,517	0	0	0	22,517
31	SH-60 SERIES	0	15,419	0	0	0	15,419
32	H-1 SERIES	0	1,825	0	0	0	1,825

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
33	H-3 SERIES	0	0	0	0	0	0
34	EP-3 SERIES	0	26,061	0	22,500	0	48,561
	EP-3E COMINT/ ELINT Upgrades (Transfer from DERF)				[22,500]		
35	P-3 SERIES	0	102,698	0	14,000	0	116,698
	Additional anti-surface warfare improvement program (AIP) kit				[14,000]		
36	S-3 SERIES	0	45,130	0	0	0	45,130
37	E-2 SERIES	0	17,195	0	0	0	17,195
38	TRAINER A/C SERIES	0	2,844	0	0	0	2,844
39	C-2A	0	29,819	0	0	0	29,819
40	C-130 SERIES	0	6,263	0	0	0	6,263
41	FEWSG	0	606	0	0	0	606
42	CARGO/TRANSPORT A/C SERIES	0	3,819	0	0	0	3,819
43	E-6 SERIES	0	57,099	0	0	0	57,099
44	EXECUTIVE HELICOPTERS SERIES	0	10,157	0	6,000	0	16,157
	VH-3D/VH-60D Comm Upgrade (Transfer from DERF)				[6,000]		
45	SPECIAL PROJECT AIRCRAFT	0	0	0	4,000	0	4,000
	APEX GOLD (Transfer from DERF)				[4,000]		
46	T-45 SERIES	0	28,246	0	0	0	28,246
47	POWER PLANT CHANGES	0	13,673	0	0	0	13,673
48	COMMON ECM EQUIPMENT	0	28,006	0	0	0	28,006
49	COMMON AVIONICS CHANGES	0	63,228	0	0	0	63,228
50	V-22 (TILT/ROTOR ACFT) OSPREY	0	4,961	0	0	0	4,961

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
51	SPARES AND REPAIR PARTS	0	1,116,535	0	0	0	1,116,535
52	COMMON GROUND EQUIPMENT	0	442,330	0	-15,000	0	427,330
	Fleet aircrew simulator training				[-15,000]		
53	AIRCRAFT INDUSTRIAL FACILITIES	0	18,112	0	0	0	18,112
54	WAR CONSUMABLES	0	12,079	0	0	0	12,079
55	INDUSTRIAL FACILITIES	0	25,309	0	0	0	25,309
56	SPECIAL SUPPORT EQUIPMENT	0	62,725	0	0	0	62,725
57	FIRST DESTINATION TRANSPORTATION	0	1,643	0	0	0	1,643
58	CANCELLED ACCOUNT ADJUSTMENTS	0	0	0	0	0	0
58a	Contract services savings				-8,046		-8,046
	TOTAL AIRCRAFT PROCUREMENT, NAVY		**8,203,955**		**833,254**		**9,037,209**
	WEAPONS PROCUREMENT, NAVY						
1	TRIDENT II	12	585,916	0	0	12	585,916
2	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
3	MISSILE INDUSTRIAL FACILITIES	0	1,318	0	0	0	1,318
4	TOMAHAWK	106	145,820	784	598,000	890	743,820
	Tomahawk Remanufacture (Transfer from DERF)				[598,000]		
5	ESSM	146	129,550	0	0	146	129,550
6	AMRAAM	100	50,937	0	0	100	50,937

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
7	SIDEWINDER	295	53,250	0	0	295	53,250
8	JSOW	363	139,537	0	0	363	139,537
9	SLAM-ER	120	83,781	0	0	120	83,781
10	STANDARD MISSILE	93	156,423	0	0	93	156,423
11	RAM	90	58,379	0	0	90	58,379
12	HELLFIRE	0	0	0	15,000	0	15,000
13	AERIAL TARGETS	0	70,332	0	0	0	70,332
14	DRONES AND DECOYS	0	0	0	0	0	0
15	OTHER MISSILE SUPPORT	0	12,039	0	0	0	12,039
16	SIDEWINDER MODS	0	595	0	0	0	595
17	HARM MODS	0	4,959	0	0	0	4,959
18	STANDARD MISSILES MODS	90	56,163	0	0	90	56,163
19	WEAPONS INDUSTRIAL FACILITIES	0	17,662	0	20,000	0	37,662
	Allegany Ballistics Lab facilities restoration				[20,000]		
20	FLEET SATELLITE COMM (MYP) (SPACE)	0	0	0	0	0	0
21	FLEET SATELLITE COMM FOLLOW-ON	0	0	0	0	0	0
22	ORDNANCE SUPPORT EQUIPMENT	0	5,422	0	0	0	5,422
22a	USMC Shadow Upgrades (Transfer from DERF)	0	0	0	15,000	0	15,000
23	ASW TARGETS	0	14,330	0	0	0	14,330
24	MK-46 TORPEDO MODS	0	38,783	0	0	0	38,783
25	MK-48 TORPEDO ADCAP MODS	0	62,124	0	0	0	62,124
26	QUICKSTRIKE MINE	0	2,025	0	0	0	2,025

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
27	TORPEDO SUPPORT EQUIPMENT	0	25,132	0	0	0	25,132
28	ASW RANGE SUPPORT	0	14,477	0	0	0	14,477
29	FIRST DESTINATION TRANSPORTATION	0	2,751	0	0	0	2,751
30	SMALL ARMS AND WEAPONS	0	2,856	0	7,000	0	9,856
	Coast Guard Small Arms Procurement (Transfer from DERF)				[3,000]		
	Physical Security Equipment (Transfer from DERF)				[4,000]		
31	AIRBORNE MINE NEUTRALIZATION SYSTEMS	0	1,539	0	0	0	1,539
32	CIWS MODS	0	32,226	0	5,000	0	37,226
	Additional CIWS Block IB upgrades				[5,000]		
33	GUN MOUNT MODS	0	8,351	0	15,000	0	23,351
	MK 45 gun rework for cruiser conversion program				[10,000]		
	MK 38 guns to support the Coast Guard				[5,000]		
34	CANCELLED ACCOUNT ADJUSTMENTS	0	0	0	0	0	0
35	CANCELLED ACCOUNT ADJUSTMENTS	0	0	0	0	0	0
36	CANCELLED ACCOUNT ADJ (89)	0	0	0	0	0	0
37	JUDGEMENT FUND	0	0	0	0	0	0
38	SPARES AND REPAIR PARTS	0	55,940	0	0	0	55,940
38a	Contract services savings				-1,797		-1,797
	TOTAL WEAPONS PROCUREMENT, NAVY		**1,832,617**		**673,203**		**2,505,820**

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	PROCUREMENT OF AMMO, NAVY & MARINE CORPS						
	NAVY AMMUNITION						
1	GENERAL PURPOSE BOMBS	0	243,395	0	61,300	0	304,695
	Laser Guided Bomb (LGB) kits (Transfer from DERF)				[25,000]		
	Laser Guided Bomb training kits (Transfer from DERF)				[36,300]		
2	JDAM	9,880	225,992	2,400	54,000	12,280	279,992
	JDAM Kits (Transfer from DERF)				[54,000]		
3	AIRBORNE ROCKETS, ALL TYPES	0	28,979	0	23,300	0	52,279
	2.75" Airborne Rockets (Transfer from DERF)				[23,300]		
4	MACHINE GUN AMMUNITION	0	26,375	0	4,500	0	30,875
	PGU-27/PGU-28 machine gun ammunition (Transfer from DERF)				[4,500]		
5	PRACTICE BOMBS	0	65,623	0	0	0	65,623
6	CARTRIDGES & CART ACTUATED DEVICES	0	26,355	0	0	0	26,355
7	AIRCRAFT ESCAPE ROCKETS	0	10,767	0	0	0	10,767
8	AIR EXPENDABLE COUNTERMEASURES	0	38,856	0	0	0	38,856
9	JATOS	0	4,536	0	0	0	4,536
10	5 INCH/54 GUN AMMUNITION	0	12,252	0	0	0	12,252
11	EXTENDED RANGE GUIDED MUNITIONS (ERGM)	0	4,022	0	0	0	4,022
12	76MM GUN AMMUNITION	0	8,342	0	0	0	8,342
13	OTHER SHIP GUN AMMUNITION	0	10,045	0	0	0	10,045
14	SMALL ARMS & LANDING PARTY AMMO	0	19,004	0	1,000	0	20,004
	Coast Guard Small Arms Ammunition (Transfer from DERF)				[1,000]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
15	PYROTECHNIC AND DEMOLITION	0	10,338	0	0	0	10,338
16	MINE NEUTRALIZATION DEVICES	0	2,725	0	0	0	2,725
17	AMMUNITION LESS THAN $5 MILLION	0	1,212	0	1,900	0	3,112
	MK-58 marine location markers (Transfer from DERF)				[1,900]		
18	CAWCF CLOSURE COSTS	0	0	0	0	0	0
	MARINE CORP AMMUNITION						
19	5.56 MM, ALL TYPES	0	31,600	0	0	0	31,600
20	7.62 MM, ALL TYPES	0	7,078	0	0	0	7,078
21	LINEAR CHARGES, ALL TYPES	0	40,623	0	0	0	40,623
22	.50 CALIBER	0	10,514	0	300	0	10,814
	.50 CAL SLAP				[300]		
23	40 MM, ALL TYPES	0	11,909	0	0	0	11,909
24	60MM, ALL TYPES	0	2,199	0	0	0	2,199
25	81MM, ALL TYPES	0	31,412	0	0	0	31,412
26	120MM, ALL TYPES	0	35,117	0	8,700	0	43,817
	120MM HEAT				[8,700]		
27	CTG 25MM, ALL TYPES	0	6,641	0	0	0	6,641
28	9 MM ALL TYPES	0	1,983	0	0	0	1,983
29	GRENADES, ALL TYPES	0	11,357	0	0	0	11,357
30	STINGER SLEP	0	1,577	0	0	0	1,577
31	ROCKETS, ALL TYPES	0	18,854	0	0	0	18,854

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
32	ARTILLERY, ALL TYPES	0	46,750	0	4,000	0	50,750
	155MM HE M795				[4,000]		
33	DEMOLITION MUNITIONS, ALL TYPES	0	4,089	0	0	0	4,089
34	FUZE, ALL TYPES	0	620	0	0	0	620
35	NON LETHALS	0	5,406	0	0	0	5,406
36	AMMO MODERNIZATION	0	6,990	0	0	0	6,990
37	ITEMS LESS THAN $5 MILLION	0	1,616	0	0	0	1,616
38	CAWCF CLOSURE COSTS	0	0	0	0	0	0
38a	Contract services savings				-996		-996
	TOTAL PROCUREMENT OF AMMO, NAVY & MARINE CORPS		**1,015,153**		**158,004**		**1,173,157**
	SHIPBUILDING & CONVERSION, NAVY						
1	CARRIER REPLACEMENT PROGRAM	0	0	0	0	0	0
2	ADVANCE PROCUREMENT (CY)	0	243,703	0	229,000	0	472,703
	Accelerate CVNX to original schedule				[229,000]		
3	VIRGINIA CLASS SUBMARINE	1	1,512,652	0	0	1	1,512,652
4	ADVANCE PROCUREMENT (CY)	0	706,309	0	415,000	0	1,121,309
	Additonal advance procurement to increase production rate				[415,000]		
5	SSGN CONVERSION	2	404,305	0	0	2	404,305
6	SSGN ADVANCE PROCUREMENT (CY)	0	421,000	0	0	0	421,000

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
7	CRUISER CONVERSION ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
8	CVN REFUELING OVERHAULS	0	0	0	0	0	0
9	ADVANCE PROCUREMENT (CY)	0	296,781	0	0	0	296,781
10	SUBMARINE REFUELING OVERHAULS	1	271,292	1	200,000	2	471,292
	Refuel rather than retire an SSN-688				[200,000]		
11	ADVANCE PROCUREMENT (CY)	0	88,257	0	0	0	88,257
12	DDG-51	2	2,295,502	0	0	2	2,295,502
13	ADVANCE PROCUREMENT (CY)	0	74,000	0	125,000	0	199,000
	Additional advance procurement				[125,000]		
14	LHD-1 AMPHIBIOUS ASSAULT SHIP	0	243,000	0	0	0	243,000
15	ADVANCE PROCUREMENT (CY)	0	10,000	0	-10,000	0	0
	Transfer to LHA[R] R&D -- RDN 127 (PE 64567N)				[-10,000]		
16	LPD-17	1	596,492	0	0	1	596,492
17	ADVANCE PROCUREMENT (CY)	0	8,000	0	150,000	0	158,000
	Additional advance procurement				[150,000]		
18	TAGOS SURTASS SHIPS	0	0	0	0	0	0
19	T-AKE-1	0	0	0	0	0	0
20	LCU(X)	0	6,756	0	0	0	6,756
21	OUTFITTING	0	300,608	0	0	0	300,608
22	LCAC SLEP	3	67,638	1	22,000	4	89,638
	SLEP an additional craft				[22,000]		
23	MINE HUNTER	0	0	0	0	0	0

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
24	COMPLETION OF PY SHIPBUILDING PROGRAMS	0	644,899	0	0	0	644,899
24a	Contract services savings				-8,034		-8,034
	SHIPBUILDING & CONVERSION, NAVY		**8,191,194**		**1,122,966**		**9,314,160**
	OTHER PROCUREMENT, NAVY						
	SHIPS SUPPORT EQUIPMENT						
1	LM-2500 GAS TURBINE	0	9,402	0	0	0	9,402
2	ALLISON 501K GAS TURBINE	0	13,710	0	0	0	13,710
3	SUBMARINE PROPELLERS	0	10,641	0	0	0	10,641
4	OTHER NAVIGATION EQUIPMENT	0	25,828	0	0	0	25,828
5	UNDERWAY REPLENISHMENT EQUIPMENT	0	1,460	0	0	0	1,460
6	SUB PERISCOPES & IMAGING EQUIP	0	31,401	0	0	0	31,401
7	FIREFIGHTING EQUIPMENT	0	21,534	0	0	0	21,534
8	COMMAND AND CONTROL SWITCHBOARD	0	7,377	0	0	0	7,377
9	POLLUTION CONTROL EQUIPMENT	0	67,502	0	0	0	67,502
10	SUBMARINE SUPPORT EQUIPMENT	0	18,195	0	0	0	18,195
11	SUBMARINE BATTERIES	0	13,996	0	0	0	13,996
12	STRATEGIC PLATFORM SUPPORT EQUIP	0	26,692	0	0	0	26,692
13	DSSP EQUIPMENT	0	21,215	0	0	0	21,215
14	LCAC	0	5,105	0	0	0	5,105

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
15	MINESWEEPING EQUIPMENT	0	3,865	0	0	0	3,865
16	ITEMS LESS THAN $5 MILLION	0	123,449	0	17,000	0	140,449
	Stainless steel sanitary spaces				[6,000]		
	Integrated condition assessment system (ICAS)				[11,000]		
17	SURFACE IMA	0	0	0	0	0	0
18	SUBMARINE LIFE SUPPORT SYSTEM	0	3,675	0	0	0	3,675
19	REACTOR POWER UNITS	0	336,500	0	0	0	336,500
20	REACTOR COMPONENTS	0	211,020	0	0	0	211,020
21	DIVING AND SALVAGE EQUIPMENT	0	7,726	0	0	0	7,726
22	STANDARD BOATS	0	33,832	0	0	0	33,832
23	OTHER SHIPS TRAINING EQUIPMENT	0	1,799	0	0	0	1,799
24	OPERATING FORCES IPE	0	17,134	0	0	0	17,134
25	NUCLEAR ALTERATIONS	0	128,543	0	0	0	128,543
26	DRUG INTERDICTION SUPPORT	0	0	0	0	0	0
	COMMUNICATIONS AND ELECTRONICS EQUIPMENT						
27	RADAR SUPPORT	0	0	0	0	0	0
28	AN/SQQ-89 SURF ASW COMBAT SYSTEM	0	24,247	0	0	0	24,247
29	SSN ACOUSTICS	0	251,909	0	0	0	251,909
30	UNDERSEA WARFARE SUPPORT EQUIPMENT	0	3,775	0	0	0	3,775
31	SURFACE SONAR WINDOWS AND DOME	0	0	0	0	0	0
32	SONAR SWITCHES AND TRANSDUCERS	0	16,348	0	0	0	16,348
33	SUBMARINE ACOUSTIC WARFARE SYSTEM	0	21,686	0	0	0	21,686

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
34	FIXED SURVEILLANCE SYSTEM	0	62,090	0	0	0	62,090
35	SURTASS	0	20,639	0	0	0	20,639
36	ASW OPERATIONS CENTER	0	5,109	0	0	0	5,109
37	AN/SLQ-32	0	1,856	0	0	0	1,856
38	AIEWS	0	15,808	0	-15,808	0	0
	Program cancellation				[-15,808]		
39	INFORMATION WARFARE SYSTEMS	0	5,158	0	2,000	0	7,158
	Navy Cover and Deception Program (Transfer from DERF)				[2,000]		
40	SHIPBOARD IW EXPLOIT	0	77,066	0	10,000	0	87,066
	Electronic Warfare (EW) Readiness Support (Transfer from DERF)				[10,000]		
41	SUBMARINE SUPPORT EQUIPMENT PROG	0	89,508	0	0	0	89,508
42	NAVY TACTICAL DATA SYSTEM	0	0	0	0	0	0
43	COOPERATIVE ENGAGEMENT CAPABILITY	0	66,736	0	0	0	66,736
44	GCCS-M EQUIPMENT	0	55,188	0	0	0	55,188
45	NAVAL TACTICAL COMMAND SUPPORT SYSTEM (NTCSS)	0	46,818	0	0	0	46,818
46	ATDLS	0	7,608	0	0	0	7,608
47	MINESWEEPING SYSTEM REPLACEMENT	0	1,974	0	0	0	1,974
48	SHALLOW WATER MCM	0	0	0	0	0	0
49	NAVSTAR GPS RECEIVERS (SPACE)	0	11,402	0	0	0	11,402
50	ARMED FORCES RADIO AND TV	0	4,186	0	0	0	4,186
51	STRATEGIC PLATFORM SUPPORT EQUIP	0	21,353	0	0	0	21,353
52	OTHER SPAWAR TRAINING EQUIPMENT	0	1,001	0	0	0	1,001

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
53	OTHER TRAINING EQUIPMENT	0	15,430	0	0	0	15,430
54	MATCALS	0	14,318	0	0	0	14,318
55	SHIPBOARD AIR TRAFFIC CONTROL	0	7,815	0	0	0	7,815
56	AUTOMATIC CARRIER LANDING SYSTEM	0	17,447	0	0	0	17,447
57	NATIONAL AIR SPACE SYSTEM	0	20,000	0	0	0	20,000
58	AIR STATION SUPPORT EQUIPMENT	0	7,012	0	0	0	7,012
59	MICROWAVE LANDING SYSTEM	0	0	0	0	0	0
60	FACSFAC	0	4,356	0	0	0	4,356
61	ID SYSTEMS	0	32,633	0	0	0	32,633
62	SURFACE IDENTIFICATION SYSTEMS	0	0	0	0	0	0
63	TAC A/C MISSION PLANNING SYS(TAMPS)	0	6,597	0	0	0	6,597
64	TADIX-B	0	0	0	0	0	0
65	NAVAL SPACE SURVEILLANCE SYSTEM	0	2,062	0	0	0	2,062
66	DIMHRS	0	4,675	0	0	0	4,675
67	COMMON IMAGERY GROUND SURFACE SYSTEMS	0	52,432	0	0	0	52,432
68	RADIAC	0	8,015	0	0	0	8,015
69	GPETE	0	6,700	0	0	0	6,700
70	INTEG COMBAT SYSTEM TEST FACILITY	0	4,498	0	0	0	4,498
71	EMI CONTROL INSTRUMENTATION	0	5,409	0	0	0	5,409
72	ITEMS LESS THAN $5 MILLION	0	9,037	0	0	0	9,037
73	SHIP COMMUNICATIONS AUTOMATION	0	161,235	0	0	0	161,235
74	COMMUNICATIONS ITEMS UNDER $5M	0	16,307	0	0	0	16,307

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
75	SHORE LF/VLF COMMUNICATIONS	0	5,427	0	0	0	5,427
76	SUBMARINE COMMUNICATION EQUIPMENT	0	132,874	0	0	0	132,874
77	SATELLITE COMMUNICATIONS SYSTEMS	0	149,636	0	0	0	149,636
78	JCS COMMUNICATIONS EQUIPMENT	0	4,256	0	0	0	4,256
79	ELECTRICAL POWER SYSTEMS	0	1,270	0	0	0	1,270
80	NSIPS	0	12,281	0	0	0	12,281
81	JEDMICS	0	0	0	3,000	0	3,000
	Ensure engineering & tech data matches deployed systems				[3,000]		
82	NAVAL SHORE COMMUNICATIONS	0	96,592	0	0	0	96,592
83	INFO SYSTEMS SECURITY PROGRAM (ISSP)	0	78,473	0	11,400	0	89,873
	Secure Wireless Communications Equipment (Transfer from DERF)				[3,000]		
	Computer Network Defense (Transfer from DERF)				[4,600]		
	Enclave boundaries (Transfer from DERF)				[2,000]		
	Intrusion detection system (Transfer from DERF)				[1,800]		
84	SPECIAL DCP	0	0	0	0	0	0
85	CRYPTOLOGIC COMMUNICATIONS EQUIP	0	18,659	0	1,500	0	20,159
	Cryptologic Direct Support (Transfer from DERF)				[1,500]		
86	COAST GUARD EQUIPMENT	0	39,789	0	4,000	0	43,789
	Coast Guard Support Night Vision Devices (NVDs) (Transfer from DERF)				[4,000]		
87	OTHER DRUG INTERDICTION SUPPORT	0	0	0	0	0	0
	AVIATION SUPPORT EQUIPMENT						
88	SONOBUOYS - ALL TYPES	0	63,277	0	0	0	63,277

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
89	WEAPONS RANGE SUPPORT EQUIPMENT	0	7,733	0	0	0	7,733
90	EXPEDITIONARY AIRFIELDS	0	7,540	0	0	0	7,540
91	AIRCRAFT REARMING EQUIPMENT	0	11,894	0	0	0	11,894
92	AIRCRAFT LAUNCH & RECOVERY EQUIPMENT	0	19,355	0	0	0	19,355
93	METEOROLOGICAL EQUIPMENT	0	27,085	0	0	0	27,085
94	OTHER PHOTOGRAPHIC EQUIPMENT	0	1,572	0	0	0	1,572
95	AVIATION LIFE SUPPORT	0	25,676	0	0	0	25,676
96	AIRBORNE MINE COUNTERMEASURES	0	19,499	0	0	0	19,499
97	LAMPS MK III SHIPBOARD EQUIPMENT	0	5,488	0	0	0	5,488
98	OTHER AVIATION SUPPORT EQUIPMENT	0	12,440	0	0	0	12,440
	ORDNANCE SUPPORT EQUIPMENT						
99	GUN FIRE CONTROL EQUIPMENT	0	27,108	0	10,000	0	37,108
	SPQ-9B solid state transmitter				[10,000]		
100	NAVAL FIRES CONTROL SYSTEM	0	5,690	0	0	0	5,690
101	NATO SEASPARROW	0	41,408	0	0	0	41,408
102	RAM GMLS	0	23,893	0	0	0	23,893
103	SHIP SELF DEFENSE SYSTEM	0	47,226	0	0	0	47,226
104	AEGIS SUPPORT EQUIPMENT	0	155,654	0	7,000	0	162,654
	Food service technology				[2,000]		
	Integrated bridge system				[5,000]		
105	SURFACE TOMAHAWK SUPPORT EQUIPMENT	0	53,614	0	0	0	53,614
106	SUBMARINE TOMAHAWK SUPPORT EQUIP	0	5,262	0	0	0	5,262

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
107	VERTICAL LAUNCH SYSTEMS	0	6,483	0	0	0	6,483
108	STRATEGIC PLATFORM SUPPORT EQUIP	0	0	0	0	0	0
109	STRATEGIC MISSILE SYSTEMS EQUIP	0	75,006	0	0	0	75,006
110	SSN COMBAT CONTROL SYSTEMS	0	46,319	0	10,000	0	56,319
	Accelerate older system replacement				[10,000]		
111	SUBMARINE ASW SUPPORT EQUIPMENT	0	7,538	0	0	0	7,538
112	SURFACE ASW SUPPORT EQUIPMENT	0	3,460	0	0	0	3,460
113	ASW RANGE SUPPORT EQUIPMENT	0	7,350	0	0	0	7,350
114	EXPLOSIVE ORDNANCE DISPOSAL EQUIP	0	7,806	0	0	0	7,806
115	ITEMS LESS THAN $5 MILLION	0	3,770	0	0	0	3,770
116	ANTI-SHIP MISSILE DECOY SYSTEM	0	27,976	0	10,800	0	38,776
	Additional NULKA decoys				[10,800]		
117	SURFACE TRAINING DEVICE MODS	0	6,557	0	0	0	6,557
118	SUBMARINE TRAINING DEVICE MODS	0	17,264	0	5,000	0	22,264
	Equipment for deployed training				[5,000]		
	CIVIL ENGINEERING SUPPORT EQUIPMENT						
119	ARMORED SEDANS	0	481	0	0	0	481
120	PASSENGER CARRYING VEHICLES	0	2,538	0	0	0	2,538
121	GENERAL PURPOSE TRUCKS	0	1,972	0	0	0	1,972
122	CONSTRUCTION & MAINTENANCE EQUIP	0	9,113	0	0	0	9,113
123	FIRE FIGHTING EQUIPMENT	0	6,284	0	0	0	6,284
124	TACTICAL VEHICLES	0	42,238	0	0	0	42,238

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
125	AMPHIBIOUS EQUIPMENT	0	47,193	0	0	0	47,193
126	DRUG INTERDICTION (BA 5)	0	0	0	0	0	0
127	POLLUTION CONTROL EQUIPMENT	0	20,734	0	0	0	20,734
128	ITEMS UNDER $5 MILLION	0	14,963	0	0	0	14,963
	SUPPLY SUPPORT EQUIPMENT						
129	MATERIALS HANDLING EQUIPMENT	0	9,504	0	0	0	9,504
130	OTHER SUPPLY SUPPORT EQUIPMENT	0	10,959	0	0	0	10,959
131	FIRST DESTINATION TRANSPORTATION	0	5,053	0	0	0	5,053
132	SPECIAL PURPOSE SUPPLY SYSTEMS	0	141,431	0	13,964	0	155,395
	Special Purpose Supply Equip. (Transfer from DERF)				[13,064]		
	Special Purpose Supply Equip. (Transfer from DERF)				[900]		
	PERSONNEL AND COMMAND SUPPORT EQUIPMENT						
133	TRAINING SUPPORT EQUIPMENT	0	707	0	0	0	707
134	COMMAND SUPPORT EQUIPMENT	0	34,770	0	0	0	34,770
135	EDUCATION SUPPORT EQUIPMENT	0	7,095	0	0	0	7,095
136	MEDICAL SUPPORT EQUIPMENT	0	9,145	0	0	0	9,145
137	INTELLIGENCE SUPPORT EQUIPMENT	0	26,564	0	10,000	0	36,564
	Intelligence Support Equipment (Transfer from DERF)				[4,000]		
	Tactical Interoperability and Information Support Systems (Transfer from DERF)				[6,000]		
138	OPERATING FORCES SUPPORT EQUIPMENT	0	16,505	0	0	0	16,505
139	MOBILE SENSOR PLATFORM	0	5,946	0	0	0	5,946
140	ENVIRONMENTAL SUPPORT EQUIPMENT	0	19,978	0	0	0	19,978

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
141	PHYSICAL SECURITY EQUIPMENT	0	81,721	0	94,483	0	176,204
	Physical Security Eq. for the Mobile Security Force (Transfer from DERF)				[14,000]		
	Physical Security Equipment for Strategic Bases (Transfer from DERF)				[4,000]		
	Physical Security Equipment (Transfer from DERF)				[76,483]		
142	JUDGEMENT FUND REIMBURSEMENT	0	0	0	0	0	0
143	CANCELLED ACCOUNT ADJUSTMENTS	0	0	0	0	0	0
144	CANCELLED ACCOUNT ADJUSTMENT (87)	0	0	0	0	0	0
145	CANCELLED ACCOUNT ADJUSTMENT (88)	0	0	0	0	0	0
	SPARES AND REPAIR PARTS						
146	SPARES AND REPAIR PARTS	0	172,886	0	0	0	172,886
146a	Financial management savings				-20,600	0	-20,600
146b	Contract services savings				-4,263	0	-4,263
	OTHER PROCUREMENT, NAVY		**4,347,024**		**169,476**		**4,516,500**
	PROCUREMENT, MARINE CORPS						
1	AAV7A1 PIP	85	62,991	0	0	85	62,991
2	AAAV	1	14,718	0	0	1	14,718
3	LAV PIP	0	53,166	0	0	0	53,166
4	IMPROVED RECOVERY VEHICLE (IRV)	0	4,179	0	0	0	4,179
5	MODIFICATION KITS (TRKD VEH)	0	3,297	0	0	0	3,297

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
6	HIMARS	2	7,869	0	0	2	7,869
7	155MM LIGHTWEIGHT TOWED HOWITZER	34	62,643	0	0	34	62,643
8	MOD KITS (ARTILLERY)	0	4,890	0	0	0	4,890
9	MARINE ENHANCEMENT PROGRAM	0	8,145	0	0	0	8,145
10	WEAPONS AND COMBAT VEHICLES UNDER $5 MILLION	0	312	0	0	0	312
11	MODULAR WEAPON SYSTEM	0	24,352	0	0	0	24,352
12	OPERATIONS OTHER THAN WAR	0	1,531	0	0	0	1,531
13	EADS MOD	0	184	0	0	0	184
14	JAVELIN	0	1,049	0	0	0	1,049
15	PEDESTAL MOUNTED STINGER (PMS) (MYP)	0	1,565	0	0	0	1,565
16	ITEMS UNDER $5 MILLION	0	0	0	0	0	0
17	PREDATOR (SRAW)	445	36,484	0	0	445	36,484
18	MODIFICATION KITS	0	7,967	0	0	0	7,967
19	AUTO TEST EQUIP SYS	0	894	0	8,000	0	8,894
	Third echelon test sets				[8,000]		
20	GENERAL PURPOSE ELECTRONIC TEST EQUIP.	0	8,324	0	0	0	8,324
21	INTELLIGENCE SUPPORT EQUIPMENT	0	18,526	0	19,600	0	38,126
	TPC (Transfer from DERF)			11	[3,300]		
	TEG (Transfer from DERF)			27	[9,000]		
	TROJAN Lite (Transfer from DERF)			10	[5,700]		
	TACPHOTO (Transfer from DERF)			1,000	[1,600]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
22	MOD KITS (INTEL)	0	2,570	0	8,800	0	11,370
	TPCS (Transfer from DERF)			3	[8,300]		
	TCAC (Transfer from DERF)			7	[500]		
23	ITEMS UNDER $5 MILLION (INTELL)	0	1,843	0	2,400	0	4,243
	I-SURSS (Transfer from DERF)			20	[2,400]		
24	GENERAL PURPOSE MECHANICAL TMDE	0	4,565	0	0	0	4,565
25	NIGHT VISION EQUIPMENT	0	23,204	0	0	0	23,204
26	ITEMS UNDER $5 MILLION (COMM & ELEC)	0	16,097	0	2,500	0	18,597
	Secure Wireless (Transfer from DERF)				[800]		
	ISR (Transfer from DERF)				[1,700]		
27	COMMON COMPUTER RESOURCES	0	38,974	0	0	0	38,974
28	COMMAND POST SYSTEMS	0	33,512	0	0	0	33,512
29	RADIO SYSTEMS	0	25,528	0	5,000	0	30,528
	Lightweight multi-band satellite terminals				[5,000]		
30	COMM SWITCHING & CONTROL SYSTEMS	0	3,974	0	0	0	3,974
31	COMM & ELEC INFRASTRUCTURE SUPPORT	0	16,426	0	4,600	0	21,026
	Continuity of Intelligence (Transfer from DERF)				[2,000]		
	Computer Network Defense (Transfer from DERF)				[1,900]		
	Deployed Security Interdiction Devices (Transfer from DERF)				[700]		
32	MOD KITS MAGTF C41	0	31,470	0	3,000	0	34,470
	FLAMES/CESAS (Transfer from DERF)				[3,000]		
33	AIR OPERATIONS C2 SYSTEMS	0	6,525	0	0	0	6,525

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
34	INTELLIGENCE C2 SYSTEMS	0	22,362	0	0	0	22,362
35	FIRE SUPPORT SYSTEM	0	34,855	0	0	0	34,855
36	COMMERCIAL PASSENGER VEHICLES	28	861	0	0	28	861
37	COMMERCIAL CARGO VEHICLES	0	13,123	0	0	0	13,123
38	5/4T TRUCK HMMWV (MYP)	1,667	118,414	0	0	1,667	118,414
39	MEDIUM TACTICAL VEHICLE REPLACEMENT	1,405	347,578	0	0	1,405	347,578
40	ITEMS LESS THAN $5 MILLION	0	3,534	0	0	0	3,534
41	ENVIRONMENTAL CONTROL EQUIP ASSORT	0	2,709	0	0	0	2,709
42	BULK LIQUID EQUIPMENT	0	10,261	0	0	0	10,261
43	TACTICAL FUEL SYSTEMS	0	2,048	0	0	0	2,048
44	DEMOLITION SUPPORT SYSTEMS	0	0	0	0	0	0
45	POWER EQUIPMENT ASSORTED	0	8,898	0	0	0	8,898
46	COMMAND SUPPORT EQUIPMENT	0	0	0	0	0	0
47	AMPHIBIOUS RAID EQUIPMENT	0	22,295	0	0	0	22,295
48	PHYSICAL SECURITY EQUIPMENT	0	8,804	0	3,600	0	12,404
	Physical Security Upgrades (Transfer from DERF)				[3,600]		
49	GARRISON MOBILE ENGR EQUIP	0	2,608	0	0	0	2,608
50	MATERIAL HANDLING EQUIP	0	52,503	0	0	0	52,503
51	FIRST DESTINATION TRANSPORTATION	0	8,221	0	0	0	8,221
52	FIELD MEDICAL EQUIPMENT	0	10,452	0	0	0	10,452
53	TRAINING DEVICES	0	18,651	0	0	0	18,651
54	CONTAINER FAMILY	0	7,120	0	0	0	7,120

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
55	FAMILY OF CONSTRUCTION EQUIPMENT	0	14,709	0	0	0	14,709
56	RAPID DEPLOYABLE KITCHEN	0	21,505	0	0	0	21,505
57	MODIFICATION KITS	0	0	0	0	0	0
58	ITEMS LESS THAN $5 MILLION	0	5,772	0	0	0	5,772
59	SPARES AND REPAIR PARTS	0	23,326	0	0	0	23,326
59a	Financial management savings				-3,400	0	-3,400
59b	Contract services savings				-1,264	0	-1,264
	TOTAL PROCUREMENT, MARINE CORPS		**1,288,383**		**52,836**		**1,341,219**

Navy Aircraft

F/A–18E/F aircraft

The budget request included $3.2 billion to buy 44 F/A–18E/F aircraft under a multiyear procurement program.

The Navy structured the multiyear contract to permit variations in quantity within a specified quantity range. Last year the Navy bought 48 aircraft. Two years ago, the Navy had planned to buy 48 aircraft in fiscal year 2003.

The Navy wants to buy F/A–18E/F aircraft at higher rates than are supported in this budget in order to allow the retirement of F–14 fighters and S–3 aircraft that are being used primarily as tanker aircraft earlier than under current production plans. In fact, despite significant shortfalls in the fiscal year 2003 budget request in the ship recapitalization area, the Chief of Naval Operations (CNO) has recommended applying any additional resources to the F/A–18E/F program before building more ships.

The committee agrees with the CNO that recapitalizing aviation is a high priority. Further, the committee believes that greater efficiency can be maintained if the Navy were to continue buying F/A–18E/F aircraft at level rates until the Navy's inventory requirements are met. Therefore, the committee recommends an additional $240.0 million to buy four more F/A–18E/F aircraft, for a total production of 48 aircraft in fiscal year 2003.

V–22 Osprey aircraft advance procurement

The budget request included $60.3 million in advance procurement for 13 V–22 Osprey aircraft in fiscal year 2004. Section 123 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107–107) restricts the procurement of V–22 Osprey aircraft to the minimum sustaining rate of 11 aircraft until the Secretary of Defense certifies to Congress that the Department of Defense has completed specific operational testing successfully. According to information provided to the committee, the Department will conduct an operational assessment in fiscal year 2003 but will not begin the operational evaluation until late fiscal year 2004, continuing into fiscal year 2005.

Since procurement of no more than 11 V–22 aircraft in fiscal year 2004 would be consistent with staying at the minimum sustaining rate until that testing is complete, the committee recommends a decrease of $9.2 million in advance procurement, a total authorization of $51.1 million.

Airborne low frequency sonar

The budget request included $86.9 million to pay for various nonrecurring charges and production support items for the MH–60R helicopter program. The budget does not include any such funding for the AN/AQS–22 airborne low frequency sonar (ALFS), a dipping sonar system that will be part of the MH–60R helicopter's equipment. The Navy competitively selected ALFS to outfit the MH–60R fleet.

The Navy intends to use the MH–60R to replace two helicopters: (1) the SH–60R, which currently fills needs for antisubmarine warfare capability on cruisers, destroyers and frigates; and (2) SH–

60F, which performs similar functions and provides other administrative support to aircraft carriers.

The Navy plans to begin production of the MH–60R helicopter in fiscal year 2004. There is a requirement for non-recurring funds in fiscal year 2003 to redesign circuit card assemblies to eliminate obsolete parts, upgrade power amplifiers, and qualify a second source for the ALFS cable. Such efforts could lead to significant reductions in total life cycle costs. Therefore, the committee recommends an increase of $5.0 million to pay for non-recurring activities to support ALFS production in fiscal year 2004.

Navy joint primary aircraft training system

The budget request included no funding for continued Navy procurement of the joint primary aircraft training system (JPATS) to support Navy training requirements. The budget also included no funding for JPATS trainers to allow the Navy to take fuller advantage of JPATS aircraft already bought.

The Navy had planned to buy JPATS aircraft throughout the Future Years Defense Program (FYDP). Last year, the Navy decided that its existing trainer, the T–34C, has sufficient service life remaining to allow the Navy to delay any additional JPATS procurement until later in the FYDP, specifically fiscal year 2007.

The Navy has been a partner in this joint program with the Air Force, although the Air Force began buying the aircraft five years before the Navy. The committee remains concerned that the Navy is willing to take such a course of action in a joint program, where its actions obviously force the Air Force to absorb greater costs than the Air Force had originally planned.

The Navy provided a report to Congress explaining the decision to interrupt JPATS production. The report indicated that: (1) they had not changed their position on the remaining useful life on the T–34C trainers; (2) the Navy would use JPATS trainers already bought to provide training services for the naval flight officer pipeline; and (3) the Navy still did not need to buy any more JPATS aircraft until later in the FYDP. Nevertheless, the Chief of Naval Operations (CNO) submitted a list of priority items that should be budgeted if additional funds were made available. The CNO's list ranked additional funding of JPATS trainer procurement as number seven on a list of 101 items. The CNO indicated that JPATS purchases now would "enable earlier transition out of aging T–34 aircraft."

The committee continues to believe that the improved aircrew survivability offered by the ejection seat-equipped JPATS aircraft is an important factor warranting continued purchases of the trainer by the Navy. The T–34C aircraft that would otherwise be used for training are aging and will be an increasing burden on operating and support costs for the Navy. The committee, therefore, recommends an increase of $39.0 million to buy six JPATS aircraft for the Navy. Continued purchases by the Navy would mean fielding a more efficient and safer primary aircraft training system. The committee also recommends an additional $7.0 million to buy operational flight trainers to support training operations using JPATS already procured, for a total authorization of $46.0 million.

EA–6B aircraft modifications

The budget request included $137.6 million for modifications to the EA–6B aircraft, including $60.3 million for buying and installing new wing center sections for 15 aircraft. The budget request did not include any funding to buy additional ALQ–99 band 9/10 transmitters or USQ–113 communications receivers/jammers. The EA–6B aircraft is one of the Department's principal high demand/low density (HD/LD) assets. This designation translates into a need to take special measures to ensure that the systems achieve higher readiness rates to increase their availability and reduce demands on already stressed maintenance support personnel.

The Navy has identified, through recent fatigue life inspection of EA–6B aircraft, the need to buy and install additional wing center section replacements. Until these modifications are completed, 51 of the fleet of 124 aircraft will be subject to restricted flight operations. The Navy has indicated that, with additional funds, they could modify and return an additional four aircraft to full operational flying envelope. Therefore, the committee recommends an additional $40.0 million to buy and install new EA–6B wing center sections.

The Navy would use additional ALQ–99 band 9/10 transmitters to replace older band 9 transmitters. The ALQ–99 Band 9/10 transmitter uses digital electronics while the older band 9 transmitters employ analog technology that is much less reliable. The newer band 9/10 transmitters would also extend the frequency coverage available compared to the band 9 transmitters. The Navy needs the expanded frequency ranges and capabilities of the ALQ–99 band 9/10 transmitters to counter the electronic protection techniques used in a wide variety of threat systems.

The Navy informs the committee that an additional $37.0 million would allow them to finish buying all of the ALQ–99 band 9/10 transmitters they need before the contractor closes the production line. Therefore, the committee recommends an increase of $37.0 million to buy ALQ–99 Band 9/10 transmitters.

The EA–6B aircraft use the USQ–113 communications receivers/jammers to monitor and jam communications in the very high frequency (VHF) and ultra high frequency (UHF) portions of the radio frequency spectrum. These systems allow the EA–6B to deny an enemy critical command and control capability and reduce an adversary's ability to maintain situational awareness. With additional funds, the Navy could buy additional USQ–113 V(3) versions of the system to outfit more of the fleet of aircraft and improve equipment maintainability and operational capability. Therefore, the committee recommends an increase of $37.0 million to buy additional USQ–113 V(3) communications receivers/jammers.

In total, the committee recommends an additional authorization of $114.0 million for the EA–6B program, recognizing that this HD/LD aircraft deserves special attention in keeping the fleet healthy while the Department decides how it intends to recapitalize this airborne electronic aircraft fleet.

In the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106–65), Congress provided an increase of $5.0 million to initiate a joint service (Navy/Air Force) analysis of alternatives to examine a replacement for the aging EA–6B aircraft. The com-

mittee is aware that the services will shortly present their preferred alternatives to the Under Secretary of Defense for Acquisition, Technology, and Logistics. The committee encourages the Department to move forward with a preferred alternative or alternatives to ensure that the vital capabilities that the EA–6B fleet currently provides will continue to be available to future combatant commanders.

AV–8B precision targeting pod

The budget request included $32.2 million for modifications to the AV–8B aircraft but included no funding for Litening II precision targeting pods. The Marine Corps began acquisition of these pods to provide the AV–8B with the ability to use precision-guided weapons. Although no funds were included in the budget request, the Marine Corps has identified buying additional Litening II pods as a high priority item to continue outfitting Marine Corps AV–8B squadrons with this capability. The committee recommends an increase of $55.0 million for the procurement of Litening II targeting pods, a total authorization for AV–8B aircraft modifications of $87.2 million.

F/A–18 aircraft modifications

The budget request included $421.7 million for modifications to the F/A–18 aircraft and $11.7 million for the engineering change proposal 583 (ECP–583) for the Marine Corps' F/A–18A aircraft. These funds were identified primarily for installation of kits procured in previous years.

ECP–583 is an upgrade package that consists of new avionics hardware allowing the older F/A–18A to process and utilize updated versions of F/A–18C/D software and accessories. This change gives these older aircraft capabilities comparable to Lot 17 F/A–18C aircraft, particularly the ability to perform precision strike missions.

Since the Marine Corps' F/A–18A aircraft are slated to remain in the inventory until replaced by the Joint Strike Fighter (JSF), the committee believes that the Marine Corps should upgrade more of the F/A–18A inventory with improved capability. Therefore, the committee recommends an increase of $25.0 million for the procurement of additional ECP–583 to continue the Marine Corps' F/A–18A aircraft modernization.

P–3 aircraft modifications

The budget request included $102.7 million for modifications to the P–3 aircraft, which included $72.4 million for the procurement of four anti-surface warfare improvement program (AIP) kits. The AIP modification has greatly expanded the capabilities of the P–3 aircraft, giving it particular capability to operate against surface targets in coastal regions. These upgrades include better ability to provide standoff surveillance and targeting. The AIP makes these aircraft very attractive to fleet and battle group commanders to supplement the capabilities offered by other high demand, low density (HD/LD) forces. The committee recommends an increase of $14.0 million for the procurement of one additional AIP kit for the P–3 aircraft.

Fleet aircrew simulator training

The budget request included $442.3 million in Navy aircraft common ground equipment, including $79.5 million for the fleet aircrew simulator trainer (FAST). These funds would be used to buy four high-fidelity, networked F/A–18C tactical flight trainers, to include: mission brief/debrief stations; instructor-operator stations; and commercial, off-the-shelf (COTS) software to enable sharing of common distributed databases. Since much of the tactically relevant training is done in two-ship formations, it would appear prudent to buy fewer stations and see whether the potential training payoff is realized before expanding the capability to simulate four-ship formations. The committee understands that, because there may be maintenance and other single station down times, buying a two-station suite could have limitations. Therefore, the committee recommends a decrease of $15.0 million in common ground equipment to buy a three-station FAST system. If this capability were to prove beneficial in operation, the committee would entertain a request to buy additional stations.

Navy Weapons

Hellfire missiles

The budget request included no funding for the procurement of AGM–114 Hellfire missiles. The Department of the Navy uses Hellfire missiles as a primary attack weapon for both the Marine Corps AH–1W attack helicopter and the Navy MH–60 helicopter. The committee understands that the fiscal year 2002 Hellfire inventory is only 54 percent of the inventory objective. Although no funds were included in the budget request, the Navy and Marine Corps have identified buying additional Hellfire missiles as a high priority item to mitigate against further erosion in the inventory level from training expenditures and from retirements due to shelf life expirations. The committee recommends an increase of $15.0 million for the procurement of AGM–114 Hellfire missiles.

Weapons industrial facilities

The budget request included $17.7 million for various activities at government-owned, contractor-operated weapons industrial facilities. The committee recommends an increase of $20.0 million to accelerate the facilities restoration program at the Allegany Ballistics Laboratory.

Close-in Weapons System modifications

The budget request included $32.2 million for modifications to the Close-in Weapons System (CIWS) for surface ship self-defense. The basic CIWS is an effective weapon for defense against antiship cruise missiles. An upgrade, called the "Block 1B" modification, enhances these capabilities, improves the reliability of the system, and expands the target set to include other threats, such as that posed by small boats. Because of the importance of providing these capabilities to the fleet, the committee recommends an increase of $5.0 million for procurement and installation of Block 1B modifications in CIWS mounts.

Gun mount modifications

The budget request included $8.4 million in gun mount modifications, including: (1) $3.7 million for the procurement and installation of modifications to surface ship five-inch, 54-caliber gun mounts; and (2) $2.0 million for procurement and installation of safety and reliability improvements for minor caliber guns including the 25-millimeter, MK–38 gun. The budget request included no funds for the procurement of additional 25-millimeter, MK–38 guns.

The five-inch gun provides the only gunfire support from the sea for the Marine Corps and comprises a part of the layered, ship self-defense system. The five-inch gun mount modification program provides gun safety updates, shock-hardens the gun and mount for future munitions, modifies five-inch, 54-caliber guns to 62-caliber, and develops a rotatable pool of gun mounts for the cruiser conversion and ship overhaul programs.

Additional funding for five-inch gun mount modifications would help prevent a break in production for procurement of modification kits for the cruiser conversion program and allow continuation of other ordnance alterations. The committee recommends an increase of $10.0 million for the five-inch gun mount modifications program.

The 25-millimeter, MK–38 gun is mounted on Navy and Coast Guard vessels to provide a gun capability against small boats. The Navy has identified a requirement for procurement of additional guns for the vessels providing port security for homeland defense. Therefore, the committee recommends an increase of $5.0 million for procurement and installation of 25-millimeter, MK–38 guns on Navy and Coast vessels, a total authorization for gun mount modifications of $23.4 million.

Navy and Marine Corps Ammunition

120mm High Explosive Anti-Tank cartridges

The budget request includes $23.2 million for the 120mm High Explosive Anti-Tank (HEAT) anti-tank and air defense multi-purpose round. The committee recommends an increase of $8.7 million for the Marine Corps to procure additional cartridges to meet war reserve shortfalls.

155mm High Explosive M795

The budget request included $23.7 million for purchases of the 155mm High Explosive (HE) M795 projectile for the Marine Corps, an extended range projectile to augment and ultimately replace current, shorter range cargo projectiles. The committee recommends an increase of $4.0 million to procure additional 155mm HE M795 projectiles.

Navy Shipbuilding and Conversion

Future aircraft carrier procurement

The budget request included $243.7 million for advance procurement of CVNX–1, the next generation nuclear powered aircraft carrier. The fiscal year 2001 budget request and the fiscal year 2002 amended budget request projected asking for full funding for this

ship in fiscal year 2006. This plan was based on an acquisition strategy that included using advance construction activities before fiscal year 2006. Congress approved the Navy's advance construction plan for CVNX–1 in the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001.

The Navy's fiscal year 2003 budget request would result in a significant cost increase and at least a one-year delay in the delivery of CVNX–1 compared to previous plans.

After submitting the 2003 budget request, the Navy provided the committee with information that indicated that restoring fiscal year 2003 funding would enable the Navy to begin the work necessary to support the Navy's previous plan. The additional Navy information identifies a Future Years Defense Program (FYDP) funding profile which would result in savings of over $200.0 million for the total cost of the ship.

The committee believes that the Navy should take reasonable actions to save funds in the shipbuilding account. Additionally, restoring the delivery schedule of CVNX–1 would underscore the importance of the aircraft carrier. Aircraft carriers have, once again, demonstrated their vital importance to U.S. national security during Operation Enduring Freedom in Afghanistan. During the early days of that operation, up to three carriers were engaged and the operational commander in chief used one of these carriers as a platform for launching Special Operations missions into Afghanistan. The aircraft carriers responded quickly to the operational commander's requirements and conducted continuous joint combat operations as directed by the operational commander in chief. Therefore, the committee recommends an increase of $229.0 million to begin restoring the original delivery schedule for CVNX–1 at a total ship cost less than that presumed in the FYDP.

Submarine refueling overhauls

The budget request included $271.3 million for refueling a single Los Angeles-class attack submarine.

The 1999 "Attack Submarine Study" conducted by the Joint Chiefs of Staff concluded that the Navy needed to have a minimum of 68 attack submarines in fiscal year 2015 to meet requirements defined by the regional commanders in chief and the national intelligence community. The Navy is building new attack submarines at a rate of only one per year in the Future Years Defense Program (FYDP) and will need to accelerate that rate to meet requirements for the better capability that will be afforded by the new *Virginia*-class submarines.

In the near-term, the only action the Navy could take to sustain submarine force levels would be to refuel, rather than retire, *Los Angeles*-class attack submarines that have many years of useful service life remaining. The Navy has indicated that there is an additional *Los Angeles*-class attack submarine that is due for refueling in fiscal year 2003. The yards capable of conducting such a refueling will be unable to accept additional work in fiscal year 2004. Absent obtaining additional funding for fueling in fiscal year 2003, the Navy would be forced to scrap this boat. Therefore, the committee recommends an increase of $200.0 million to refuel an addi-

tional attack submarine in fiscal year 2003 and extend its useful life in the fleet.

Large deck amphibious ship replacement

The budget request included $10.0 million for advance procurement plans for LHD–9, a ship to replace an aging LHA–1 *Tarawa*-class amphibious assault ship. The budget documentation indicated that the Navy would seek authorization for LHD–9 in fiscal year 2008.

LHD–8, already under construction, is scheduled to replace one of the retiring *Tarawa*-class ships. The committee received testimony that the Navy will complete, in the next few months, an analysis of alternatives to determine the specifications for ships to replace the remaining four *Tarawa*-class ships that will reach 35 years of ship life between 2011 and 2015. The Navy's study activities are included in a program called the "LHA Replacement" or LHA(R) program.

The Navy identified a need for additional research and development funds to continue LHA(R) operational requirements and preliminary concept design activities. Therefore, the committee recommends a decrease of $10.0 million in LHD–1 advance procurement and an increase of $10.0 million in PE 64567N to continue LHA(R) operational requirements development and preliminary concept design activities.

Landing craft air cushion service life extension program

The budget request included $67.6 million for inducting three landing craft air cushion (LCAC) vehicles into a service life extension program (SLEP). This SLEP effort is designed to increase the life of the LCACs by 20 years and provide them with increased capability. This capability expansion includes enhanced command, control and navigation capabilities and increased operational range and lift capacity.

The Marine Corps has indicated that accelerating this program would be a high priority if additional funds were to be made available. Therefore, the committee recommends an increase of $22.0 million to induct another LCAC into the SLEP in fiscal year 2003.

Other Navy Procurement

Ship integrated condition assessment system

The budget request included no funds for procurement of integrated condition assessment systems (ICAS) for surface ships. ICAS remotely monitors the operating parameters of machinery throughout a ship, analyzes the collected data, and alerts operators to potential performance problems. ICAS has the potential to: (1) reduce the hours required to measure, analyze and report machinery operations; (2) reduce total operating costs; and (3) improve operational availability. ICAS has been installed in a number of surface ships and is performing well. The committee recommends an increase of $11.0 million for procurement and installation of ICAS in surface ships.

Stainless steel sanitary spaces

The budget request included $123.4 million for procurement and installation of various items of ship support equipment costing less than $5.0 million. The budget did not include funding specifically for providing stainless steel sanitary spaces for backfitting on existing Navy ships. The use of stainless steel sanitary spaces could result in lower life cycle costs and improved quality of life for sailors. Therefore, the committee recommends an increase of $6.0 million to accelerate the procurement and installation of the stainless steel sanitary spaces on Navy ships.

Electronic warfare program change

The budget request included $168.8 million for development, procurement and installation of the advanced integrated electronic warfare system (AIEWS). Of that amount, $25.9 million was included in PE 64757N for research and development; $15.8 million was included in Other Procurement, Navy (OPN) to buy and install one AIEWS in an active duty ship; and $127.2 million was included in Shipbuilding and Conversion, Navy (SCN) to buy and install eight AIEWSs in new construction ships.

The Navy recently terminated the AIEWS effort and announced a restructuring of surface ship electronic warfare programs. The Navy has decided to focus on upgrading the SLQ–32 systems presently installed in Navy ships rather than developing and procuring a new system. As part of that restructuring, the Navy has asked to transfer:

(1) $25.9 million within PE 64757N from AIEWS development to development of SLQ–32 system improvements as part of the shipboard electronic warfare system improvement program; and

(2) $1.6 million of the OPN funding to PE 64757N for the shipboard electronic warfare system improvement program.

The Navy has indicated that the remaining OPN funding is excess to current requirements. The Navy has taken no position on what should happen with the SCN funding.

An electronic countermeasures suite is vital to the layered defenses of surface combatants. Therefore, the committee directs the Secretary of the Navy to ensure that, for any new construction ships previously scheduled to receive the AIEWS, the Navy outfits those ships with a suitable replacement system of at least equal capability to that installed in other ships of the same ship class. Therefore, the committee authorizes: (1) an increase of $1.6 million in PE 64757N; (2) the requested realignment of $25.9 million within that program element from AIEWS to electronic warfare system improvement; and (3) a decrease of $15.8 million in OPN. In addition, the committee authorizes the Secretary of the Navy to apply the SCN funds to buy and install electronic warfare equipment as directed above.

Joint engineering data management information and control system

The budget request included no funding for the joint engineering data management information and control system (JEDMICS) program. JEDMICS is the joint Department of Defense (DOD) system

for permanently storing, managing and controlling digital engineering drawings and associated technical data. JEDMICS replaced labor-intensive, inefficient manual and semi-automated engineering drawing repositories with automated central repositories for all engineering and manufacturing information for DOD weapons systems.

The committee is concerned that, without additional funding, the Navy may not be able to ensure that engineering and technical data for weapons systems in JEDMICS are aligned with the exact configuration of weapons systems and their spare parts being used in the fleet. Therefore, the committee recommends an increase of $3.0 million to continue verification of the JEDMICS databases.

SPQ–9B radar

The budget request included $27.1 million in gunfire control equipment, including $14.4 million for procurement of SPQ–9B radars. The SPQ–9B provides surface ships with a gunfire control radar that also enhances ship self-defense capabilities. Developing and fielding a solid state transmitter has the potential to reduce life cycle costs and improve performance of this radar. Therefore, the committee recommends an increase of $10.0 million to design, build, test and integrate a solid state transmitter into the SPQ–9B radar.

Improving efficiency on ships through food service technology

The budget request included $9.8 million for procurement and installation of smart ship-type systems for AEGIS system ships. The aim of these systems is to improve the quality of service for personnel serving aboard ship.

The Navy has successfully tested a program to provide an advanced food service technology system aboard two non-combatant ships. The Navy is now testing the system on an AEGIS cruiser. The committee believes that the system has the potential to significantly reduce the time required for food service and reduce demands on personnel to support ship food service operations. Therefore, the committee recommends an increase of $2.0 million for procurement and installation of the advanced food service technology system.

Integrated bridge to improve ship situational awareness

The budget request included $14.8 million for procurement and installation of eight integrated bridge system upgrades for AEGIS system ships. The integrated bridge system, by automating navigation and ship control functions, improves situational awareness and provides continuous updates to displays which previously required manual updates. The committee recommends an increase of $5.0 million to accelerate the procurement and installation of the integrated bridge system.

Submarine combat control system

The budget request included $46.3 million for procurement and installation of various items of equipment to modernize submarine combat control systems. Upgrading submarines to a common com-

bat control system configuration should help improve fleet operational readiness and reduce life cycle costs. Such upgrades could also lead to improved war fighting capability. For example, replacing older weapons' launch control systems with newer equipment would help eliminate single points of failure for self-defense. The committee recommends an increase of $10.0 million to accelerate the procurement and installation of submarine combat control systems upgrades.

NULKA anti-ship missile decoy system

The budget request included $28.0 million for anti-ship missile decoy systems, including $12.3 million for procuring 40 new NULKA decoys. Procuring additional NULKA decoys would ensure that fleet installations remain on a reasonable schedule, would keep production rates above the minimum sustaining level, and would achieve more reasonable unit production costs. The committee recommends an increase of $10.8 million for the NULKA procurement program to purchase additional decoys.

Submarine training device modifications

The budget request included $17.3 million to procure submarine training device modifications. The Navy has critical training requirements to support submarines in the fleet and is beginning to use performance support systems that would enhance training quality opportunities. The committee understands that the Navy is using such systems to support operator training and diagnostics for submarine Tomahawk launch systems. The committee believes that the Navy could use these systems more extensively to provide on-the-job operation, maintenance and troubleshooting support normally provided by journeymen and advanced schoolhouse training. Therefore, the committee recommends an increase of $5.0 million to expand the use of performance support systems in conducting submarine training.

Marine Corps Procurement

Auto test equipment systems

The budget request included $0.9 million for the third echelon test system (TETS). TETS is a portable, automated tester that provides diagnostic testing and fault isolation capability for communications, electronic, and ground weapons systems, such as the tube-launched, optically-tracked, wire-guided missile (TOW); Light Armored Vehicle (LAV); and the target location designation and hand-off system. The committee understands that the Marine Corps has recently increased the requirement for TETS to support high-powered lasers and track/motorized vehicle platforms. However, the Marine Corps has not requested funding to buy the test equipment to meet this requirement. Therefore, the committee recommends an increase of $8.0 million for additional TETS to meet these new requirements.

Lightweight multi-band satellite terminals

The budget request included $1.0 million to continue purchasing lightweight multi-band satellite terminals for Marine Corps com-

munications battalions to support all combat echelons. Having these terminals would allow the communications battalions to provide reliable communications to highly mobile combat elements in addition to reducing operations and support costs. The committee recommends an increase of $5.0 million for buying additional lightweight multi-band satellite terminals.

SUBTITLE D—AIR FORCE PROGRAMS

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	AIRCRAFT PROCUREMENT, AIR FORCE						
1	F-22 RAPTOR	23	4,090,434	0	0	23	4,090,434
2	ADVANCE PROCUREMENT (CY)	0	530,634	0	0	0	530,634
3	F-15A	0	0	0	0	0	0
4	F-16A (MYP)	0	0	0	0	0	0
5	C-17A (MYP)	12	2,694,140	0	11,300	12	2,705,440
	Aircraft engine trainer (AET)				[9,200]		
	Software enhancements for existing trainers				[2,100]		
6	ADVANCE PROCUREMENT (CY)	0	391,890	0	0	0	391,890
7	C-17 ICS	0	612,452	0	-59,700	0	552,752
	Reduce unjustified growth in flexible sustainment				[-59,700]		
8	EC-130J	0	0	1	110,000	1	110,000
9	C-130H	0	18,672	0	0	0	18,672
10	C-130J	0	175,923	0	0	0	175,923
11	JPATS	35	211,848	0	0	35	211,848
12	V-22 OSPREY	0	90,904	0	0	0	90,904
13	ADVANCE PROCUREMENT (CY)	0	10,100	0	-10,100	0	0
	CV-22 - FY 04 procurement would exceed minimum sustaining rate				[-10,100]		
14	C-32B FEST/DEST AIRCRAFT	0	0	0	0	0	0
15	CIVIL AIR PATROL A/C	27	2,616	0	0	27	2,616
16	OPERATIONAL SUPPORT AIRCRAFT	0	0	0	0	0	0
17	TARGET DRONES	0	30,586	0	0	0	30,586

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
18	C-40 ANG	0	0	0	0	0	0
19	E-8C	1	279,268	0	0	1	279,268
20	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
21	HAEUAV	2	63,861	1	65,000	3	128,861
	Global Hawk UAV (Transfer from DERF)				[65,000]		
22	ADVANCE PROCUREMENT (CY)	0	41,000	0	0	0	41,000
23	PREDATOR UAV	7	23,068	15	90,000	22	113,068
	Predator A (Transfer from DERF)				[68,000]		
	Pred SatCom Equip & Ground Control Station Equip (Transfer from DERF)				[14,000]		
	3rd Squadron Initial Spares (Transfer from DERF)				[8,000]		
	MODIFICATION OF INSERVICE AIRCRAFT						
24	B-2A	0	72,123	0	25,200	0	97,323
	Transfer from PE 64240F (RDAF 69) -- UHF SatCom				[25,200]		
25	B-1B	0	98,026	0	0	0	98,026
26	B-52	0	0	0	20,000	0	20,000
	ALQ-172 electronic countermeasures improvement (ECMI)				[20,000]		
27	F-117	0	21,079	0	0	0	21,079
28	A-10	0		0	0	0	21,775
29	F-15	0	232,500	0	0	0	232,500
30	F-16	0	265,007	0	60,000	0	325,007
	F100-PW-229 engines				[60,000]		
31	F22 RAPTOR	0	11,200	0	0	0	11,200

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
32	T/AT-37	0	81	0	0	0	81
33	C-5	0	86,008	0	-26,600	0	59,408
	Avionics modernization program - Transfer to RDAF 204 (PE 4119F)				[-26,600]		
34	C-9	0	1,346	0	0	0	1,346
35	C-17A	0	128,178	0	0	0	128,178
36	C-21	0	2,562	0	0	0	2,562
37	C-32A	0	26,684	0	0	0	26,684
38	C-37A	0	373	0	0	0	373
39	C-141	0	796	0	0	0	796
40	T-38	0	168,112	0	0	0	168,112
41	T-41 AIRCRAFT	0	90	0	0	0	90
42	T-43	0	2,183	0	0	0	2,183
43	KC-10A (ATCA)	0	14,176	0	0	0	14,176
44	C-12	0	400	0	12,000	0	12,400
	Classified - General Info Tech (Transfer from DERF)				[12,000]		
45	C-18	0	800	0	0	0	800
46	C-20 MODS	0	828	0	0	0	828
47	VC-25A MOD	0	12,171	0	68,000	0	80,171
	Passenger Data System (Transfer from DERF)				[68,000]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
48	C-130	0	138,533	0	38,000	0	176,533
	Traffic alert / collision avoidance system (TCAS)				[15,000]		
	T56 quick engine change (QEC) kits				[13,000]		
	Composite propeller system test				[10,000]		
49	C-135	0	108,670	0	95,500	0	204,170
	KC-135 boom operator weapons system trainer				[6,500]		
	Air Refueling (Transfer from DERF)				[89,000]		
50	DARP	0	150,123	0	6,000	0	156,123
	Rivet Joint QRC Sustainment (Transfer from DERF)				[1,000]		
	U-2 Airframe Repairs (Transfer from DERF)				[5,000]		
51	E-3	0	29,478	0	0	0	29,478
52	E-4	0	39,139	0	0	0	39,139
53	E-8	0	19,307	0	0	0	19,307
54	H-1	0	473	0	0	0	473
55	H-60	0	40,640	0	0	0	40,640
56	OTHER AIRCRAFT	0	54,653	0	0	0	54,653
57	PREDATOR MODS	0	10,532	0	0	0	10,532
58	CLASSIFIED PROJECTS	0	18,546	0	0	0	18,546
	SPARES AND REPAIR PARTS						
59	SPARES AND REPAIR PARTS	0	275,982	0	0	0	275,982
60	COMMON SUPPORT EQUIPMENT	0	180,943	0	0	0	180,943
61	A-10	0	0	0	0	0	0

Title I - Procurement
(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
62	B-1	0	1,969	0	0	0	1,969
63	B-2A	0	3,279	0	0	0	3,279
64	B-2A	0	33,484	0	0	0	33,484
65	C-130	0	10,922	0	0	0	10,922
66	E-4	0	0	0	0	0	0
67	F-15 POST PRODUCTION SUPPORT	0	7,512	0	0	0	7,512
68	F-16 POST PRODUCTION SUPPORT	0	14,200	0	0	0	14,200
69	INDUSTRIAL PREPAREDNESS	0	22,248	0	0	0	22,248
70	WAR CONSUMABLES	0	38,429	0	0	0	38,429
71	MISC PRODUCTION CHARGES	0	349,516	0	31,600	0	381,116
	Upgrade Litening targeting pods				[20,000]		
	Upgrade theater airborne reconnaissance systems (TARS) pods				[11,600]		
72	COMMON ECM EQUIPMENT	0	1,182	0	0	0	1,182
73	CANCELLED ACCOUNT PY ADJUSTMENTS	0	0	0	0	0	0
74	DARP	0	83,751	0	10,000	0	93,751
	U-2 Defensive System (Transfer from DERF)				[10,000]		
	TOTAL AIRCRAFT PROCUREMENT, AIR FORCE		**12,045,630**		**546,200**		**12,613,605**

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	PROCUREMENT OF AMMUNITION, AIR FORCE						
1	ROCKETS	0	40,909	0	0	0	40,909
2	CARTRIDGES	0	154,620	0	0	0	154,620
3	PRACTICE BOMBS	0	71,935	0	0	0	71,935
4	GENERAL PURPOSE BOMBS	0	108,589	0	25,000	0	133,589
	General Purpose Bombs (Transfer from DERF)				[25,000]		
5	CAWCF CLOSURE COSTS	0	0	0	0	0	0
6	SENSOR FUZED WEAPON	298	105,985	0	10,000	298	115,985
7	JOINT DIRECT ATTACK MUNITION	17,917	378,863	5,212	106,000	23,129	484,863
	JDAM Tail Kits (Transfer from DERF)				[106,000]		
8	WIND CORRECTED MUNITIONS DISP	4,959	71,165	0	0	4,959	71,165
9	CAD/PAD	0	19,816	0	0	0	19,816
10	EXPLOSIVE ORDINANCE DISPOSAL	0	2,727	0	0	0	2,727
11	SPARES AND REPAIR PARTS	0	3,008	0	0	0	3,008
12	MODIFICATIONS LESS THAN $5M	0	202	0	0	0	202
13	ITEMS LESS THAN $5,000,000	0	2,013	0	0	0	2,013
14	FLARES	0	131,967	0	1,000	0	132,967
	MJU-52B IR				[1,000]		
15	FUZES	0	37,705	0	0	0	37,705
16	SMALL ARMS	0	4,360	0	0	0	4,360
	TOTAL PROCUREMENT OF AMMUNITION, AIR FORCE		**1,133,864**		**142,000**		**1,275,864**

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	MISSILE PROCUREMENT, AIR FORCE						
1	MISSILE REPLACEMENT EQ-BALLIS	0	48,685	0	0	0	48,685
2	ADVANCED CRUISE MISSILE	0	0	0	0	0	0
3	JASSM	100	54,240	0	0	100	54,240
4	JOINT STANDOFF WEAPON	113	55,740	0	0	113	55,740
5	SIDEWINDER (AIM-9X)	286	56,964	0	0	286	56,964
6	AGM-130 POWERED GBU-15	0	0	0	0	0	0
7	AMRAAM	161	89,593	0	0	161	89,593
7a	Hellfire	0	0	200	10,000	200	10,000
	Missiles for Predator (Transfer from DERF)				[10,000]		
8	INDUSTRIAL FACILITIES	0	2,105	0	0	0	2,105
9	MISSILE REPLACEMENT EQ-OTHER	0	0	0	0	0	0
	MODIFICATION OF INSERVICE MISSILES						
10	ADVANCED CRUISE MISSILE	0	3,376	0	0	0	3,376
11	SIDEWINDER (AIM-9X)	0	0	0	0	0	0
12	MM III MODIFICATIONS	0	580,701	0	23,200	0	603,901
	Guidance replacement program (GRP)				[5,200]		
	Propulsion replacement program (PRP)				[5,200]		
	Containers				[12,800]		
13	AGM-65D MAVERICK	0	333	0	0	0	333

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
14	AIR LAUNCH CRUISE MISSILE	0	1,998	0	0	0	1,998
15	PEACEKEEPER (M-X)	0	0	0	0	0	0
16	MODIFICATIONS UNDER $5.0M	0	0	0	0	0	0
17	MISSILE SPARES & REPAIR PARTS	0	48,412	0	0	0	48,412
18	ADVANCED EHF ADVANCE PROCUREMENT (CY)	0	94,523	0	-94,500	0	23
	Slip in critical design review				[-94,500]		
19	WIDEBAND GAPFILLER SATELLITES	1	189,666	0	0	1	189,666
20	ADVANCE PROCUREMENT (CY)	0	0	0	0	0	0
21	SPACEBORNE EQUIP (COMSEC)	0	9,368	0	0	0	9,368
22	GLOBAL POSITIONING (SPACE)	0	206,470	0	0	0	206,470
23	ADVANCE PROCUREMENT (CY)	0	3,000	0	0	0	3,000
24	NUDET DETECTION SYSTEM	0	0	0	0	0	0
25	DEF METEOROLOGICAL SAT PROG(SPACE)	0	60,051	0	0	0	60,051
26	DEFENSE SUPPORT PROGRAM(SPACE)	0	114,382	0	2,100	0	116,482
	New display units for mobile DSP ground terminals				[2,100]		
27	DEFENSE SATELLITE COMM SYSTEM	0	20,669	0	0	0	20,669
28	TITAN SPACE BOOSTERS(SPACE)	0	335,303	0	-20,000	0	315,303
	Program execution delays				[-20,000]		
29	EVOLVED EXPENDABLE LAUNCH VEHICLE	1	158,867	0	14,500	1	173,367
	Mission assurance for wideband gapfiller satellite (WGS) program				[14,500]		
30	MEDIUM LAUNCH VEHICLE(SPACE)	0	48,208	0	0	0	48,208
31	DEFENSE SPACE RECONN PROGRAM	0	384,000	0	0	0	384,000

Title I - Procurement
(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
32	SPECIAL PROGRAMS	0	879,516	0	-252,300	0	627,216
33	SPECIAL UPDATE PROGRAMS	0	128,992	0	0	0	128,992
	TOTAL MISSILE PROCUREMENT, AIR FORCE		**3,575,162**		**-317,000**		**3,258,162**
	OTHER PROCUREMENT, AIR FORCE						
	VEHICULAR EQUIPMENT						
1	SEDAN, 4 DR 4X2	35	552	0	0	35	552
2	STATION WAGON, 4X2	28	476	0	0	28	476
3	BUSES	120	7,982	0	0	120	7,982
4	AMBULANCES	10	755	0	0	10	755
5	LAW ENFORCEMENT VEHICLE	70	1,910	0	0	70	1,910
6	ARMORED VEHICLE	2	465	0	0	2	465
7	TRUCK, CARGO-UTILITY, 3/4T, 4X4	0	9,681	0	0	0	9,681
8	TRUCK, CARGO-UTILITY, 3/4T, 4X2	0	5,162	0	0	0	5,162
9	TRUCK MAINT/UTILITY/DELIVERY	0	10,475	0	0	0	10,475
10	FAMILY MEDIUM TACTICAL VEHICLES	0	0	0	0	0	0
11	HIGH MOBILITY VEHICLE (MYP)	0	11,881	0	0	0	11,881
12	CAP VEHICLES	0	792	0	0	0	792
13	ITEMS LESS THAN $5,000,000	0	39,616	0	0	0	39,616
14	HMMWV, ARMORED	0	1,019	0	0	0	1,019

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
15	HMWWV, UP-ARMORED	0	3,629	0	0	0	3,629
16	TRACTOR, A/C TOW, MB-2	0	2,726	0	0	0	2,726
17	TRACTOR, A/C TOW, MB-4	0	6,143	0	0	0	6,143
18	TRACTOR, TOW, FLIGHTLINE	0	7,928	0	0	0	7,928
19	TRUCK HYDRANT FUEL	0	7,941	0	0	0	7,941
20	ITEMS LESS THAN $5,000,000	0	24,755	0	0	0	24,755
21	TRUCK CRASH P-19	0	0	0	0	0	0
22	ITEMS LESS THAN $5,000,000	0	10,023	0	0	0	10,023
23	TRUCK, F/L 10,000 LB	0	14,572	0	0	0	14,572
24	TUNNER LOADER	38	84,329	0	0	38	84,329
25	HALVERSEN LOADER	86	49,554	0	0	86	49,554
26	ITEMS LESS THAN $5,000,000	0	10,922	0	0	0	10,922
27	TRUCK, DUMP	0	0	0	0	0	0
28	RUNWAY SNOW REMOV AND CLEANIN	0	15,466	0	0	0	15,466
29	MODIFICATIONS	0	5,000	0	0	0	5,000
30	ITEMS LESS THAN $5,000,000	0	24,369	0	0	0	24,369
31	CANCELLED ACCOUNT ADJUSTMENTS	0	0	0	0	0	0
	ELECTRONICS AND TELECOMMUNICATION EQUIPMENT						
32	COMSEC EQUIPMENT	0	26,331	0	6,800	0	33,131
	Wireless Communications (Transfer from DERF)				[3,000]		
	Enclove and Network Tools (Transfer from DERF)				[2,000]		
	Intrusion Detection Systems (Transfer from DERF)				[1,800]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
33	MODIFICATIONS (COMSEC)	0	460	0	0	0	460
34	INTELLIGENCE TRAINING EQUIP	0	1,310	0	0	0	1,310
35	INTELLIGENCE COMM EQUIP	0	9,043	0	3,300	0	12,343
	Tactical Terminal (Transfer from DERF)				[3,300]		
36	AIR TRAFFIC CTRL/LAND SYS (AT	0	52,038	0	0	0	52,038
37	NATIONAL AIRSPACE SYSTEM	0	55,561	0	0	0	55,561
38	THEATER AIR CONTROL SYS IMPRO	0	16,713	0	0	0	16,713
39	WEATHER OBSERVE/FORECAST	0	29,071	0	0	0	29,071
40	STRATEGIC COMMAND AND CONTROL	0	23,889	0	0	0	23,889
41	CHEYENNE MOUNTAIN COMPLEX	0	17,588	0	0	0	17,588
42	TAC SIGINT SUPPORT	0	406	0	10,000	0	10,406
	Tactical Information Program (Transfer from DERF)				[10,000]		
43	DRUG INTERDICTION PROGRAM	0	0	0	0	0	0
44	GENERAL INFORMATION TECHNOLOGY	0	55,789	0	189,984	0	245,773
	Integrated Broadcast Service (Transfer from DERF)				[10,800]		
	Classified - General Info Tech (Transfer from DERF)				[176,584]		
	Commercial Imagery - General Info Tech (Transfer from DERF)				[2,600]		
45	AF GLOBAL COMMAND & CONTROL S	0	28,182	0	0	0	28,182
46	MOBILITY COMMAND AND CONTROL	0	9,735	0	0	0	9,735
47	AIR FORCE PHYSICAL SECURITY SYSTEMS	0	41,835	0	46,800	0	88,635
	AT/FP Equipment Enhance/Modernize (Transfer from DERF)				[7,200]		
	Base Physical Security Systems (Transfer from DERF)				[39,600]		

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
48	COMBAT TRAINING RANGES	0	17,242	0	0	0	17,242
49	MINIMUM ESSENTIAL EMERGENCY C	0	1,072	0	0	0	1,072
50	C3 COUNTERMEASURES	0	13,409	0	4,000	0	17,409
	Information Warfare Support (Transfer from DERF)				[2,000]		
	Computer Network Defense (Transfer from DERF)				[2,000]		
51	BASE LEVEL DATA AUTO PROGRAM	0	12,793	0	0	0	12,793
52	THEATER BATTLE MGT C2 SYS	0	56,202	0	0	0	56,202
53	BASE INFORMATION INFRASTRUCTURE	0	214,727	0	0	0	214,727
54	USCENTCOM	0	9,839	0	0	0	9,839
55	DEFENSE MESSAGE SYSTEM (DMS)	0	18,967	0	0	0	18,967
56	NAVSTAR GPS SPACE	0	13,110	0	0	0	13,110
57	NUDET DETECTION SYS (NDS) SPA	0	7,937	0	0	0	7,937
58	AF SATELLITE CONTROL NETWORK	0	45,063	0	0	0	45,063
59	SPACELIFT RANGE SYSTEM SPACE	0	108,281	0	9,500	0	117,781
	Recapitalization, including planning & scheduling systems and spares				[9,500]		
60	MILSATCOM SPACE	0	45,698	0	0	0	45,698
61	SPACE MODS SPACE	0	10,938	0	0	0	10,938
62	TACTICAL C-E EQUIPMENT	0	134,427	0	0	0	134,427
63	COMBAT SURVIVOR EVADER LOCATE	0	11,049	0	0	0	11,049
64	RADIO EQUIPMENT	0	8,801	0	0	0	8,801
65	TV EQUIPMENT (AFRTV)	0	2,620	0	0	0	2,620
66	CCTV/AUDIOVISUAL EQUIPMENT	0	3,259	0	0	0	3,259

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
67	BASE COMM INFRASTRUCTURE	0	202,900	0	0	0	202,900
68	CAP COM & ELECT	0	0	0	0	0	0
69	ITEMS LESS THAN $5,000,000	0	9,278	0	0	0	9,278
70	COMM ELECT MODS	0	68,894	0	0	0	68,894
	OTHER BASE MAINTENANCE AND SUPPORT EQUIP						
71	BASE/ALC CALIBRATION PACKAGE	0	13,809	0	0	0	13,809
72	PRIMARY STANDARDS LABORATORY	0	1,107	0	0	0	1,107
73	ITEMS LESS THAN $5,000,000	0	8,059	0	0	0	8,059
74	NIGHT VISION GOGGLES	0	3,814	0	8,100	0	11,914
	Panoramic night vision goggles				[8,100]		
75	ITEMS LESS THAN $5,000,000	0	9,312	0	0	0	9,312
76	MECHANIZED MATERIAL HANDLING	0	25,612	0	0	0	25,612
77	ITEMS LESS THAN $5,000,000	0	12,256	0	0	0	12,256
78	FLOODLIGHTS	0	11,023	0	0	0	11,023
79	ITEMS LESS THAN $5,000,000	0	6,201	0	0	0	6,201
80	BASE PROCURED EQUIPMENT	0	11,321	0	0	0	11,321
81	MEDICAL/DENTAL EQUIPMENT	0	13,992	0	0	0	13,992
82	ENVIRONMENTAL PROJECTS	0	817	0	0	0	817
83	AIR BASE OPERABILITY	0	5,700	0	0	0	5,700
84	PHOTOGRAPHIC EQUIPMENT	0	5,893	0	0	0	5,893
85	PRODUCTIVITY ENHANCING CAPITA	0	7,806	0	0	0	7,806
86	MOBILITY EQUIPMENT	0	102,990	0	0	0	102,990

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
87	AIR CONDITIONERS	0	9,593	0	0	0	9,593
88	ITEMS LESS THAN $5,000,000	0	16,131	0	0	0	16,131
89	INTELLIGENCE PRODUCTION ACTIVE	0	47,160	0	0	0	47,160
90	TECH SURV COUNTERMEASURES EQ	0	4,057	0	0	0	4,057
91	DARP RC135	0	13,123	0	0	0	13,123
92	DARP, MRIGS	0	115,777	0	0	0	115,777
93	SELECTED ACTIVITIES	0	8,098,917	0	-330,590	0	7,768,327
94	SPECIAL UPDATE PROGRAM	0	178,876	0	0	0	178,876
95	DEFENSE SPACE RECONNAISSANCE Activities (SPACE) (Transfer from DERF)	0	6,694	0	18,600 [18,600]	0	25,294
96	INDUSTRIAL PREPAREDNESS	0	0	0	0	0	0
97	MODIFICATIONS	0	201	0	0	0	201
98	FIRST DESTINATION TRANSPORT	0	9,767	0	0	0	9,767
	SPARES AND REPAIR PARTS						
99	SPARES AND REPAIR PARTS	0	41,358	0	0	0	41,358
99a	Financial management savings				-12,000	0	-12,000
99b	Contract services savings				-2,100	0	-2,100
	TOTAL OTHER PROCUREMENT, AIR FORCE		**10,523,946**		**-47,606**		**10,476,340**

C–130J aircraft program (sec. 131)

The committee recommends a provision that would authorize the Secretary of the Air Force to enter into a multiyear contract to purchase C–130J aircraft and variants of the C–130J, subject to the C–130J completing the process to achieve certification for worldwide over-water capability.

The Air Force has indicated that the recently announced overall airlift roadmap assumes approval of the Air Force's request to approve multiyear procurement authority for the C–130J. Such purchases would include purchases for the Marine Corps. The Air Force has estimated that buying 64 C–130Js (40 for the Air Force and 24 for the Marine Corps) under a multiyear contract would save more than $650 million.

The committee recognizes that the Air Force will not complete final C–130J operational test and evaluation until early in fiscal year 2004. The Air Force, however, is buying the C–130J as a commercial item. The aircraft has already achieved FAA certification. In addition, the delay in operational testing has been caused primarily by added requirements for defensive systems that were not part of the original program.

The C–130J has been performing well in interim operational assessments, and operational squadrons are already flying the aircraft successfully. Therefore, the committee believes that the possibility of achieving the promised savings outweighs any risk remaining in the testing program once over-water capability clearance is achieved.

Pathfinder programs (sec. 132)

The Air Force has designated a number of "pathfinder" pilot programs for spiral development and acquisition reform. Among those identified as pathfinders are large significant programs such as the Global Positioning System, the Space-based Radar and the Global Hawk Unmanned Aerial Vehicle. The committee encourages the Air Force to continually look for new ways to reduce the time that it takes to acquire weapons systems. However, the committee believes that certain minimum standards for oversight should apply to these programs.

Therefore, the committee recommends a provision that would require the Secretary of the Air Force to determine by February 1, 2003, which pathfinder programs the Air Force intends to conduct as spiral development programs. The committee directs the Secretary to submit a spiral development plan to the Secretary of Defense for each of the selected programs in accordance with the requirements of section 803. For the pathfinder programs that are not selected and approved for spiral development, the committee provision would require the Director of Operational Test and Evaluation, the Joint Requirements Oversight Council, the Under Secretary of Defense (Comptroller) and Under Secretary of Defense for Acquisition, Technology, and Logistics to assess the pathfinder program acquisition plans and report the results of these assessments to the committee no later than May 15, 2003.

Oversight of acquisition for defense space programs (sec. 133)

The committee recommends a provision that would direct the Office of the Secretary of Defense (OSD) to maintain oversight of space program acquisition and require the Secretary of Defense to submit to Congress by March 15, 2003 a detailed plan on how oversight by OSD and the Joint Staff will be accomplished. The Defense Department's space acquisition programs are among the most important programs in the Department because they are critical to maintaining and improving the surveillance, communications and situational awareness needed to support U.S. military forces.

Currently, however, a number of defense space programs are experiencing significant problems with cost growth and schedule slippage, and at least some of the problems appear to be connected with the oversight and management of the programs. For example, in December 2001 the Space-based Infrared System-High (SBIRS-High) program sustained a Nunn-McCurdy cost breach when the unit cost estimate for the program increased by more than 70 percent, indicating more than $2.0 billion in cost growth. The program has also experienced an 18- to 24-month schedule slip. An independent review team established by the Air Force found significant problems with the oversight and management of the SBIRS-High program, including less-than-optimal systems engineering and requirements development processes. The Advanced Extremely High Frequency (AEHF) program has also been experiencing delays and cost overruns.

In February 2002, the Under Secretary of Defense for Acquisition, Technology and Logistics delegated oversight authority over all major defense space programs to the Under Secretary of the Air Force. In testimony to the Strategic Subcommittee on March 20, 2002, the Under Secretary stated his intent to significantly alter most of the existing processes by which the OSD oversees space programs, including the Integrated Product Team and Defense Acquisition Executive Summary processes. The committee believes that the Office of the Secretary of Defense should maintain a strong oversight role for space programs because of their military importance and their inherently joint nature.

Leasing of tanker aircraft (sec. 134)

The Air Force has stated that it has a requirement for additional tanker aircraft but has not budgeted funds for the acquisition of such aircraft until fiscal year 2008. Section 8159 of the Department of Defense Appropriations Act for Fiscal Year 2002 gave the Secretary of the Air Force discretion to enter into leases for up to 100 Boeing 767 aircraft for use as tanker aircraft but provided no funds for that purpose.

Section 8159 required the Secretary to submit a report to the congressional defense committees outlining any plans for implementing the provision at least 30 days before entering into any lease arrangement under this authority. The Secretary indicated on February 12, 2002, that he would not take any action without first coming to both the authorization committees and the appropriations committees to have money authorized and appropriated.

The committee recommends a provision that would require the Secretary of the Air Force to submit the report required by section 8159 and obtain authorization and appropriation of funds necessary to enter a lease for such aircraft, in accordance with his publicly stated commitments to the Congress, before entering such a lease.

The committee reserves judgement on any particular lease of tanker aircraft, on the source of funding for such a lease, and on other specific issues regarding the lease until the Secretary decides whether to recommend a lease, submits the report required by section 8159, and seeks authorization and appropriation of funds necessary to enter the proposed lease in accordance with the requirements of this provision.

Air Force Aircraft

C–17 aircraft trainers

The budget request included $2.7 billion for buying C–17 aircraft and various support equipment. The budget, however, included no funding for maintenance training devices to support additional operating locations for the C–17 aircraft. To maintain core task proficiency, a minimum of three maintenance training devices is required:

(1) an aircraft maintenance systems trainer (AMST);

(2) a trainer evaluation performance aircraft training set (TEPATS); and

(3) an aircraft engine trainer (AET).

An AMST and TEPATS have been funded in recent years, but an AET is required to complete the set of maintenance training devices. The Air Force also needs to make software enhancements to the AMST and TEPATS devices. The committee recommends an increase of $11.3 million for C–17 aircraft modifications including $9.2 million for the procurement of an AET training device and $2.1 million for software enhancements.

C–17 aircraft interim contractor support

The budget request included $612.5 million for interim contractor support (ICS) for the C–17 aircraft. The C–17 flexible sustainment program provides ICS for the airframe, including material management for unique spares, a wartime surge capability, and a process to incorporate aircraft modifications rapidly into the program. With additional aircraft being delivered each year, the required funding for this support is increasing. The amount authorized and appropriated for fiscal year 2002 was approximately $71 million greater than that for fiscal year 2001. In fiscal year 2003, however, the budget request is for an increased amount that represents a growth of almost twice the fiscal year 2002 increase. Therefore, the committee recommends a decrease of $59.7 million to sustain the previously established growth in C–17 ICS, a total authorization of $552.8 million.

EC–130J aircraft program

The budget request included no funds to purchase EC–130J aircraft to support modernization of the Commando Solo aircraft

squadron whose mission is to engage in psychological operations activities. The Commando Solo aircraft is designed to jam local radio and television station broadcasts and inject programming from our psychological operations forces. Using the Commando Solo, our forces disseminate our message to the local population and prevent them from hearing only the word of an adversary. In testimony before the Subcommittee on Emerging Threats and Capabilities, the Commander in Chief, Special Operations Command, singled out this unit's contribution in Operation Enduring Freedom.

An Air National Guard unit operates the Commando Solo aircraft for the Special Operations Command. This unit has six EC–130 Commando Solo aircraft. The currently funded program includes providing the unit with three EC–130J Commando Solo aircraft, leaving the unit to operate a mix of three EC–130J and three EC–130E aircraft for at least six years.

While any such unit getting new equipment faces some overlap period, the longer the transition period stretches out, the greater the demand on training ground support personnel, pilots, operators and maintenance personnel. This situation is particularly difficult for the unit operating Commando Solo aircraft, because the aircraft have been heavily tasked and fit the definition of a "high demand/low density," or HD/LD unit.

The current Future Years Defense Program (FYDP) would provide newer EC–130J aircraft to replace the three remaining older EC–130E aircraft at a rate of one per year, starting in fiscal year 2006. Adding an EC–130J this year would permit the Air Force and SOCOM to accelerate this replacement by at least a year. This initiative fits with the committee's efforts to help alleviate the pressure on HD/LD units. Therefore, the committee recommends an increase of $110.0 million in Aircraft Procurement, Air Force to buy one C–130J aircraft and convert it to the EC–130J Commando Solo configuration.

CV–22 Osprey aircraft advance procurement

The budget request included $10.1 million in advance procurement for two CV–22 Osprey aircraft in fiscal year 2004. Section 123 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107–107) restricts the procurement of V–22 Osprey aircraft to the minimum sustaining rate of 11 aircraft until the Secretary of Defense certifies to Congress that the Department of Defense has completed specific operational testing successfully. According to information provided to the committee, the Department will conduct an operational assessment in fiscal year 2003 but will not begin the operational evaluation until late in fiscal year 2004, continuing into fiscal year 2005.

Procuring more than 11 V–22 aircraft in fiscal year 2004 would be inconsistent with staying at the minimum sustaining rate until that testing is complete. The committee recommends advance procurement in Aircraft Procurement, Navy, to support buying 11 MV–22 aircraft in fiscal year 2004. Therefore, the committee recommends a decrease of $10.1 million, leaving no advance procurement funding for CV–22 aircraft.

B–2 Spirit bomber

The budget request included $72.1 million in funding for Aircraft Procurement, Air Force, line 24 for the B–2 bomber. The research and development request for the B–2 bomber inadvertently included $25.2 million that should have been included in the procurement account to buy Airborne Integrated Terminals (AIT) for UHF satellite communications. The committee recommends a $25.2 million decrease in B–2 research and development in PE 64240F and a corresponding increase in procurement for the B–2 in PE 11127F, a total authorization of $97.3 million.

B–52 bomber

The budget request for fiscal year 2003 contained no funding for procurement for the B–52 bomber. The committee recommends $20.0 million for PE 11113 for the B–52 for the Electronic Countermeasures Improvement (ECMI) program to continue the upgrades for the current ALQ–172 electronic countermeasures system. The ECMI provides better situational awareness, ground and in-flight reprogramming capability, and improved reliability and maintainability over the current system. The Air Force has not included funding for any of the ECMI kits in fiscal year 2003. Without funding for 2003, the production line would have to shut down for one year, which would result in increased per unit costs and would delay the ECMI by two years. The B–52 bomber, although the oldest bomber in the Air Force, once again demonstrated its value through its performance in Afghanistan. Only by a continued commitment to modernization and upgrade programs can the B–52 be relied upon for the next 35 years as planned.

F–16 aircraft modifications

The budget request included $265.0 million for modifications to the F–16 aircraft, but it included no funding for continuing a program to replace engines of block 42 F–16 aircraft with the F100–PW–229 engine. This re-engining program would enable Air National Guard units flying the block 42 F–16 aircraft to have comparable speed, thrust, and maneuverability with other F–16 aircraft, allowing full integration into the Expeditionary Air Force structure. Such a modification would also increase the reliability and maintainability of these aircraft. Therefore, the committee recommends an increase of $60.0 million for F100–PW–229 engines for block 42 F–16 aircraft, a total authorization of $325.0 million for F–16 aircraft modifications.

C–5 aircraft avionics modernization program

The budget request included $86.0 million in procurement for C–5 aircraft modifications, including $78.1 million for the avionics modernization program (AMP).

The budget request also included $277.8 million in PE 41119F for operational system development for the C–5 aircraft, including $41.7 million for AMP development.

After the Defense Department submitted the budget request, the service conducted an integrated risk assessment. That assessment concluded that the Air Force had underestimated the time required to complete development and testing and needed to restructure the

AMP effort. The Air Force has informed the committee that their restructuring plan includes a need to shift some of the procurement budget request for fiscal year 2003 to research and development to complete development and testing. Therefore, the committee recommends a decrease of $26.6 million in C–5 aircraft modification procurement and a corresponding increase of $26.6 million in PE 41119F for C–5 aircraft operational system development.

C–130 aircraft modifications

The budget request included $138.5 million for modifications to the C–130 aircraft. The committee recommends an overall increase of $38.0 million, a total authorization of $176.5 million.

The budget request included $18.4 million for the enhanced traffic alert and collision avoidance system (TCAS). This modification is required by the Air Force Navigation and Safety Master Plan and global air traffic management mandates. Meeting these requirements is essential for aircraft to maintain worldwide, unrestricted airspace access. Because of the essential contribution that TCAS can make to aircraft safety, the committee recommends an increase of $15.0 million to accelerate installation of TCAS for C–130s.

The budget request included no funding for quick engine change (QEC) kits for the T56 engines used in Air Force Special Operations Command (AFSOC) MC–130E, AC–130H, or AM–130P aircraft. AFSOC units currently face the difficulty of using and maintaining five different versions of T56 QECs across the AFSOC C–130 fleet. These versions are neither compatible nor interchangeable, greatly complicating the required logistics. These differences could be eliminated if the MC–130E and AC–130H aircraft received an oil cooler augmentation (OCA) and if the MC–130P aircraft received both the OCA and a generator modification. The committee, therefore, recommends an increase of $13.0 million to procure T56 QEC kits for the AFSOC C–130 fleet.

The budget request included no funding for prototyping and testing an eight-bladed propeller and a new electronic control system. The propeller system is designed to increase available thrust and improve reliability and maintainability. The Navy has invested $45.0 million in an eight-bladed propeller for the E–2 and C–2 aircraft, both of which have T56 engines similar to the C–130 fleet. Navy testing of an E–2 outfitted with this system is scheduled to finish later this year.

If the Air Force were to conduct a test with a C–130 aircraft using the new propeller system, they would have the basis upon which to decide whether to program the rest of the C–130 fleet for a propeller upgrade program. Such testing could evaluate claims of significant savings in operating and support costs. If these estimates are correct, the fact that the Air Force operates a large fleet of C–130 aircraft could translate into substantial benefits to the operating forces. Therefore, the committee recommends an increase of $10.0 million to conduct the prototyping and testing of an eight-bladed propeller and a new electronic control system for the C–130 aircraft.

KC–135 aircraft boom operator weapons system trainer

The budget request included $108.7 million for modifications to the C–135 aircraft, including modifications to the KC–135 air refueling aircraft. The budget did not include any funding for a new boom operator weapons system trainer (BOWST).

The Air Force has indicated that the current system for training boom operators is obsolete and unreliable. If it fails, the air crews would have to conduct this critical training on actual sorties. In addition, the Air Force expects that if they deploy the new BOWST, air crews will actually be able to supplant some of the actual training sorties that now provide training that is impossible to conduct on the current ground training equipment. For example, the Air Force expects that new boom operators will require only six actual aircraft sorties to achieve initial qualification instead of nine. The committee believes that these savings would be significant. Therefore, the committee recommends an increase of $6.5 million for the procurement of the BOWST, a total authorization of $115.2 million in C–135 aircraft modifications.

Upgrades to Air National Guard targeting pods

The budget request included $349.5 million for miscellaneous production charges related to Air Force aircraft but included no funding to modify existing Litening II precision targeting pods deployed in the Air National Guard F–16 fleet.

The Air National Guard has identified a candidate upgrade program that would install a new forward-looking infrared (FLIR) sensor in the Litening II pod. This upgraded FLIR would have higher reliability than current systems, thereby reducing the demands on maintenance personnel. The new FLIR would also yield capability improvements, including doubled detection range, automatic target tracking and multiple target tracking. The committee recommends an increase of $20.0 million for procurement of Litening II targeting pod improvements.

Air Force Ammunition

Sensor-fuzed weapon

The budget request included $106.0 million for the sensor-fuzed weapon, a cluster munition used against land combat vehicles. The committee recommends an increase of $10.0 million to achieve a more economic order quantity rate and to lower the overall unit cost.

MJU–52/B infrared countermeasures

The budget request did not include funding for MJU–52/B infrared (IR) countermeasures for F–15 aircraft. However, Air Combat Command has validated a compelling requirement to field an expendable countermeasure for F–15s as soon as possible. Therefore, the committee recommends an increase of $1.0 million to purchase additional MJU–52/B IR countermeasures. These countermeasures would provide Air Force F–15s with new defensive capabilities to deny sophisticated infrared missile-seekers, thereby increasing survivability.

Air Force Missiles

Minuteman III modifications

The budget request included $580.7 million in PE 11213F for modifications to the Minuteman III (MMIII) land-based Intercontinental Ballistic Missile (ICBM). The committee recommends an additional $23.2 million to ensure that the multi-part MMIII modernization program remains on track. Two elements of the modernization effort, the Guidance Replacement Program (GRP) and the Propulsion Replacement Program (PRP), must move in tandem. However, recent labor rate increases in the PRP and GRP have led to a mismatch in the tandem production rates of these two components.

The additional funds would also support the purchase of shipping and storage containers and container inserts to allow the Air Force to download the MMIII ICBMs to a single warhead configuration, consistent with the Nuclear Posture Review. The committee urges the Air Force to continue to download the MMIII ICBMs as quickly as possible so that all MMIII warheads are in a single warhead configuration by 2007.

Advanced Extremely High Frequency satellite program

The budget request included $94.5 million for Advanced Extremely High Frequency (AEHF) satellite procurement in PE 33604F. Due to the slip of the AEHF program's Critical Design Review schedule, however, the Air Force has indicated that the proposed fiscal year 2003 procurement funding will not be required to carry out the program in fiscal year 2003. Therefore, the committee recommends a reduction of $94.5 million in PE 33604F.

Defense Support Program mobile terminal displays

The Defense Support Program (DSP) satellites are the space component of the nation's current early warning system for ballistic missile launches. These satellites detect intercontinental ballistic missile launches against the U.S. and can also detect the launch of short-range ballistic missiles. The system provided early warning of Iraqi SCUD missile launches to soldiers and civilians during the Desert Storm conflict.

Currently, the more capable Space-based Infrared System-High (SBIRS-High) is in line to replace the DSP satellites, the first of which was launched in the 1970's. Significant cost and schedule problems with SBIRS-High, however, have called into question whether a replacement system for DSP will be ready on time.

In the meantime, the mobile ground terminal displays for DSP, which provide an important means to receive DSP missile warning data, have become obsolete and are no longer supportable. If any of the displays were to fail in the future, the nation's ability to detect and warn of ballistic missile launches would be degraded. Given the likelihood that DSP will be required to serve longer than anticipated because of the SBIRS-High problems, it is prudent to ensure DSP systems are adequately funded and modernized.

Therefore, the committee recommends an increase of $2.1 million for procurement of new display units for DSP mobile ground terminals.

Titan space boosters

The budget request included $335.3 million in Missile Procurement, Air Force for the Titan space booster. The committee recommends a reduction of $20.0 million as a result of program execution delays.

Evolved Expendable Launch Vehicle mission assurance

The budget request included $158.9 million for the Evolved Expendable Launch Vehicle (EELV). The EELV is a new, low-cost commercial-government partnership that will reduce the cost of launch by 25 to 50 percent. The Wideband Gapfiller Satellites (WGS) will be launched using the EELV and will provide critical and substantially improved communications services. The committee recommends an additional $14.5 million for mission assurance to support the WGS first-of-a-kind as recommended by the EELV broad area review.

Other Air Force Procurement

Spacelift range system (space)

The budget request contained $108.3 million in Other Procurement, Air Force for spacelift range system (space) to continue range modernization and recapitalization efforts, a $23.0 million decrease from the fiscal year 2002 level. In order to support the growing reliance of the United States on space systems and other systems that rely on the spacelift ranges, the Air Force must ensure that the ranges can meet the requirements for an automated and standardized spacelift range system. The committee is concerned that the modernization schedule has not been maintained as originally planned. Therefore, the committee recommends an additional $9.5 million for recapitalization and modernization efforts, including the planning and scheduling system and adequate spares. The committee recommends a total increase of $29.0 million for spacelift ranges for procurement, research and development, and operation and maintenance accounts.

Panoramic night vision goggles

The budget request included $3.8 million to procure night vision goggles but included no funding to begin buying the next generation device for aviators, the panoramic night vision goggles (PNVG). The Air Force has informed the committee that the tremendous improvement in field-of-view offered by PNVGs will greatly improve situational awareness, reduce aircrew spatial disorientation, and enable quicker, more accurate target identification. The improvements directly translate to greatly enhanced aircrew safety. With the funding Congress provided last year to complete development, the Air Force will be ready to begin buying the PNVGs in fiscal year 2003. Because of the tremendous potential for improved operational capability and safety for aviators using PNVGs, the committee recommends an increase of $8.1 million to buy PNVGs.

SUBTITLE E—OTHER MATTERS

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	PROCUREMENT, DEFENSE-WIDE						
1	MOTOR VEHICLES, WHS	0	0	0	0	0	0
2	MAJOR EQUIPMENT, OSD	0	84,964	0	29,000	0	113,964
	OSD Continuity of Operations (COOP)-Network improvements (Transfer from DERF)				[9,000]		
	Horizontal Fusion Analysis (Transfer from DERF)				[8,000]		
	Coalition-Intelligence Information Sharing (CENTRIX) (Transfer from DERF)				[12,000]		
3	MAJOR EQUIPMENT, WHS	0	18,452	0	304,358	0	322,810
	Classified (Transfer from DERF)				[304,358]		
	MAJOR EQUIPMENT, NSA			0	0	0	0
4	CONSOLIDATED CRYPTOLOGIC PROGRAM	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
	Mobile Secure Communications (Transfer from DERF)				[500]		
	Classified program				[3,000]		
5	INFORMATION SYSTEMS SECURITY PROGRAM	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
6	DEFENSE AIRBORNE RECONNAISSANCE PROGRAM	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
7	DEFENSE COUNTERDRUG INTELLIGENCE PROGRAM	0	0	0	0	0	0
	MAJOR EQUIPMENT, DISA						
8	INFORMATION SYSTEMS SECURITY	0	37,544	0	11,000	0	48,544
	Suite of Enclave Security Tools (Transfer from DERF)				[5,500]		
	Test Suite - Wireless NIPRNET Gateway (Transfer from DERF)				[500]		
	Intelligence Community Systems (Transfer from DERF)				[5,000]		
9	CONTINUITY OF OPERATIONS	0	3,325	0	0	0	3,325
10	DEFENSE MESSAGE SYSTEM	0	19,425	0	0	0	19,425

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
11	GLOBAL COMMAND AND CONTROL SYS	0	3,453	0	0	0	3,453
12	GLOBAL COMBAT SUPPORT SYSTEM	0	2,442	0	0	0	2,442
13	STANDARD TACTICAL ENTRY POINT	0	0	0	0	0	0
14	TELEPORTS	0	53,542	0	0	0	53,542
15	GLOBAL INFORMATION GRID	0	517,000	0	-108,500	0	408,500
	Bandwidth Expansion (Transfer from DERF)				[7,400]		
16	ITEMS LESS THAN $5M	0	25,474	0	6,900	0	32,374
	Secure Voice Teleconferencing System and Secure Telephone Equipment (Transfer from DERF)				[1,000]		
	Transportable Systems (Transfer from DERF)				[5,900]		
	MAJOR EQUIPMENT, DIA						
17	INTELLIGENCE AND COMMUNICATIONS	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
	Critical Database Backup (Transfer from DERF)				[10,000]		
18	INTELLIGENCE PLANNING AND REVIEW ACTIVITIES	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
19	HEADQUARTERS MANAGEMENT DIA	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
20	MAJOR EQUIPMENT, DLA	0	9,304	0	0	0	9,304
21	MAJOR EQUIPMENT/ITEMS LESS THAN $5.0M DCAA	0	1,500	0	0	0	1,500
22	MAJOR EQUIPMENT, TJS	0	31,836	0	25,000	0	56,836
	C4I Equipment and Connectivity (Transfer from DERF)				[15,000]		
	Physical Security Equipment (Transfer from DERF)				[10,000]		
23	PATRIOT PAC-3	0	0	0	0	0	0
24	C4I (BMDO)	0	0	0	0	0	0
25	PERSONNEL ADMINISTRATION (DHRA)	0	7,404	0	0	0	7,404

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
26	MAJOR EQUIPMENT, NIMA	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
	Major Equipment -NIMA Airborne Integration (Transfer from DERF)				[1,000]		
	IEC Workstations - Major Equipment NIMA (Transfer from DERF)				[2,000]		
	Libraries Communications - NIMA (Transfer from DERF)				[2,000]		
	Libraries Storage - Major equipment (NIMA) (Transfer from DERF)				[7,600]		
	Classified program				[-16,000]		
27	VEHICLES (DTRA)	0	80	0	0	0	80
28	OTHER MAJOR EQUIPMENT (DTRA)	0	36,896	0	0	0	36,896
29	OTHER MAJOR EQUIPMENT (DSCA)	0	0	0	0	0	0
30	MAJOR EQUIPMENT, AFIS	0	7,762	0	0	0	7,762
31	AUTOMATION/EDUCATIONAL SUPPORT AND LOGISTICS DODDEA	0	2,404	0	0	0	2,404
32	MAJOR EQUIPMENT (DCMA)	0	13,677	0	0	0	13,677
	SPECIAL OPERATIONS COMMAND						
33	SOF ROTARY WING UPGRADES	0	289,792	0	9,600	0	299,392
	Avionics enhanced situational awareness				[9,600]		
34	SOF TRAINING SYSTEMS	0	14,000	0	0	0	14,000
35	MC-130H COMBAT TALON II	0	8,148	0	0	0	8,148
36	CV-22 SOF MODIFICATION	0	58,540	0	0	0	58,540
37	AC-130U GUNSHIP ACQUISITION	0	65,502	2	60,000	2	125,502
	AC-130U Gunship Acquisition (Transfer from DERF)				[60,000]		
38	C-130 MODIFICATIONS	0	77,889	0	0	0	77,889

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
39	AIRCRAFT SUPPORT	0	101	0	2,200	0	2,301
	EC-130J Commando Solo spares				[2,200]		
40	ADVANCED SEAL DELIVERY SYS	0	21,804	0	5,500	0	27,304
	Purchase lithium ion batteries				[12,000]		
	Defer funding for purchasing boat #2				[-5,000]		
	Use excess FY 02 funds for FY 03 requirements				[-1,500]		
41	ADVANCE PROCUREMENT (CY)	0	34,730	0	-34,730	0	0
	Defer funding for purchasing boat #2				[-34,730]		
42	MK VIII MOD 1 - SEAL DELIVERY VEH	0	8,484	0	4,500	0	12,984
	SEAL delivery vehicle (SDV)				[4,500]		
43	SUBMARINE CONVERSION	0	0	0	0	0	0
44	SOF ORDNANCE REPLENISHMENT	0	28,628	0	0	0	28,628
45	CONVENTIONAL AMMO WORKING CAPITAL FUND	0	0	0	0	0	0
46	SOF ORDNANCE ACQUISITION	0	7,078	0	0	0	7,078
47	COMM EQUIPMENT & ELECTRONICS	0	28,827	0	5,000	0	33,827
	Multiband multimission radios				[5,000]		
48	SOF INTELLIGENCE SYSTEMS	0	8,166	0	0	0	8,166
49	SOF SMALL ARMS & WEAPONS	0	4,768	0	10,000	0	14,768
	Advanced lightweight grenade launcher				[3,000]		
	Low profile night vision goggles				[2,000]		
	Modular integrated communications helmets				[5,000]		
50	MARITIME EQUIPMENT MODS	0	650	0	0	0	650

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
51	SOF COMBATANT CRAFT SYSTEMS	0	6,285	0	8,000	0	14,285
	SOF riverine craft				[8,000]		
52	SPARES AND REPAIR PARTS	0	5,327	0	0	0	5,327
53	SOF MARITIME EQUIPMENT	0	3,155	0	0	0	3,155
54	DRUG INTERDICTION	0	0	0	0	0	0
55	MISCELLANEOUS EQUIPMENT	0	5,745	0	0	0	5,745
56	SOF PLANNING AND REHEARSAL SYSTEM	0	300	0	0	0	300
57	SOF OPERATIONAL ENHANCEMENTS	0	93,233	0	10,000	0	103,233
	Advanced night vision system				[4,000]		
	Classified program adjustments				[6,000]		
58	PSYOP EQUIPMENT	0	5,642	0	0	0	5,642
	CHEMICAL/BIOLOGICAL DEFENSES						
59	INDIVIDUAL PROTECTION	0	125,276	0	500	0	125,776
	M48 masks				[500]		
60	DECONTAMINATION	0	15,561	0	6,000	0	21,561
	M12 decon system upgrades				[6,000]		
61	JOINT BIOLOGICAL DEFENSE PROGRAM	0	143,233	0	0	0	143,233
62	COLLECTIVE PROTECTION	0	34,749	0	7,000	0	41,749
	Chem-bio protective shelters				[7,000]		
63	CONTAMINATION AVOIDANCE	0	116,912	0	0	0	116,912
999	CLASSIFIED PROGRAMS	0	599,506	0	10,100	0	609,606
63a	Financial management savings				-3,500	0	-3,500

Title I - Procurement
(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
63b	Contract services savings				-1,500	0	-1,500
	TOTAL PROCUREMENT, DEFENSE-WIDE		**2,688,515**		**366,428**		**3,054,943**
	NATIONAL GUARD & RESERVE EQUIPMENT						
	RESERVE EQUIPMENT						
	ARMY RESERVE						
1	MISCELLANEOUS EQUIPMENT	0	0	0	0	0	0
	NAVY RESERVE						
2	MISCELLANEOUS EQUIPMENT	0	0	0	0	0	0
	MARINE CORPS RESERVE						
3	MISCELLANEOUS EQUIPMENT	0	0	0	0	0	0
	AIR FORCE RESERVE						
4	MISCELLANEOUS EQUIPMENT	0	0	0	0	0	0
	NATIONAL GUARD EQUIPMENT						
	ARMY NATIONAL GUARD						
5	MISCELLANEOUS EQUIPMENT	0	0	0	0	0	0
	AIR NATIONAL GUARD						
6	MISCELLANEOUS EQUIPMENT	0	0	0	0	0	0
	TOTAL NATIONAL GUARD & RESERVE EQUIPMENT		**0**		**0**		**0**

Title I - Procurement

(Dollars in Thousands)

Line No	Program	FY 2003 Request Qty	FY 2003 Request Cost	Change Qty	Change Cost	Recommended Qty	Recommended Cost
	CHEM AGENTS & MUNITIONS DESTRUCTION, DEFENSE					0	0
1	CHEM DEMILITARIZATION - O&M: Transfer from Army	0	0	0	974,238	0	974,238
2	CHEM DEMILITARIZATION - RDT&E: Transfer from Army	0	0	0	302,683	0	302,683
3	CHEM DEMILITARIZATION - PROC: Transfer from Army	0	0	0	213,278	0	213,278
	TOTAL CHEM AGENTS & MUNITIONS DESTRUCTION, DEFENSE		**0**		**1,490,199**		**1,490,199**

Defense-Wide Programs

Global information grid

The budget request included $517.0 million for the Defense Information Services Agency (DISA) to begin the first year of a two-year program to build the global information grid (GIG) to expand existing bandwidth at key Department of Defense (DOD) sites. The committee supports the aim of the GIG to enhance DOD's ability to transmit greater quantities of information more rapidly around the world but is concerned that the planned execution of almost $1.0 billion over two years is overly ambitious. For example, efforts to expand information transmission capabilities in the past have been slowed because, upon attempting to insert new technology, DOD has discovered that the facilities to house those technologies are inadequate. The committee believes that similar challenges are likely to arise in a program of this magnitude. Therefore, the committee recommends a decrease of $115.9 million, reflecting the need for a more realistic execution schedule. The committee's recommendation for fiscal year 2003 totals $401.1 million to support expansion of the network backbone to the highest priority sites in the continental United States, Europe, and Pacific Command.

Avionics enhanced situational awareness

The budget request included $18.6 million in the Special Operations Forces (SOF) Rotary Wing Upgrades and Sustainment procurement account for purchasing, integrating, and installing Mission Processors (MPs), Multifunction Displays (MFDs), and Intelligence Broadcast Receivers (IBRs) in Army Special Operations aircraft. The MP and MFD replace obsolete equipment that is no longer supportable or upgradeable. The IBR allows the pilots to receive the latest intelligence data from national intelligence sources while conducting their worldwide missions. These three programs together form a large part of the rotary wing Common Avionics Architecture for Penetration (CAAP) Enhanced Situational Awareness (ESA) program. Given the fact that the MP and MFD functions are being handled by antiquated systems that will no longer be supportable in fiscal year 2004, that there is no IBR capability in current aircraft, and that the timetable for the MH47 Service Life Extension Program provides an opportunity to also execute the CAAP ESA program, the committee recommends an increase of $9.6 million in Procurement, Defense-Wide for SOF Rotary Wing Upgrades and Sustainment for purchasing, integrating, and installing six additional sets of MPs, MFDs, and IBRs.

EC–130J Commando Solo spares

The budget request did not include any funding for a set of spares for the EC–130J TV/radio broadcast equipment required for the Commando Solo psychological operations missions. These spare parts, including radios, TV converters, and media players, support the airborne special mission equipment package contained in the EC–130J. The committee recommends an increase of $2.2 million in Procurement, Defense-Wide for Special Operations Aircraft Support to purchase a set of spares for the EC–130J Commando Solo mission.

SEAL Delivery Vehicles

The budget request did not include funding for procurement of the SEAL Delivery Vehicle (SDV). The SDV is a wet submersible operated by a crew of two that can clandestinely transport up to four SEALs with their combat gear and mission equipment into hostile waters. The Special Operations Command considers SDVs a high priority requirement in order to conduct successful naval special operations. Additional funding would accelerate procurement of the SDVs required to meet the inventory objective. Therefore, the committee recommends an increase of $4.5 million in Procurement, Defense-Wide for the MK VIII MOD 1—SEAL Delivery Vehicle for an additional SDV.

Multiband Multimission Radios

The budget request included $6.0 million in the Special Operations Communications Equipment and Electronics procurement account for the Multiband Multimission Radio (MBMMR). This funding should ensure fielding of the radios to approximately 58 percent of the Special Operations Forces (SOF) who have a requirement for the radios. The MBMMR allows SOF teams to communicate on a user-selected frequency utilizing a single radio with embedded communications security. It reduces the communications combat load by approximately 37 pounds, augmenting or replacing other radios. The command has stated that, "MBMMR is required for SOF operations in the current war on global terrorism." Therefore, the committee recommends an increase of $5.0 million in Procurement, Defense-Wide for the Special Operations Communications Equipment and Electronics for the MBMMR.

Advanced Lightweight Grenade Launcher

The budget request included $3.7 million for the Special Operations Forces Small Arms and Weapons procurement account for the Advanced Lightweight Grenade Launcher (ALGL) systems for the Special Operations Command (SOCOM). The committee recommends an increase of $3.0 million in Procurement, Defense-Wide for Special Operations Forces Small Arms and Weapons to purchase additional ALGL systems, which provide first-round-hit capability on lightly armored vehicles at ranges beyond 1,500 meters. The ALGL procurement would provide special operators with an improved 40mm weapons system capability consisting of a lightweight 40mm grenade launcher, day/night fire control, and mount (ground and vehicle). The system would replace one that is twice as heavy, non-man portable, and less accurate.

Low Profile Night Vision Goggle

The budget request did not include funding for Low Profile Night Vision Goggles (LPNVG) for the Naval Special Warfare Command. The LPNVG is an image intensification system using folded optics to reduce the overall system profile. The current goggle system, whose optics are mounted more than two inches away from the front of the eye, puts undue strain on the user's neck when used in a high-sea state. The LPNVG system moves the center of gravity closer to the user's face, reducing fatigue and neck strain associated with long sea transit, and reduces mount failure. The LPNVG

also provides a superimposed day image and can accommodate a Heads-Up Display, which would allow the user to simultaneously view displays from a Global Positioning System (GPS), Maritime Forward Looking Infrared Radar (MARFLIR), or other instruments. The committee recommends an increase of $2.0 million in Procurement, Defense-Wide for Special Operations Forces Small Arms and Weapons Acquisition for the procurement of approximately 147 additional LPNVGs.

Modular Integrated Communications Helmet system

The budget request did not include funding for the Modular Integrated Communications Helmet (MICH) System. The MICH system provides the special operations forces with state-of-the-art ballistic and impact protection while providing an advanced communications capability, which allows Special Forces operators to connect to a wide range of radios and vehicle, boat and aviation intercoms. The communications portion of the helmet can also be used separately. The committee recommends an increase of $5.0 million in Procurement, Defense-Wide for Special Operations Forces Small Arms and Weapons to purchase approximately 4,250 MICH systems.

Special Operations Craft-Riverine

The budget request did not include any funding for Special Operations Craft-Riverine (SOC–R) procurement. The SOC–R is an air-transportable, armored craft that is capable of carrying special operations forces for insertion, extraction, and reconnaissance missions in riverine environments. SOC–R is more capable and supportable than existing Vietnam-era craft and, unlike the latter, fully meets operational requirements. Procurement of SOC–Rs would allow Special Operations Command to accelerate attainment of its total inventory objective. Therefore, the committee recommends an increase of $8.0 million in Procurement, Defense-Wide for Special Operations Forces Combatant Craft Systems to purchase approximately six SOC–R systems.

Advanced night vision system

The budget request included $1.9 million for advanced night vision goggles in the Special Operations Forces Operational Enhancements procurement program for a helmet-mounted goggle system that includes a state-of-the-art night vision capability, combining image intensification with thermal imagery. It also allows operators to direct fire on threats detected by thermal signatures and, in sum, provides the operator with a distinct battlefield advantage. The committee recommends an increase of $4.0 million in Procurement, Defense-Wide for Special Operations Forces Operational Enhancements for an advanced night vision system.

M48 protective masks

The budget request included $125.3 million in the Defense-wide procurement account for individual protection in the Chemical-Biological Defense Program for equipment and items to protect military personnel from exposure to chemical and biological agents. The request, however, did not include funding for the M48 mask

for AH–64 Apache helicopter crews. The committee recommends an increase of $500,000 to procure additional M48 masks for Apache crews.

M12 decontamination system

The budget request included $15.6 million in the Defense-wide procurement account for decontamination in the Chemical-Biological Defense Program for equipment to decontaminate personnel and equipment exposed to chemical or biological agents. The request did not include funds for upgrades to the M12 decontamination system, which will eventually be replaced by the Modular Decontamination System (MDS). The committee notes that production of the MDS is behind schedule. Therefore, the committee recommends an increase of $6.0 million to procure additional upgrades for the M12 decontamination system.

Chemical-Biological Protective Shelter

The budget request included $14.9 million in the Defense-wide procurement account for collective protection in the Chemical-Biological Defense Program to procure 27 Chemical-Biological Protective Shelters (CBPS). The CBPS is a highly mobile, rapidly deployable shelter system designed for forward medical treatment in contaminated battlefield environments. The committee recommends an increase of $7.0 million to procure additional Chemical-Biological Protective Shelters to meet the increasing threat of chemical and biological attack against U.S. military personnel.

OTHER ITEMS OF INTEREST

Abrams tank program

The budget request included $376.3 million to upgrade M1 Abrams tanks to the M1A2 System Enhancement Package (SEP) configuration and $123.7 million to continue the retrofit of M1A2 tanks to the M1A2 SEP configuration.

While retrofit of existing M1A2s to the SEP configuration will continue in the out-years, the fiscal year 2003 budget request represented the last year of funding for the Abrams upgrade program. As a result, after 2003, the United States will not be funding production of new or significantly upgraded main battle tanks for the first time since the end of World War II.

The committee strongly supports the Army's plan to acquire the Future Combat Systems for its transformation to the Objective Force. However, the committee is equally strong in its support for efforts to recapitalize and selectively modernize the heavy Counter-Attack Corps which will be the basis of the Army's warfighting capability for the next 10 to 20 years until the Objective Force systems are fielded in sufficient numbers to assume that responsibility.

Current Army plans are to retrofit only 419 of the remaining 627 M1A2 tanks to the SEP configuration. The resulting tank fleet will consist of 966 M1A2 SEP, 208 M1A2, and over 4,000 M1A1 tanks. Three years ago the Army strongly opposed a proposed plan that would have resulted in a similar mix of three separate tank configurations, arguing emphatically against the perceived operational

and logistical difficulties in supporting that mixture and urging the committee to ensure that the M1A2 tank fleet would consist of only the SEP configuration. Now the Army has apparently reversed its position with what the committee fears is little consideration of the Army's own former arguments against such a mixture.

The committee does not understand the rationale for maintaining 208 M1A2 tanks not modernized to the SEP configuration, nor does it understand the slow pace of the SEP retrofit program. The committee is also concerned with the limited funding being applied to the electronic obsolescence problem in the tank fleet and to continued updating of the digitization systems in the M1A2 SEP tanks.

The committee directs the Army to present to the congressional defense committees, no later than March 30, 2003, a plan to accelerate the SEP retrofit program, including the upgrade of the entire fleet of 627 M1A2 tanks by fiscal year 2009, and to establish an adequate obsolescence management and technology insertion program. This plan should consider all innovative acquisition means, including a multiyear procurement and modernization through spares of electronic modules.

Accelerated chemical demilitarization

The budget request included $1.5 billion for Chemical Agents and Munitions Destruction. This level of funding supports the schedule and cost estimated by the Defense Acquisition Board in 2001 for the chemical demilitarization program. Since that cost estimate, and since the fiscal year 2003 budget submission was finalized, the Department of Defense approved a new plan for accelerated destruction of chemical agents at the Aberdeen Chemical Agent Disposal Facility. In addition, the Army, which serves as the executive agent for chemical demilitarization, developed a proposal for accelerated destruction and reconfiguration at other chemical stockpile sites in order to reduce or eliminate the risk of a terrorist attack against them.

If fully implemented, accelerated destruction could reduce the schedule for destruction of chemical agents at some sites by an estimated three to five years and could produce life cycle cost savings estimated as high as $3.0 billion. Accelerated destruction could also permit the United States to meet its Chemical Weapons Convention destruction deadline for almost all of its stockpile sites instead of being five or more years out of compliance as is now projected.

The Department of Defense included a request for $300.0 million for accelerated chemical demilitarization in its fiscal year 2002 supplemental budget request to the Office of Management and Budget (OMB), but the proposed funding was not approved by OMB.

The committee believes that accelerated demilitarization of chemical weapons and agents is in the national security interest and urges the Department of Defense to identify funds to implement accelerated destruction, possibly through a reprogramming request or a supplemental budget request.

Chemical demilitarization secondary waste disposal

An important element of the chemical demilitarization program is the safe and efficient disposal of the contaminated by-products of the chemical weapons destruction process. By-products, other-

wise referred to as "secondary waste," include contaminated charcoal, haloginated plastics, brines, dunnage, and spent decontamination solution. The committee notes that States with chemical weapons stockpiles are working individually with the Department of the Army to resolve secondary waste disposal issues. As a result, the commencement and execution of the chemical demilitarization activities at several destruction sites are directly related to the selection of the means by which to dispose of secondary waste.

The safe and timely destruction of the chemical stockpile remains the primary goal of the chemical demilitarization program. Therefore, the committee urges the Department of the Army to continue to work with these States to identify and implement solutions for the disposal of secondary waste using appropriate processes.

Acquisition programs at the National Security Agency

The Senate report accompanying S. 1438 (S. Rept. 107–62) raised several concerns about acquisition programs at the National Security Agency (NSA). The report noted that the Director of the NSA has made progress in transforming the NSA. The report, however, expressed concern that more progress needs to be made in the NSA processes if the NSA is to achieve the capabilities that the Nation will require.

The statement of managers accompanying S. 1438 (Conf. Rpt. 107–333) identified a number of specific actions to help improve the situation at the NSA. The statement of managers also expressed the view that the NSA should seek the advice of independent, outside experts to assist in guiding its selection of technologies under this baselining effort. The statement of managers concluded that, unless the Office of the Secretary of Defense (OSD), the Community Management Staff (CMS), and the NSA complete the baselining by December 1, 2002, Congress would direct that the NSA's modernization effort be designated a major defense acquisition program, with milestone decision authority likely residing with the Under Secretary of Defense for Acquisition, Technology, and Logistics until initial operational capability (IOC) is achieved.

The committee believes that, although the NSA has been making some progress since last year, much remains to be done. The committee encourages the NSA, the OSD and the CMS to make greater progress before December 1, 2002.

Advanced Aviation Institutional Training Simulator

The budget request included $111.7 million for non-system training devices such as the Multiple Integrated Laser Engagement System 2000 and the Engagement Skills Trainer. In the National Defense Authorization Act for Fiscal Year 2002, Congress authorized $5.0 million for the procurement of Advanced Aviation Institutional Training Simulators (AAITS), yet the Army did not request funding for AAITS in the fiscal year 2003 budget request. The committee understands that AAITS provides full-motion, reconfigurable cockpit simulation for AH–64 Apache, UH–60 Blackhawk, and the OH–58C/D Kiowa Warrior helicopters. The committee believes that the Army should maximize the use of training simulators and encourages the Army to consider the AAITS as a training platform to improve aviator student safety upon transition to the actual aircraft.

Armored Security Vehicle

The budget request included $14.6 million for the Armored Security Vehicle (ASV). The Army has decided to terminate the ASV program after completion of the multiyear contract in fiscal year 2003. At that time, the Army will have approximately 100 ASVs, well short of the 602 required for the Counter-Attack Corps and the forward deployed units in Korea and Europe, and far from the total requirement of 1940.

By any standard, the ASV has been a success. The vehicle provides ample protection for soldiers in military police units from anti-personnel land mines and from small arms and crew-served weapons fire, a serious threat to a soldier standing in the unprotected turret of a High Mobility Multi-purpose Wheeled Vehicle, the Army's alternative military police vehicle. The ASV can protect the crew against anti-personnel mines; .50-caliber, armor-piercing machine gun fire; and 155-millimeter artillery fire at 15 meters. It is strategically mobile, able to deploy on a C–130 aircraft with 95 percent of its fuel and ammunition. Finally, the tactical mobility of the ASV is at least equal to, and in some aspects greater than, that of the Interim Armored Vehicle, a program on which the Army plans to spend over $6.0 billion.

The committee does not understand the Army's decision to terminate the ASV and directs the Chief of Staff of the Army to fully justify the Army's position to the congressional defense committees no later than March 30, 2003.

Hydra 70 rocket

The budget request included $22.4 million for the Hydra 70 rocket system, an 83 percent reduction from the fiscal year 2002 appropriated level. The Army directed this reduction in conjunction with the planned termination of the program in fiscal year 2004. The Army's intent is to replace the Hydra 70 rocket with the Advanced Precision Kill Weapon System (APKWS). The committee notes, however, that the APKWS, currently in research and development, is not scheduled to be available until 2008 at the earliest.

In the interim, the Army's plan is to decrease training to extend the existing Hydra 70 inventory until the APKWS becomes available. The full training requirements for Army units call for an annual expenditure of 179,000 rounds of Hydra 70; at this rate, the Army's Hydra 70 inventory would be depleted by 2004.

Compounding the risk associated with planned training shortfalls, the war on terrorism has further accelerated the draw on existing Hydra 70 stocks. During operations in Afghanistan, special forces and regular military units have relied heavily on the Hydra 70 rocket system to provide fire support to forces on the ground.

Given the importance of the Hydra 70 rocket to both training and warfighting, the committee does not understand the Army's plan to terminate the Hydra 70 program. The committee finds that the Army may be incurring a significantly high level of risk by this action. Therefore, the committee directs the Chief of Staff of the Army to fully justify the Army's position to the congressional defense committees no later than March 30, 2003.

Vessels for tactical sealift

The Army and Navy are leasing a commercially built, high-speed vessel for experiments and exercises which gather data and test the military utility and suitability of high-speed vessel concepts, sea-keeping, and tactics. The Marine Corps is leasing a similar vessel for intra-theater tactical lift in the Western Pacific. The Department of Defense will use information collected from all three of these efforts to assist in determining the requirements for tactical sealift vessels for the future.

These analyses could very well point toward the need to build some hull form never before constructed in a U.S. shipyard. If this were the case, the Department and the U.S. shipbuilding industry might need to use a different acquisition strategy in acquiring the vessels, including taking steps to develop the skilled trades required to design and build such vessels. If the Department were to decide on a hull form never before constructed in a U.S. shipyard, the committee would encourage the Army, Navy, and Marine Corps to consider a wider range of acquisition strategies that would reduce risk in acquiring a brand-new type of ship.

TITLE II—RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

Explanation of tables

The following tables provide the program-level detailed guidance for the funding authorized in title II of this Act. The tables also display the funding requested by the administration in the fiscal year 2003 budget request for research, development, test and evaluation programs and indicate those programs for which the committee either increased or decreased the requested amounts. As in the past, the administration may not exceed the authorized amounts (as set forth in the tables or, if unchanged from the administration request, as set forth in the Department of Defense's budget justification documents) without a reprogramming action in accordance with established procedures. Unless noted in the report, funding changes to the budget request are made without prejudice.

Funds transferred to the accounts in this title from the Defense Emergency Response Fund (DERF) are displayed on the tables that follow as increases to the amount requested for those programs in the research and development accounts. Programs for which funds were transferred from the DERF are annotated to indicate that funds were originally requested in the DERF.

SUBTITLE A—AUTHORIZATION OF APPROPRIATIONS

National Defense Authorization for Fiscal Year 2003
(Dollars in Thousands)

TITLE II Research, Development, Test & Evaluation	Authorization Request	Change	Recommended
Research, Development, Test & Evaluation, Army	6,918,494	382,039	7,300,533
Research, Development, Test & Evaluation, Navy	12,501,630	427,505	12,929,135
Research, Development, Test & Evaluation, Air Force	17,601,233	1,002,451	18,603,684
Research, Development, Test & Evaluation, Defense-Wide	16,613,551	-122,178	16,491,373
Operational Test & Evaluation, Defense	222,054	139,500	361,554
TOTAL	**53,856,962**	**1,829,317**	**55,686,279**

SUBTITLE B—PROGRAM REQUIREMENTS, RESTRICTIONS, AND LIMITATIONS

Basic seismic research program for support of national requirements for monitoring nuclear explosions (sec. 211)

The committee recommends a provision that would require the Secretary of the Air Force, through the Director of the Air Force Research Laboratory, to manage the Department of Defense program of basic seismic research to support U.S. national requirements for monitoring nuclear explosions. The provision would authorize $20.0 million for this research program.

The budget request included $37.6 million for Arms Control Technology in PE 63711BR, a reduction of $25.3 million from the previous year. The amount requested includes $4.0 million for the seismic research program, which is not sufficient funding to ensure mission accomplishment. The committee provision would authorize $20.0 million of this funding for the seismic research program needed to support the national requirement to monitor nuclear explosions.

For more than 50 years, the Air Force has had a unique mission requirement to monitor nuclear explosions around the world. This mission is assigned to the Air Force Technical Applications Center (AFTAC) at Patrick Air Force Base in Florida. Since the mid–1990s, newly validated national requirements have substantially lowered the mandated thresholds for detecting, locating, and identifying nuclear explosions. In order to meet these challenging requirements, AFTAC is currently implementing a program to build high frequency seismic arrays to monitor areas of national interest. This program will roughly double the size of the operational U.S. seismic network.

In order to meet the national requirement to monitor nuclear explosions, it is necessary to conduct basic seismic research to understand the geology and seismic characteristics of each region of concern. This understanding is essential in order to calibrate each seismic array so the data they receive can be interpreted correctly. For nearly 40 years, the Air Force has managed this basic seismic research program, which is conducted by numerous universities with geological and seismic expertise.

Since this program was transferred to the Department of Defense in fiscal year 1997, funding requests by the Department for this essential research have been insufficient, and the program has relied on additional funds provided by Congress to ensure that the mission could be accomplished adequately.

The committee believes $20.0 million is the proper level of funding to ensure mission accomplishment and urges the Department to program adequate and stable funding in the future to perform this essential seismic research mission supporting a critical national requirement.

Advanced SEAL Delivery System (sec. 212)

The budget request included $56.5 million for procurement associated with the Advanced SEAL Delivery System (ASDS), including $21.8 million for ASDS procurement and $34.7 million for ASDS

advance procurement. The ASDS is a miniature, combatant submarine being developed for the covert delivery of naval special operations forces. Unlike existing SEAL delivery vehicles, it transports Navy SEALs to longer ranges in a dry environment, enhancing the operators' ability to perform. The system includes the ASDS mini-sub and transport equipment.

Significant technical and financial problems continue to plague this program. The National Defense Authorization Act for Fiscal Year 2000 required the Department of Defense to review this program and consider elevating it to a higher level of acquisition review. The Department conducted a review and instituted a more rigorous oversight mechanism but has yet to conduct the overarching integrated product team review of the ASDS program, which had been scheduled for this year. The National Defense Authorization Act for Fiscal Year 2002 directed the Comptroller General to review the ASDS program. The Comptroller General's review of the program indicated that the ASDS program continues to experience problems associated with performance, technical issues, mission requirements, and cost and schedule, which, if not resolved, could lead to further cost growth, schedule delays, and an inability to meet program objectives.

The committee recognizes the technical challenges associated with developing and fielding this unique system and continues to support the overall effort to develop a mini-submarine, given the potential value of such a vehicle for naval special warfare missions. The committee is increasingly concerned, however, about the program's technological, cost, and scheduling problems. The committee does not believe that funding advance procurement items related to the second boat and procuring sonar for the second boat are justified until problems with the first boat are resolved.

Therefore, the committee recommends a decrease of $34.7 million in the ASDS advance procurement and a decrease of $5.0 million in the ASDS procurement. In addition, the program has yet to obligate the $13.7 million in fiscal year 2002 advance procurement for items associated with purchasing the second boat. Again, due to the fact that the program has not been able to resolve the problems associated with the first boat, the committee believes that there is no justification for spending fiscal year 2002 funds on procurement for the second boat. Therefore, the committee recommends a provision that would allow the Secretary of Defense to use funds that were authorized and appropriated for fiscal year 2002 for ASDS advance procurement, but are no longer needed for that purpose, for ASDS research and development in the Special Operations Tactical Systems Development program, PE 11644BB, and for ASDS procurement activities associated with the first boat; the use of these funds would be subject to an action in an appropriations act. The committee also recommends a reduction of the $12.2 million in the budget request for ASDS research and development in the Special Operations Tactical Systems Development program, PE 11644BB, and a $1.5 million reduction in the budget request for ASDS procurement to reflect the use of these funds available from fiscal year 2002.

In order to encourage development of a solution to these technical problems, especially those associated with the batteries, the

committee also recommends an increase of $12.0 million for ASDS procurement for purchase of a lithium ion battery set for the first boat. The committee believes, however, that the program requires more attention from the Commander in Chief, Special Operations Command; the Navy; and the Office of the Secretary of Defense. The committee, therefore, recommends that no more than 50 percent of the fiscal year 2003 ASDS procurement funding (excluding the amount of $12.0 million added for the battery set) be released before the Secretary of Defense conducts a complete review of the requirements, mission, management, and cost structure of the ASDS program and reports to the congressional defense committees on his findings.

Army experimentation program regarding design of the Objective Force (sec. 213)

Section 113 of the National Defense Authorization Act for Fiscal Year 2002 requires the Secretary of the Army to develop and provide resources for an experimentation program that will provide information on the design of the Objective Force and will include the formal linkage of the interim brigade combat teams to that experimentation. The committee considers such an experimentation program to be of critical importance to the successful transformation of the Army to the Objective Force and is concerned that the Secretary of the Army has not taken concrete steps to comply with that legislation. Therefore, the committee recommends a provision that would require the Secretary of the Army to submit a report to Congress on the details of the experimentation program no later than March 30, 2003, and to fund that experimentation program as a separate program element in the fiscal year 2004 budget request submission to Congress.

SUBTITLE C—MISSILE DEFENSE PROGRAMS

Annual operational assessments and reviews of ballistic missile defense program (sec. 221)

The Missile Defense Agency has discussed the possibility of "contingency deployments" of a number of ballistic missile defense systems in the 2004 time frame, including the Ground-based Midcourse, Sea-based Midcourse, Theater High Altitude Area Defense (THAAD), and Air-based Boost (or Airborne Laser) systems. The committee believes that before a decision on "contingency deployment" is made, the Department of Defense should have the best possible information on the potential operational effectiveness of the candidate system. Therefore, the committee recommends a provision that would require the Director of Operational Test and Evaluation (DOT&E) to conduct annual operational assessments of the ballistic missile defense systems discussed above and report the results of these assessments to the Secretary of Defense and Congress by January 15 of each year, beginning in 2003.

In testimony to the committee on March 7, 2002, the committee chairman asked each of the military service chiefs whether he had been consulted on the Department's missile defense budget for fiscal year 2003; each responded that he had not. The committee is concerned that under the new Missile Defense Agency organization,

the military services have not been afforded the opportunity to provide the proper guidance and advice on the missile defense budget. Therefore, this provision would direct the Joint Requirements Oversight Council (JROC) to review annually the cost, schedule and performance criteria for all Missile Defense Agency programs and assess the validity of the criteria in relation to military requirements. The provision would require the JROC to report the results of this review to the Secretary of Defense and Congress by January 15 of each year, beginning in 2003.

Report on Midcourse Defense program (sec. 222)

In a January 2, 2002 memorandum from the Secretary of Defense restructuring the Department's ballistic missile defense programs, the Secretary stated that the "special nature of missile defense development, operations, and support calls for non-standard approaches to both acquisition and requirements generation." As such, the Secretary has exempted missile defense programs from the Department's traditional acquisition directives and processes that require certain programmatic information be developed to assist in oversight of programs within the Department.

The committee is concerned that the exemption of missile defense programs from these acquisition processes has also resulted in the elimination of certain reports to Congress on missile defense programs. These reports are critical to congressional understanding and oversight for missile defense programs, and are required for all other major defense acquisition programs. One of the most important ballistic missile defense programs affected by the exemption is the Midcourse Defense program, which includes both the Ground-based national missile defense system and the Sea-based Midcourse system (formerly known as Navy Theater-Wide). The committee, therefore, recommends a provision that would require the Secretary of Defense to submit to Congress, by January 15, 2003, certain types of programmatic information for the Ground-based Midcourse program which are required by sections 2431 and 2432 of title 10 United States Code for all major defense acquisition programs and are critical to congressional review and oversight.

Until the fiscal year 2002 budget submission, all information required by sections 2431 and 2432 of title 10, United States Code had been submitted to Congress for all major ballistic missile defense programs. However, neither the fiscal year 2002 budget submission nor the fiscal year 2003 submission included such information. Both the Under Secretary of Defense for Acquisition, Technology and Logistics Pete Aldridge and the Director of the Missile Defense Agency Lieutenant General Ronald Kadish have testified to the committee that they intend to provide Congress with the information it needs. This committee provision, therefore, would establish the minimum congressional requirements for information on the Midcourse Defense program.

Section 2431 of title 10, United States Code requires the Secretary of Defense to submit to Congress, along with the budget justification, documentation regarding the development and procurement schedules for each weapons system for which funding is requested. The required documentation includes the following:

(1) the development schedule, including estimated annual costs until development is completed; and

(2) the planned procurement schedule, including the best estimate by the Secretary of Defense of the annual costs and units to be procured until procurement is completed.

This provision would require that this information be provided for the Midcourse Defense program.

Section 2432 of title 10, United States Code requires the Secretary of Defense to submit to Congress at the end of each quarter of each fiscal year a report on current major defense acquisition programs, including the current estimate of program acquisition unit costs, the reasons for any changes in that estimate, and the major contracts under the program together with the reasons for any changes in cost or schedule variances under those contracts. Additionally, section 2430 of title 10, United States Code defines major defense acquisition programs to include those acquisition programs estimated by the Secretary of Defense to require an eventual total expenditure for research, development, test and evaluation of more than $300.0 million. The budget request for the Midcourse Defense program exceeds $3.0 billion for fiscal year 2003 alone. Therefore, the committee provision would require that this information be provided for the Midcourse Defense program.

Finally, section 149 of title 10, United States Code establishes the Director of Operational Test and Evaluation (DOT&E) as the principal advisor to the Secretary of Defense and the Under Secretary of Defense for Acquisition, Technology and Logistics on operational test and evaluation. A primary function for the DOT&E is oversight of the development of the Test and Evaluation Master Plan (TEMP) for major defense acquisition programs in accordance with Department of Defense regulations. The committee provision would require that the TEMP for the Ground-based Midcourse program be developed in accordance with Departmental regulations and subsequently provided to Congress.

Report on Air-based Boost program (sec. 223)

The committee recommends a provision that would require the Secretary of Defense to submit to Congress, by January 15, 2003, certain types of programmatic information for the Air-based Boost (formerly known as the Airborne Laser) program which are required by sections 2431 and 2432 of title 10 of the United States Code for all major defense acquisition programs and are critical to congressional understanding and oversight.

The Air-based Boost program is a well established program which the Department of Defense has stated could be ready for "contingency deployment" within the next few years and for which almost $600.0 million has been requested in fiscal year 2003. No detailed information on the plans for this program has been submitted to Congress, however, in either the fiscal year 2002 or 2003 budget submissions. The information required by this provision for the Air-based Boost program would be the same as required by section 222 of the committee bill for the Midcourse Defense program.

Report on Theater High Altitude Air Defense (THAAD) program (sec. 224)

The committee recommends a provision that would require the Secretary of Defense to submit to Congress by January 15, 2003, certain types of programmatic information for the THAAD program which are required by sections 2431 and 2432 of title 10 of the United States Code for all major defense acquisition programs and are critical to congressional understanding and oversight. The information required by this provision for THAAD would be the same as required by section 222 for the Midcourse Defense program.

THAAD is a well established program which the Department of Defense has stated could be ready for "contingency deployment" within the next few years and for which more than $900.0 million has been requested in fiscal year 2003. No detailed information on the plans for this program, however, has been submitted to Congress in either the fiscal year 2002 or 2003 budget submissions.

Section 232 of the National Defense Authorization Act for Fiscal Year 2002 specifically required the Secretary of Defense to submit to Congress by February 1, 2002, the estimated total life cycle costs for each ballistic missile defense program which enters Engineering and Manufacturing Development (EMD). The Department has failed to provide such information for THAAD even though THAAD entered into EMD in calendar year 2000. In addition, the Department has failed to provide estimated total life cycle costs for THAAD despite repeated requests from Congress, including a letter to the Under Secretary of Defense for Acquisition, Technology and Logistics from the Committee on Armed Services chairman and the Strategic Subcommittee chairman requesting such information.

Therefore, the recommended provision would place a funding limitation on the THAAD program: no more than 50 percent of the amount authorized to be appropriated in fiscal year 2003 for THAAD may be expended until Congress has received the information required by the provision.

References to new name for Ballistic Missile Defense Organization (sec. 225)

In January 2002, the Secretary of Defense directed a reorganization of the Department's missile defense programs that included changing the name of the Ballistic Missile Defense Organization (BMDO) to the Missile Defense Agency (MDA). Therefore, the committee recommends a provision that would amend existing provisions of law to refer to the MDA vice the BMDO.

SUBTITLE D—IMPROVED MANAGEMENT OF DEPARTMENT OF DEFENSE TEST AND EVALUATION FACILITIES

The annual report of the Department of Defense (DOD) Director of Operational Test and Evaluation for fiscal year 2001 concludes that inadequate funding of DOD test and evaluation (T&E) infrastructure has led to inadequate testing of major weapons systems. The Director's report states:

> During the past decade while T&E infrastructure resources were being reduced, we witnessed an alarming

> trend of too many programs entering dedicated operational T&E (OT&E) without having completed sufficient developmental T&E (DT&E). As a result, the services have conducted OT&E on immature systems and the results reflect the consequences. In recent years, 66 percent of Air Force programs have stopped operational testing due to a major system or safety shortcoming. Since 1996, approximately 80 percent of Army systems tested failed to achieve reliability requirements during operational testing. * * * The acquisition process fails to deliver systems to the warfighter that meet reliability and effectiveness requirements.

In section 913 of the National Defense Authorization Act for Fiscal Year 2000, the committee required the Defense Science Board (DSB) to assess the resources and capabilities of the test and evaluation facilities of the Department of Defense. The DSB report, issued in December 2000, supports the Director's conclusion that the Department is no longer conducting adequate testing of weapon systems. The DSB report states:

> 1. Testing is not being conducted adequately—if systems are not adequately tested they enter the inventory with latent defects that can be very costly and can impact operational effectiveness.
> 2. A particularly shocking finding is that there is growing evidence that the acquisition system is not meeting expectations as far as delivering high quality, reliable and effective equipment to our military forces.
> 3. The lack of testing cannot be blamed on the lack of facilities; however, limited infrastructure is a contributor to the lack of interoperability testing.
> 4. There is an increasing incidence of test waivers.
> 5. The T&E process is not funded properly—in phasing or in magnitude
> a. Funds are not available early enough
> b. Corners are cut in the testing that is done[.]
> 6. There is not enough government oversight of testing done by industry. * * *
>
> It appears that we too often fail to carry out adequate testing. In those cases where the testing is adequate, we fail to take the corrective actions needed based on the results of that testing. In many cases, we allow our acquisition programs to proceed to their next phases, such as moving from development or technical testing to operational testing or moving from development into production and deployment with our combat forces, when the test results we have gathered clearly indicate the systems are not ready.

The committee believes that the Department of Defense has no greater duty than to ensure that the weapons systems that it puts in the hands of our soldiers, sailors, airmen and marines will operate as intended in combat situations. Adequate testing of weapons systems is not an abstract concept: lives depend upon it.

For this reason, the committee recommends a series of provisions to implement the recommendations of the Director of Operational Test and Evaluation and the report of the Defense Science Board task force on test and evaluation capabilities.

Department of Defense Test and Evaluation Resource Enterprise (sec. 231)

The committee recommends a provision that would establish a Department of Defense Test and Evaluation Resource Enterprise (T&E/RE), which shall report to the Director of Operational Test and Evaluation.

The Director of Operational Test and Evaluation stated in his annual report for fiscal year 2001:

> The current approach to managing the DOD T&E infrastructure is through centralized oversight by DOT&E and decentralized funding and management by the Military Departments and Defense Agencies. Funding and manpower levels for the individual ranges and centers are programmed by the owning service, even though the ranges may possess unique T&E capabilities which are used primarily by the other services and defense agencies. This approach has led to a reluctance by the owning service to fully fund and sustain some of these unique capabilities.

The Director noted that the establishment of a T&E/RE to address this problem was the "most significant recommendation" of the December 2000 report of the Defense Science Board task force on test and evaluation facilities. The task force explained this recommendation as follows:

> Extensive reduction in test facilities and personnel has been pursued during the last five years. Notwithstanding this necessary effort, unnecessary duplication of capabilities exists in all three services. * * *
>
> [The] unwillingness of the services to provide adequate resources for T&E [while] still maintain[ing] substantial redundant capabilities suggests that a change is needed.
>
> The fundamental concern of T&E facility managers is how [to] get enough money and manpower to continue their operations. They compete with other activities within their services for resources, and with other activities both within their Services and outside for "business" support. This does not lead to long-range business planning and, it is not possible for them to make investment decisions based on future utilization or business-like return on assets analyses. They have little control over the "business" they manage and are subject to highly variable budgeted support. * * * Centralized, consolidated management of T&E facilities within the Department of Defense could overcome many of these serious problems.

The provision recommended by the committee would implement the task force recommendation by establishing a centralized T&E/RE, which would report to the Director of Operational Test and Evaluation. Under this provision, funding for the investment, oper-

ation and maintenance, development and management of Major Range Test and Facility Base (MRTFB) facilities and resources would be transferred to the new T&E/RE. The T&E/RE would also be responsible for ensuring that test planning and test execution is conducted by the appropriate military service organizations. However, the day-to-day operation and management of the test ranges and facilities and the testing activities carried out at those ranges and facilities would remain in the hands of the military services.

The provision would require that the new T&E/RE be established within one year of the date of enactment. To ensure central oversight over investments in the MRTFB, the provision would require that the Director of Operational Test and Evaluation approve all investments of $500,000 or more during the one-year transition period.

Transfer of testing funds from program accounts to infrastructure accounts (sec. 232)

The committee recommends a provision that would transfer testing funds from the research and development programs of the military departments and defense agencies to the major test and evaluation investment accounts of the Department of Defense.

The Director of Operational Test and Evaluation stated in his annual report for fiscal year 2001:

> In the long run, increasing the tempo of testing will require a shift in our current practices for funding and managing test facilities and ranges. * * * At the present time, defense programs must bear both the cost of their tests and the overhead costs to maintain the ranges. This has proven to be a disincentive to testing. The cost to program managers has risen sharply over the past decade as they take on the overhead costs of the test ranges; as a result, program managers seek to minimize the amount (and therefore the cost) of testing. As they succeed, their success forces the price even higher for each test. * * *
>
> A recent analysis shows that about $2.4 billion in test costs (previously funded in the MRTFB [Major Range and Test Facility Base] institutional budgets) have been shifted to the users since FY90. Eighty-five percent of the shift occurred during the last five years.
>
> As institutional funds have fallen, the test ranges and centers have sought to recover more costs from users. The users, in turn, have reduced testing and accepted additional risk to remain within their budgets. Test adequacy has suffered as a consequence. In FY01, the MRTFB charged an estimated $250 million per year more to users than was charged to them prior to FY90. Effectively, this means that, although users in FY01 collectively paid the same amount as in FY90, they were doing less testing.

The committee provision would address this problem by shifting five-eighths of one percent of the budgets of the military departments and defense agencies for Demonstration and Validation, Engineering and Manufacturing Development, and Operational Sys-

tems Development (approximately $250.0 million) to the major test and evaluation investment accounts of the Department. The specific transfers would be as follows:

For the Army: from Demonstration and Validation to PE 64759A, $5.0 million; from Engineering and Manufacturing Development to PE 64759A, $18.0 million; from Operational Systems Development to PE 64759A, $6.0 million.

For the Navy: from Demonstration and Validation to PE 64759N, $15.0 million; from Engineering and Manufacturing Development to PE 64759N, $32.0 million; from Operational Systems Development to PE 64759N, $17.0 million.

For the Air Force: from Demonstration and Validation to PE 64759F, $9.0 million; from Engineering and Manufacturing Development to PE 64759F, $27.0 million; from Operational Systems Development to PE 64759F, $60.0 million.

For Defense-wide: from Demonstration and Validation to PE 64940D8Z, $37.0 million; from Engineering and Manufacturing Development to PE 64940D8Z, $8.0 million; from Operational Systems Development to PE 64940D8Z, $25.0 million.

The Committee expects that these transfers will not be implemented as an across-the-board reduction on programs undergoing demonstration and validation, engineering and manufacturing development, or operational development, but will instead be proportionally allocated to such programs on the basis of the projected test and evaluation costs to be paid by these programs.

The provision would also require the military services to change their funding policies to ensure that users of the MRTFB are charged only for the direct costs of testing and are no longer required to pay for overhead costs. The committee anticipates that the research and development programs of the Department should recover a significant portion of the funds transferred to the MRTFB investment accounts through lower overhead rates charged for testing at MRTFB facilities. However, any shortfall of funding resulting from this transfer should not be taken directly from testing budgets of the programs and shall not be used as a basis for reducing testing requirements for any system. On the contrary, the committee believes that the lower rates charged for testing at MRTFB facilities should lead to increased testing of Department of Defense systems.

The committee also recognizes that the elimination of indirect costs could lead to increased funding needs in test and evaluation accounts other than the investment accounts to which funds would be transferred by this provision. The committee urges the Department of Defense Comptroller, in consultation with the Director of Operational Test and Evaluation, to make any adjustments among the test and evaluation accounts of the Department of Defense and the military services that may be needed, pursuant to established procedures, to ensure that the test ranges and facilities of the Department are able to conduct required operations.

Increased investment in test and evaluation facilities (sec. 233)

The committee recommends a provision that would increase the amount authorized to be appropriated for the Central Test and

Evaluation Investment Program (CTEIP) of the Department of Defense (PE 64940D8Z) to $251.3 million, an increase of $128.0 million. The increase consists of $70.0 million transferred to the CTEIP program by section 232; $50.0 million added to the CTEIP program to increase the Department's overall level of investment in its test and evaluation facilities; and $8.0 million that would be made available for specific technology programs to support testing and evaluation, as described elsewhere in this report.

Overall, the $251.3 million total provided by the committee recommendations would more than double the amount of funding available in the CTEIP account and the transfers and increases made by this bill would more than double the funding available in the test and evaluation (T&E) investment accounts of the Department as a whole.

In his annual report for fiscal year 2001, the Director of Operational Test and Evaluation identified significant deficiencies in the Department's T&E infrastructure. The Director's report states:

> When the capabilities of the test ranges are compared with requirements for testing current and future systems, significant deficiencies are evident. They limit the ability to conduct adequate testing of weapons and support systems. Some of the more significant deficiencies are:
>
> Range infrastructure. * * * Miss distance and attitude measurement systems lack adequate fidelity. Instrumentation shortfalls include limited radar, telemetry, and optical equipment assets to support multiple simultaneous engagements and insufficient instrumentation to track multiple vehicles. There are no chemical-biological test chambers large enough to accommodate complete systems. A replacement for the self-defense test ship is needed to retain the capability to demonstrate surface ship cruise missile defense systems.
>
> Targets and threat representations. Generally, realistic targets are not available in sufficient numbers to support the various weapon systems under development. Representative targets for certain anti-ship cruise missile threats are not available. Deficiencies exist in the quantity and types of ballistic missile defense targets. Threat representation shortfalls have also been identified. Needs include a vector-scoring capability on full-scale targets and improved capability for testing infrared missile engagements.
>
> Realistic test environments. New-generation systems have much more extensive operating footprints than their predecessors and, therefore, need much larger test ranges to support full-scale operational scenarios. Space test capabilities are not sufficient to meet space mission area testing requirements. Shallow water ranges for undersea warfare testing are inadequate. Chemical and biological simulators and simulants are not representative of the threat. Generally, there is a lack of priority and funding for testing of weapon systems in the extremes of their natural operating environments.

> Interoperability. Interfaces with other systems are not included in many test plans. Many systems are tested only on an individual basis. The failure to test systems with complementary ones in combined scenarios precludes effective assessment of their compatibility and ability to operate together.

The committee believes that the increased funding levels for the CTEIP program and the test and evaluation investment and modernization accounts of the military services represent the minimum level needed to address the serious infrastructure problems identified in the Director's report. For this reason, the committee urges the Department to maintain these funding levels in future budget requests.

Uniform financial management system for Department of Defense test and evaluation facilities (sec. 234)

The committee recommends a provision that would require the Secretary of Defense to implement a single financial management and accounting system for all test and evaluation (T&E) facilities of the Department of Defense (DOD).

Section 907 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 required the Secretary to develop a plan, including a schedule, for establishing a cost-based management information system for DOD laboratories and test and evaluation centers.

Despite this requirement, the annual report of the Director of Operational Test and Evaluation for fiscal year 2001 states that cost comparisons between the test and evaluation facilities of military services are difficult "because there is no common financial management system among the services." The Defense Science Board (DSB) Task Force on Test and Evaluation Capabilities strongly supports this conclusion in its December 2000 report, which states:

> The Task Force found each of the Services uses different financial management methods to manage the affairs of their facilities and recommends that DOD implement a common financial management methodology for all T&E facilities. * * *
>
> Consistent financial management practices would ease the problem of interservice range utilization and make it possible to determine the value of making changes in facilities usage. It would also facilitate more efficient operations. At present we cannot measure either input or output values. * * * Each service has a different financial management system for T&E.

The provision recommended by the committee would implement a recommendation of the DSB Task Force by requiring that the Secretary establish a common financial management methodology for all T&E facilities. The provision would require that the new T&E financial management and accounting system be consistent with the financial management enterprise architecture developed by the Secretary pursuant to section 1006.

One of the objectives of the new financial management methodology would be to enable the Department of Defense to track the total cost of test and evaluation activities. The committee recognizes that this total cost includes costs incurred by activities outside the test and evaluation facilities of the Department of Defense. The committee believes that the financial management enterprise architecture developed by the Department should enable the Department to track such costs.

Test and evaluation workforce improvements (sec. 235)

The committee recommends a provision that would require the Under Secretary of Defense for Acquisition, Technology and Logistics to develop a plan to ensure that the test and evaluation (T&E) workforce of the Department of Defense (DOD) is of sufficient size and has the expertise needed to ensure that the testing of DOD systems identifies issues of military suitability and effectiveness in a timely and accurate manner.

The Director of Operational Test and Evaluation stated in his annual report for fiscal year 2001:

> Infrastructure is not limited to facilities, but also includes people and processes. The DSB [Defense Science Board] Task Force learned that the issue of human resources—how to attract and retain personnel with the motivation and skill to serve and lead in civilian and military capacities—is one of the most significant concerns of the T&E community.
>
> The demographics of T&E show that a large fraction of its community will soon be eligible to retire. Further, the downsizing over the last ten years has all but precluded the recruiting of new talent. As a result, the relationships established by our T&E community over the years with universities and the hiring of graduates with skills in new research areas have suffered.

The provision recommended by the committee would implement one of the recommendations of the DSB Task Force on Test and Evaluation Capabilities by requiring the Department to develop a strategic plan for future human resource requirements of the DOD test and evaluation community. The plan would establish the number and qualifications of military and civilian personnel needed to properly staff the test and evaluation community of the Department of Defense and develop specific milestones for achieving a workforce with the desired composition.

The committee expects the Department to conduct a thorough review of the personnel system to identify any enhanced personnel flexibility that may be needed to attract and retain quality test and evaluation personnel. The committee notes that section 4308 of the National Defense Authorization Act for Fiscal Year 1996 authorized the Department to establish an acquisition workforce demonstration project. This authority, which enables the Department to waive certain regulatory requirements and to utilize pay-banding approaches such as those recommended by the Director of Operational Test and Evaluation in his annual report, has been utilized only on a small scale to date.

Compliance with test and evaluation master plan requirements (sec. 236)

The committee recommends a provision that would prohibit unauthorized deviations from testing requirements.

The Director of Operational Test and Evaluation stated in his annual report for fiscal year 2001:

> The December 2000 Defense Science Board Report noted, "The systems below Acquisition Category (ACAT) I in the priority system are being fielded without adequate testing. Even for the ACAT I programs there is growing evidence that testing is not being done adequately." * * *
>
> One feature of current practice I seek to change is the services' ability to waive tests without DOT&E review and approval. The Defense Science Board strongly recommended that Secretary of the Navy Instruction 5000.2B be modified to rule out waivers as a unilateral action by the Service. The current policy allows waivers from criteria for certification of readiness for operational test (such as completion of the system safety program) and waivers for deviation from testing requirements directed by the Test and Evaluation Master Plan.

In fact, the Defense Science Board (DSB) Task Force on Test and Evaluation (T&E) Capabilities concluded, "The process of handling waivers seriously undermines the T&E process—and may have already had negative impact on weapons systems."

The provision recommended by the committee would implement a recommendation of the DSB Task Force by requiring that any deviation from the requirements of a Test and Evaluation Master Plan be either: (1) approved through the same procedures pursuant to which the Plan was established (including the approval of the Director of Operational Test and Evaluation); or (2) approved by the Secretary or Deputy Secretary of Defense. This provision is not intended to preclude the certifying official for operational test readiness from approving a test "limitation of scope" where testing to actual requirements would constitute a regulatory violation or a safety hazard.

Report on implementation of Defense Science Board recommendations (sec. 237)

The committee recommends a provision that would require the Secretary of Defense to report on the implementation of the recommendations of the December 2000 report of the Defense Science Board (DSB) Task Force on Test and Evaluation Capabilities.

In addition to the overarching recommendations that would be implemented by the provisions of this subtitle, the DSB Report contains a number of recommendations regarding specific test and evaluation investments. These include recommendations on frequency spectrum management, embedded instrumentation, investment in targets, and the use of training facilities and exercises for test and evaluation events. The committee believes that these recommendations merit detailed review by the Department.

SUBTITLE E—OTHER MATTERS

Pilot programs for revitalizing Department of Defense laboratories (sec. 241)

The committee recommends a provision that would re-authorize and expand a set of pilot programs aimed at improving the quality of the Department of Defense (DOD) laboratories and test and evaluation centers. In section 246 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 and section 245 of the National Defense Authorization Act for Fiscal Year 2000, Congress authorized the Secretary of Defense to establish pilot programs and, if necessary, waive regulations in order to attract the finest quality, highly trained technical talent to Department labs and test centers, enable these facilities to adopt more business-like practices to increase efficiency, and permit the establishment of new cooperative programs with the private sector to promote technological innovation. The provision would re-authorize these pilot programs for an additional three years.

The committee notes that support for these types of reforms exists throughout the Department. In testimony to the Emerging Threats and Capabilities subcommittee, the Director of Defense Research and Engineering noted that he had requested an extension of the pilot programs through Department channels. At the same hearing, representatives of the military services all highlighted the need to attract the best technical workforce possible for the Department's science and technology enterprise.

Despite this support, the committee notes with concern that the Department has made limited progress in exploiting these pilot programs. An Army briefing for the committee stated that, "Between the personnel and legal communities we have been effectively shut down."

An October 2000 Defense Science Board study highlighted a number of reasons that these pilot programs are critical for the vitality of the labs and test centers. It noted that "there is a clear relationship between the technical capabilities of the laboratories and the capabilities of future U.S. military forces." It concluded that "personnel practices of the Federal Civil Service System" are the primary cause for the defense labs' difficulty in recruiting and retaining high quality staff. The committee provision seeks to assist the Department in addressing these issues to support the revitalization of the labs.

The committee's provisions would expand the existing program so that the Secretary could make use of waivers to: assist the labs in retaining and shaping the best possible scientific and engineering workforce, enter into partnerships to promote the education of the next generation of defense technology specialists, and promote the defense technological industrial base. The provision would also require the Secretary to report on the barriers encountered in attempting to execute the existing pilot programs and progress being made to overcome the barriers. The committee directs the Secretary to coordinate these reports between the Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics and the Office of the Undersecretary of Defense for Personnel and Readiness.

The committee directs the Comptroller General to review the implementation and execution of the pilot programs. The review shall examine the pilot programs and assess the extent of utilization of the authorities, effects of the executed programs in achieving stated revitalization goals, barriers to implementation and execution, and recommendations for follow-on actions or clarification of authorities.

Additionally, the provision would extend the authorities of the pilot programs to leverage some of the opportunities that arose during the limited implementation of the existing pilot programs. The provision would authorize the Secretary to establish a limited liability corporation as part of an expansion of public-private partnerships involving the labs and test centers. The committee believes that this type of partnership is in the best interest of the Department and will assist the labs and test centers in improving their technical capabilities.

Finally, the provision would authorize the Secretary to designate a total of no more than 30 scientific, technical, and engineering positions across the organizations participating in the pilot program as positions in the excepted service. This is intended to allow the labs to attract the finest, highly trained scientific and engineering talent available. In testimony to the Emerging Threats and Capabilities subcommittee, government officials contrasted the different approaches that the Department of Defense, Department of Energy, and National Nuclear Security Administration (NNSA) use to fill technical positions. The witnesses noted that NNSA has been authorized with a number of excepted service positions that they are using to bring additional expertise into the organization. This excepted service approach is already used by a number of DOD organizations, including the Defense Intelligence Agency and the service academies, and was recommended by the service organizations participating in the original pilot program.

Technology transition initiative (sec. 242)

The committee recommends a provision that would require the Secretary of Defense to carry out a technology transition initiative to facilitate the rapid transition of new technologies from science and technology programs of the Department of Defense into acquisition programs for the production of the technologies. The committee has had a long-standing concern about the Department's ability to effectively and efficiently transition technologies out of the laboratory and into the hands of the warfighter. Successful and rapid transition of revolutionary technologies into defense systems is one of the central aspects of military transformation.

The committee notes that, historically, technology transition has been stifled by three major issues: leadership, organizational cooperation, and funding. Aggressive leadership and championing of new technologies from the highest levels of the Department is necessary to overcome organizational and cultural barriers and effect real technological change. All technology transition depends on the coordination of technology developers, acquisition program managers, and military users. Successful technology transition is often associated with programs that have established innovative personnel and technical exchanges, have entered into formal coopera-

tive agreements, or have made extensive use of technology demonstrations and experimentation. Finally, it is critical that funding be available to transition science and technology programs that have achieved required technological maturity. Too often, the Department's budgeting process moves too slowly to take advantage of transition opportunities, even if those opportunities develop over a number of years and within funded Department science and technology programs.

The committee commends the Department for initiating a number of activities to support technology transition. The Navy's Future Naval Capabilities Integrated Product Teams, Air Force's Applied Technology Council, and the Advanced Concept Technology Demonstrations (ACTDs) are excellent examples of involving technology developers and users in the planning and funding of new technologies in order to promote transition. The Department's move toward spiral acquisition policies and growing use of technology readiness levels are also supportive of technology transition.

In testimony to the Emerging Threats and Capabilities subcommittee, the Director of Defense Research and Engineering highlighted the Department's ACTD program and Quick Reaction fund as the centerpiece of the DOD technology transition strategy. The committee supports these efforts, but notes that the majority of technologies developed both inside and outside of the Department cannot be transitioned through these limited efforts. Therefore, the committee's recommended provision is intended to broaden Departmental efforts at transition, establish high-level leadership, promote organizational cooperation, and provide funding for transition activities.

The provision requires the Secretary to (1) establish a council comprised of organizations critical for successful technology transition, in particular the science and technology executives, service acquisition executives, and operational users; (2) develop memoranda of agreement, joint funding agreements, and other cooperative arrangements for the transition of technologies into production; and (3) establish a technology transition fund to carry out jointly-funded technology transition projects with the military services.

The committee recommends that joint-funding of these projects should be contingent upon the development of a specific agreement between the science and technology, acquisition, and operational requirements communities which delineates technological maturity of the program, acquisition strategy of the relevant acquisition program, and a preliminary description of the concept of operational use of the technology under consideration.

The committee directs each of the military services to designate a senior official to serve as an advocate for technology transition within the military service and to work with the DOD Technology Transition Initiative Manager designated pursuant to this provision. The senior technology transition advocates in the military services should work to identify and transition both technologies that are developed within the DOD science and technology programs and technologies that are developed in the private sector. The committee recommends that the council meet at least semi-annually to review candidate proposals.

The committee encourages the Initiative Manager to work with the Assistant Secretary of Defense for Logistics, the Commander of the Joint Forces Command, and the Director of Operational Test and Evaluation as the council works to evaluate proposals and transition technologies. Each of these organization's areas of responsibility—logistics, experimentation, and test and evaluation—are important factors in developing a successful and rapid transition pathway. The committee also notes that the transition of critical logistical, sustainment and testing technologies are increasingly important to reducing costs and improving the efficiency of the Department of Defense.

Encouragement of small business and nontraditional defense contractors to submit proposals potentially beneficial for combating terrorism (sec. 243)

The committee recommends a provision that would create a Small Business Outreach panel to enhance the Department's ability to utilize small businesses and non-traditional defense contracts as it works to develop technologies for combating terrorism and weapons of mass destruction.

The committee notes that in the wake of the terrorist activities in 2001, an overwhelming number of technology developers have approached the Department of Defense, Office of Homeland Security, and Congress with proposals for research or technology in support of the war on terrorism. The Department's broad agency announcement relating to combating terrorism resulted in over 12,000 proposals, many of which have yet to be given a formal technical evaluation and response.

The provision would establish a panel consisting of government and private sector experts who would serve as the Department's screening committee for technology proposals to combating terrorism and weapons of mass destruction. The panel would screen and evaluate research and development proposals that it believes are likely to make a significant contribution to the government's efforts to combat terrorism at home and abroad. The committee understands that no panel can fairly be expected to review 12,000 proposals and expects the panel members to apply their professional expertise in screening proposals to determine which submissions merit in-depth review.

The panel would make recommendations to the Under Secretary of Defense for Acquisition, Technology, and Logistics on the technical merits of proposals, potential contract sponsors (military service or defense agency) within the Department, recommended funding levels, and transition pathways.

The committee directs the Department to use all available electronic commerce technology to carry out its activities, including proposal submission, review, response to proposers, and recommendations within the Department. This is consistent with the Department's efforts to streamline its procedures and make more use of electronic transactions in conducting Department business.

The committee also recommends that the Department increase its outreach efforts to small businesses and non-traditional contractors. This part of the industrial base can and should play a critical role in the development of technologies to fight terrorism at home

and overseas. This is evident in the success that the Department has achieved in using the Small Business Innovative Research (SBIR) program to fulfill some of its technology development needs. The Committee directs the Department to expand its outreach activities using web-based tools, conferences, and other informational activities to assist small innovative companies in understanding the Department's technology goals, funding opportunities and mechanisms, and management processes.

Vehicle fuel cell program (sec. 244)

The committee recommends a provision that would require the Secretary of Defense to carry out a cost-shared program to identify and support technological advances that are necessary to develop fuel cell technology for use in vehicles that would be used by the Department of Defense. The committee recommends $10.0 million to carry out the program and directs the Secretary to conduct the program in cooperation with the Secretary of Energy; other appropriate federal agencies, including the Army; and private industry. The committee directs the Secretary to ensure that at least half of the total cost of the program be borne by industry, either in cash or in kind.

The vehicle fuel cell program shall include development of vehicle propulsion technologies and fuel cell auxiliary power units as well as pilot demonstration of such technologies as appropriate. The program shall also include development of technologies necessary to address critical issues such as hydrogen storage and the need for a hydrogen fuel infrastructure.

Over the last decade, the Department of Defense has supported the development and utilization of fuel cell technology in three broad areas: stationary power applications, mobile applications, and other power applications. The committee believes that significant benefits could be gained from these existing programs that will have applications for vehicle fuel cell technology. Important objectives of the program established by this provision are to ensure that critical technology advances are shared among the varied fuel cell technology programs within the Department and other federal agencies, and to ensure the maximum leverage of federal funding for fuel cell technology development across this broad spectrum.

To facilitate cooperation with industry and to leverage the investments of both the federal government and the private sector, the Secretary shall consider establishment of a Defense Industry Fuel Cell Partnership. Significant advancements have been made in the development of fuel cell technology, but the committee believes that more could be accomplished if this work is done in cooperation with private industry.

The committee directs the Secretary to submit a report to the congressional defense committees no later than April 30, 2003, that describes how funding for the vehicle fuel cell program will be expended in fiscal year 2003 and how the program meets the objectives set forth in this provision.

Defense Nanotechnology Research and Development Program (sec. 245)

The committee recommends a provision that would establish a comprehensive program to organize and coordinate nanoscale research and development within the Department of Defense (DOD) and with appropriate civilian agencies. The committee recognizes the importance of advances in this field to the genesis of revolutionary military technologies and to military transformation.

The need for an integrated program in nanotechnology research is predicated on two major considerations. The first is the vast potential for new military capabilities to be derived from nanoscale research and development. The list of potentially transformative capabilities enabled by nanotechnology extends to numerous defense needs, including warfighter protection, mobility, information processing, communication, energy, and cost- and size-reduction of weapons systems. This potential makes the establishment of a dedicated program to advance the field, develop applications, and accelerate the transition of nanoengineered products into the services an imperative.

Secondly, the magnitude of DOD investment in nanoscale research and development has tripled since 1998, reaching over $200.0 million in the fiscal year 2003 budget request. This request mirrors investment trends across the entire government and internationally. Given the scale and scope of the DOD and federal commitment to nanotechnology, the committee feels that it is necessary to coordinate the various programs to ensure completeness, balance, and the minimization of redundancy within the nanotechnology research portfolio.

The provision directs the Department to establish a set of long-term challenges for nanotechnology research, which should be coordinated with and modeled after the Grand Challenges articulated by the National Nanotechnology Initiative. Specifically, the challenges should represent broad goals or capabilities related to national defense that are not yet attainable given the present state of nanotechnology, but which may be achieved within a time frame of several years to several decades. These challenges will provide the operating framework and benchmarks under which the program will be organized, funded, and evaluated.

The committee directs that each challenge be comprised of a set of specific technical goals, each with a lead service or defense agency charged with organizing and coordinating research and technology transition in that area. The committee directs the Department to execute, as appropriate, memoranda of agreement, joint funding agreements, and other cooperative arrangements in order to optimize coordination and accomplish program goals.

The provision requires an annual report to the Congress to describe the program's research and coordination activities. The report should review and assess the status and progress of the program with respect to the established challenges and technical goals; describe the funding levels for each service and defense agency participating in the program; describe the coordination between the research efforts within the program and with those of civilian agencies and the private sector; evaluate efforts at transitioning research, technologies, and concepts into military

products and uses; and recommend new initiatives, programs, mechanisms for coordination, or other activities that would facilitate the achievement of program purposes.

The committee also recognizes the important role that Information Analysis Centers (IAC) have played in data collection, analysis, and dissemination within specific areas of science and technology of relevance and interest to the defense community. The committee believes that the establishment of an IAC for defense nanotechnology would substantially support the activities of the program, and recommends that the Secretary of Defense consider instituting such a center.

ADDITIONAL MATTERS OF INTEREST

Science and technology initiatives

The committee supports Department of Defense efforts to transform itself to meet the emerging threats of the 21st century. The committee feels that a robust defense science and technology program is a requirement in order to develop the new systems and operational concepts that will enable transformation. Unmanned vehicles, satellite communications, and precision weapons are transforming today's military. In the same way, new systems based on nanotechnology, robotics, and artificial intelligence will transform the military of the future. To ensure that each wave of technological change is sustainable and can be expanded upon, however, it is critical to make the small but stable investments in fundamental and applied research that produce the capabilities of the future.

The committee fully supports the Department's stated goal of investing 3 percent of the defense budget into science and technology programs. The fiscal year 2003 budget request fell short of that goal. In fact, the budget request would decrease the percentage of the budget invested in science and technology each consecutive year, falling to 2.3 percent of the budget by 2007. The committee urges the Department and each of the military services to achieve the 3 percent goal as soon as practicable.

To support the transformation of the military, the committee recommendations would provide over $170.0 million for high priority science and technology programs above the amount requested in the fiscal year 2003 budget. This includes over $200.0 million in research to support the development of the Army's Objective Force, with new technologies such as unmanned ground vehicles, hybrid electric vehicles, and next generation weapons systems. The committee recommends adding $23.5 million to research programs to address corrosion problems in platforms, weapons systems, and installations. This research could eventually save the Department billions of dollars per year in corrosion maintenance and repair costs.

The committee recommendations would provide an additional $33.0 million for revolutionary research and technology to meet future cyberthreats. The funding would include extensive investments in scholarship programs to train the next generation of information security specialists. The committee notes that a limiting factor to technological transformation will be the ability to generate

and deliver power on demand to critical military assets. For this reason, the committee recommends an increase of $41.0 million in research and development on revolutionary power technologies.

The committee recommendations would also provide an additional $34.0 million for nanotechnology investments. This burgeoning scientific field has the promise to transform technologies ranging from power systems to aerospace materials to biological sensors. In addition, the committee recommendations increase Department investments in basic research by nearly $50.0 million. These fundamental research programs are often performed in collaboration with universities and national laboratories and help serve to train tomorrow's scientific leaders.

In addition to these investments, the committee continues to work to ensure that the Department gets the best return on investment on research dollars. The committee recommendations would provide an additional $25.0 million for the Department's technology transition activities as well as establish a new funding mechanism and coordinated process for rapid transition of technologies from the laboratory to the battlefield.

The recommendations for authorization of appropriations for fiscal year 2003 would continue the committee's tradition of strongly supporting the defense science and technology enterprise. By supporting strong research investments, strengthening our defense laboratories, and working to speed transition of technologies into operational systems, the committee hopes to continue and accelerate the transformation of the military.

Merit-based selection procedures

The committee notes that section 2304(j) of title 10, United States Code, states that it is the policy of Congress that any contract for a program, project, or technology identified in legislation be entered into through merit-based selection procedures. Section 2374 of title 10 establishes the same policy for the award of any new grant for research, development, test, or evaluation to a non-Federal Government entity. Each of these provisions states that the presumption in favor of competitive, merit-based awards may be overridden only by a provision of law that specifically refers to section 2304(j) or section 2374, specifically identifies the particular non-Federal Government entity involved, and specifically states that the award to that entity is required notwithstanding the policy favoring merit-based selection.

The committee is concerned that, despite the enactment of section 2304(j) and section 2374, the Department of Defense continues to award contracts and grants for research and development programs and projects to specific entities without the use of merit-based selection procedures. The committee directs the Department to use all applicable procedures in the award of any new contract, grant or other agreement entered into with funds authorized to be appropriated by this title.

The committee directs the Department to make use of memoranda of agreements, cost sharing, and other cooperative arrangements as necessary to ensure that the funds authorized to be appropriated by this title address defense technology development goals in the most cost effective and technically sound manner.

Army

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
		RESEARCH, DEVELOPMENT, TEST & EVALUATION, ARMY			
0601101A	1	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	22,998		22,998
0601102A	2	DEFENSE RESEARCH SCIENCES	139,633	8,000	147,633
		Optical research		[3,000]	
		Animal modeling genetics research		[1,000]	
		Desert terrain analysis		[4,000]	
0601104A	3	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	74,855	4,000	78,855
		Armor materials modeling & simulation		[2,500]	
		Ferroelectric materials nanofabrication		[1,500]	
0602105A	4	MATERIALS TECHNOLOGY	18,659	12,500	31,159
		Advanced materials processing		[4,000]	
		Electronic components reliability		[2,500]	
		Composite materials technology for FCS		[3,000]	
		Multifunctional composite materials		[3,000]	
0602120A	5	SENSORS AND ELECTRONIC SURVIVABILITY	24,305		24,305
0602122A	6	TRACTOR HIP	6,839		6,839
0602211A	7	AVIATION TECHNOLOGY	43,692		43,692
0602270A	8	EW TECHNOLOGY	19,584		19,584
0602303A	9	MISSILE TECHNOLOGY	31,884	5,000	36,884
		Short range air defense radar		[3,000]	
		Advanced composite chassis		[2,000]	
0602307A	10	ADVANCED WEAPONS TECHNOLOGY	11,208		11,208
0602308A	11	ADVANCED CONCEPTS AND SIMULATION	20,634	2,500	23,134
		Interactive training technology transition		[2,500]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0602601A	12	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	55,763	30,300	86,063
		Advanced coatings research		[1,500]	
		Fastening & joining research		[1,800]	
		21st Century Truck		[17,000]	
		Combat truck initiative (COMBATT) hybrid vehicle		[5,000]	
		Advanced manufacturing technology		[5,000]	
0602618A	13	BALLISTICS TECHNOLOGY	74,094		74,094
0602622A	14	CHEMICAL, SMOKE AND EQUIPMENT DEFEATING TECHNOLOGY	3,675		3,675
0602623A	15	JOINT SERVICE SMALL ARMS PROGRAM	5,812		5,812
0602624A	16	WEAPONS AND MUNITIONS TECHNOLOGY	38,090	6,400	44,490
		Tungsten kinetic energy projectile		[1,000]	
		Warhead technology for FCS		[2,400]	
		Countermobility systems		[3,000]	
0602705A	17	ELECTRONICS AND ELECTRONIC DEVICES	27,448	2,000	29,448
		Portable hybrid electric power systems		[2,000]	
0602709A	18	NIGHT VISION TECHNOLOGY	22,333		22,333
0602712A	19	COUNTERMINE SYSTEMS	13,186	12,500	25,686
		Polymer-based landmine detection		[2,000]	
		Acoustic landmine detection		[3,000]	
		Airborne landmine detection		[7,500]	
0602716A	20	HUMAN FACTORS ENGINEERING TECHNOLOGY	17,415		17,415
0602720A	21	ENVIRONMENTAL QUALITY TECHNOLOGY	23,018	4,000	27,018
		Environmental restoration technology		[4,000]	
0602782A	22	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	21,821		21,821
0602783A	23	COMPUTER AND SOFTWARE TECHNOLOGY	4,354		4,354

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0602784A	24	MILITARY ENGINEERING TECHNOLOGY	51,124	12,000	63,124
		Geosciences research		[2,000]	
		Stationary fuel cell initiative		[10,000]	
0602785A	25	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	14,335		14,335
0602786A	26	WARFIGHTER TECHNOLOGY	25,502	2,500	28,002
		Heavy precision airdrop technology		[2,500]	
0602787A	27	MEDICAL TECHNOLOGY	67,476		67,476
0602789A	28	ARMY ARTIFICIAL INTELLIGENCE TECHNOLOGY			
0602805A	29	DUAL USE SCIENCE AND TECHNOLOGY			
0603001A	30	WARFIGHTER ADVANCED TECHNOLOGY	50,262	41,000	91,262
		Personal navigation of the future warfighter		[5,000]	
		Warfighter position, location, & tracking sensor		[3,000]	
		Objective Force Warrior technologies		[33,000]	
0603002A	31	MEDICAL ADVANCED TECHNOLOGY	16,590		16,590
0603003A	32	AVIATION ADVANCED TECHNOLOGY	45,404	3,000	48,404
		UAV datalinks		[3,000]	
0603004A	33	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	66,514		66,514
0603005A	34	COMBAT VEHICLE AND AUTOMOTIVE ADVANCED TECHNOLOGY	229,778	41,000	270,778
		Multi-fuel APU program		[3,000]	
		Imp Matls & Powertrain Arch for 21st Century Truck (IMPACT)		[3,000]	
		Networked standardized exchange of product data		[5,000]	
		Mobile parts hospital		[8,000]	
		Rapid prototyping		[2,000]	
		Hybrid electric vehicles		[7,500]	
		Unmanned ground vehicles (UGVs)		[5,000]	
		Active protection system		[7,500]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603006A	35	COMMAND, CONTROL, COMMUNICATIONS ADVANCED TECHNOLOGY	4,826		4,826
0603007A	36	MANPOWER, PERSONNEL AND TRAINING ADVANCED TECHNOLOGY	3,527	2,000	5,527
		Aircrew coordination training		[2,000]	
0603008A	37	ELECTRONIC WARFARE ADVANCED TECHNOLOGY (H)	28,254		28,254
0603009A	38	TRACTOR HIKE	18,069		18,069
0603017A	39	TRACTOR RED			
0603020A	40	TRACTOR ROSE	4,895		4,895
0603105A	41	MILITARY HIV RESEARCH			
0603122A	42	TRACTOR HIP			
0603125A	42a	Combating Terrorism, Technology Development		43,900	43,900
		Language translation (Transfer from DERF)		[7,300]	
		Blue force awareness suite (Transfer from DERF)		[10,000]	
		Remote observation & confirming sensors (Transfer from DERF)		[600]	
		Multi-function remote unattended ground sensor (Transfer from DERF)		[1,500]	
		Laser induced breakdown spectroscopy (Transfer from DERF)		[1,500]	
		Universal soldier sensor (Transfer from DERF)		[8,000]	
		CT echelon surveillance & reconnaissance (Transfer from DERF)		[15,000]	
0603238A	43	GLOBAL SURVEILLANCE/AIR DEFENSE/PRECISION STRIKE TECHNOLOGY DEMONSTRATIOI	31,291		31,291
0603270A	44	EW TECHNOLOGY	11,600		11,600
0603313A	45	MISSILE AND ROCKET ADVANCED TECHNOLOGY	87,890	15,000	102,890
		Loiter attack munition		[15,000]	
0603322A	46	TRACTOR CAGE	3,083		3,083
0603606A	47	LANDMINE WARFARE AND BARRIER ADVANCED TECHNOLOGY	24,104		24,104
0603607A	48	JOINT SERVICE SMALL ARMS PROGRAM	6,013		6,013
0603654A	49	LINE-OF-SIGHT TECHNOLOGY DEMONSTRATION	28,283		28,283

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603710A	50	NIGHT VISION ADVANCED TECHNOLOGY	36,494	7,800	44,294
		Sensors for micro air vehicles		[5,000]	
		High speed target recognition		[2,800]	
0603728A	51	ENVIRONMENTAL QUALITY TECHNOLOGY DEMONSTRATIONS	8,980		8,980
0603734A	52	MILITARY ENGINEERING ADVANCED TECHNOLOGY	2,921	5,000	7,921
		Proton exchange membrane fuel cell demonstration		[5,000]	
0603772A	53	ADVANCED TACTICAL COMPUTER SCIENCE AND SENSOR TECHNOLOGY	21,674		21,674
0603305A	54	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	27,887		27,887
0603308A	55	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION (DEM/VAL)	7,417	14,000	21,417
		Low-cost interceptor flight test demonstrations		[8,000]	
		Supercluster distributed memory technology (SDMT)		[4,000]	
		Family of systems simulators (FOSSIM)		[2,000]	
0603619A	56	LANDMINE WARFARE AND BARRIER - ADV DEV	20,286		20,286
0603627A	57	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ADV DEV	2,432		2,432
0603639A	58	TANK AND MEDIUM CALIBER AMMUNITION	11,354		11,354
0603653A	59	ADVANCED TANK ARMAMENT SYSTEM (ATAS)	124,108	3,000	127,108
		Common remote stabilized sensor system		[3,000]	
0603713A	60	ARMY DATA DISTRIBUTION SYSTEM			
0603747A	61	SOLDIER SUPPORT AND SURVIVABILITY	20,788		20,788
0603766A	62	TACTICAL ELECTRONIC SURVEILLANCE SYSTEM - ADV DEV	16,392		16,392
0603774A	63	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	11,694		11,694
0603779A	64	ENVIRONMENTAL QUALITY TECHNOLOGY DEM/VAL	9,331	1,000	10,331
		Army technology environmental enhancement		[1,000]	
0603782A	65	WARFIGHTER INFORMATION NETWORK-TACTICAL - DEM/VAL	60,809		60,809
0603790A	66	NATO RESEARCH AND DEVELOPMENT	8,773		8,773

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603801A	67	AVIATION - ADV DEV	8,643		8,643
0603802A	68	WEAPONS AND MUNITIONS - ADV DEV	27,761		27,761
0603804A	69	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	11,419		11,419
0603805A	70	COMBAT SERVICE SUPPORT CONTROL SYSTEM EVALUATION AND ANALYSIS	8,971		8,971
0603807A	71	MEDICAL SYSTEMS - ADV DEV	10,398		10,398
0603850A	72	INTEGRATED BROADCAST SERVICE (JMIP/DISTP)	1,962		1,962
0603851A	73	TRACTOR CAGE (DEM/VAL)			
0603854A	74	ARTILLERY SYSTEMS - DEM/VAL	251,665		251,665
0603856A	75	SCAMP BLOCK II DEM/VAL	21,006		21,006
0603869A	76	MEDIUM EXTENDED AIR DEFENSE SYSTEM (MEADS) CONCEPTS - DEM/VAL	117,745	-48,000	69,745
		Lack of internationally agreed-upon plan		[-48,000]	
	76a	Dem/val Test and Evaluation transfer		-5,000	-5,000
0604201A	77	AIRCRAFT AVIONICS	40,308		40,308
0604220A	78	ARMED, DEPLOYABLE OH-58D	1,873		1,873
0604223A	79	COMANCHE	914,932		914,932
0604270A	80	EW DEVELOPMENT	22,819	15,900	38,719
		Prophet block II-IV acceleration (Transfer from DERF)		[15,900]	
0604280A	81	JOINT TACTICAL RADIO	65,818		65,818
0604321A	82	ALL SOURCE ANALYSIS SYSTEM	42,322	12,300	54,622
		FALCON language translator (Transfer from DERF)		[8,000]	
		Analysis & control element (ACE) software development (Transfer from DERF)		[4,300]	
0604328A	83	TRACTOR CAGE	9,800		9,800
0604329A	84	COMMON MISSILE	29,919		29,919
0604601A	85	INFANTRY SUPPORT WEAPONS			
0604604A	86	MEDIUM TACTICAL VEHICLES	1,953		1,953
0604609A	87	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ENG DEV	8,153		8,153

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0604611A	88	JAVELIN	489	6,500	6,989
		Counteractive protection capability		[6,500]	
0604619A	89	LANDMINE WARFARE	11,913		11,913
0604622A	90	FAMILY OF HEAVY TACTICAL VEHICLES	3,990		3,990
0604633A	91	AIR TRAFFIC CONTROL	2,339		2,339
0604641A	92	TACTICAL UNMANNED GROUND VEHICLE (TUGV)			
0604642A	93	LIGHT TACTICAL WHEELED VEHICLES	7,877		7,877
0604645A	94	ARMORED SYSTEMS MODERNIZATION (ASM)-ENG. DEV.	59,860	105,000	164,860
		Future combat system (FCS)		[105,000]	
0604649A	95	ENGINEER MOBILITY EQUIPMENT DEVELOPMENT	8,146		8,146
0604710A	96	NIGHT VISION SYSTEMS - ENG DEV	32,328		32,328
0604713A	97	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	94,474		94,474
0604715A	98	NON-SYSTEM TRAINING DEVICES - ENG DEV	43,650		43,650
0604716A	99	TERRAIN INFORMATION - ENG DEV	8,232		8,232
0604726A	100	INTEGRATED METEOROLOGICAL SUPPORT SYSTEM	3,417		3,417
0604738A	101	JSIMS CORE PROGRAM	24,230	3,000	27,230
		Common component workstation		[3,000]	
0604739A	102	INTEGRATED BROADCAST SERVICE			
0604741A	103	AIR DEFENSE COMMAND, CONTROL AND INTELLIGENCE - ENG DEV	26,978		26,978
0604742A	104	CONSTRUCTIVE SIMULATION SYSTEMS DEVELOPMENT	53,294		53,294
0604746A	105	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	11,839	4,000	15,839
		Digital source collector - health & monitoring system		[4,000]	
0604760A	106	DISTRIBUTIVE INTERACTIVE SIMULATIONS (DIS) - ENGINEERING DEVELOPMENT	21,487		21,487
0604766A	107	TACTICAL SURVEILLANCE SYSTEMS - ENG DEV	56,662		56,662
0604768A	108	BRILLIANT ANTI-ARMOR SUBMUNITION (BAT)	190,293	55,000	245,293
		Earth-penetrating warhead for TACMS (Transfer from DERF)		[55,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0604770A	109	JOINT SURVEILLANCE/TARGET ATTACK RADAR SYSTEM	4,740		4,740
0604778A	110	POSITIONING SYSTEMS DEVELOPMENT (SPACE)			
0604780A	111	COMBINED ARMS TACTICAL TRAINER (CATT) CORE	7,579		7,579
0604783A	112	JOINT NETWORK MANAGEMENT SYSTEM	8,028		8,028
0604801A	113	AVIATION - ENG DEV	3,150		3,150
0604802A	114	WEAPONS AND MUNITIONS - ENG DEV	41,758		41,758
0604804A	115	LOGISTICS AND ENGINEER EQUIPMENT - ENG DEV	65,857		65,857
0604805A	116	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ENG DEV	82,238		82,238
0604807A	117	MEDICAL MATERIEL/MEDICAL BIOLOGICAL DEFENSE EQUIPMENT - ENG DEV	12,625		12,625
0604808A	118	LANDMINE WARFARE/BARRIER - ENG DEV	128,992		128,992
0604814A	119	ARTILLERY MUNITIONS - EMD	70,888		70,888
0604817A	120	COMBAT IDENTIFICATION	1,995		1,995
0604818A	121	ARMY TACTICAL COMMAND & CONTROL HARDWARE & SOFTWARE	80,672	10,000	90,672
		Transfer from A2C2S procurement - APA 26		[10,000]	
0604819A	122	LOSAT	14,463		14,463
0604820A	123	RADAR DEVELOPMENT			
0604823A	124	FIREFINDER	26,122		26,122
0604854A	125	ARTILLERY SYSTEMS - EMD	251,376		251,376
0604865A	126	PATRIOT PAC-3 THEATER MISSILE DEFENSE ACQUISITION - EMD	150,819		150,819
0605013A	127	INFORMATION TECHNOLOGY DEVELOPMENT	50,865		50,865
	127a	EMD Test and Evaluation transfer		-18,000	-18,000
0604256A	128	THREAT SIMULATOR DEVELOPMENT	15,251	3,000	18,251
		Multi-mode top attack threat simulators		[3,000]	
0604258A	129	TARGET SYSTEMS DEVELOPMENT	10,772		10,772
0604759A	130	MAJOR T&E INVESTMENT	53,797	29,000	82,797
		Transfer from acquisition programs		[29,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0605103A	131	RAND ARROYO CENTER	22,148	-5,000	17,148
		Army reports, studies, & analyses		[-5,000]	
0605301A	132	ARMY KWAJALEIN ATOLL	132,831		132,831
0605326A	133	CONCEPTS EXPERIMENTATION PROGRAM	22,627	3,000	25,627
		Battle Lab cooperative R&D		[3,000]	
0605502A	134	SMALL BUSINESS INNOVATIVE RESEARCH			
0605601A	135	ARMY TEST RANGES AND FACILITIES	144,183		144,183
0605602A	136	ARMY TECHNICAL TEST INSTRUMENTATION AND TARGETS	43,222		43,222
0605604A	137	SURVIVABILITY/LETHALITY ANALYSIS	39,200		39,200
0605605A	138	DOD HIGH ENERGY LASER TEST FACILITY	14,410		14,410
0605606A	139	AIRCRAFT CERTIFICATION	4,062		4,062
0605702A	140	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	7,310		7,310
0605706A	141	MATERIEL SYSTEMS ANALYSIS	10,189		10,189
0605709A	142	EXPLOITATION OF FOREIGN ITEMS	3,490		3,490
0605712A	143	SUPPORT OF OPERATIONAL TESTING	99,375		99,375
0605716A	144	ARMY EVALUATION CENTER	41,250		41,250
0605801A	145	PROGRAMWIDE ACTIVITIES	78,452		78,452
0605803A	146	TECHNICAL INFORMATION ACTIVITIES	34,040		34,040
0605805A	147	MUNITIONS STANDARDIZATION, EFFECTIVENESS AND SAFETY	16,014		16,014
0605856A	148	ENVIRONMENTAL COMPLIANCE			
0605857A	149	ENVIRONMENTAL QUALITY TECHNOLOGY MGMT SUPPORT	1,902		1,902
0605898A	150	MANAGEMENT HEADQUARTERS (RESEARCH AND DEVELOPMENT)	11,533		11,533
0909999A	151	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS			
0603778A	152	MLRS PRODUCT IMPROVEMENT PROGRAM	57,825		57,825
0102419A	153	AEROSTAT JOINT PROJECT OFFICE	29,081	4,000	33,081
		Aerostat design & manufacturing (ADAM) program		[4,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0203610A	154	DOMESTIC PREPAREDNESS AGAINST WEAPONS OF MASS DESTRUCTION			
0203726A	155	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	38,161		38,161
0203735A	156	COMBAT VEHICLE IMPROVEMENT PROGRAMS	54,465		54,465
0203740A	157	MANEUVER CONTROL SYSTEM	44,444		44,444
0203744A	158	AIRCRAFT MODIFICATIONS/PRODUCT IMPROVEMENT PROGRAMS	196,794		196,794
0203752A	159	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	3,689	8,000	11,689
		Full authority digital engine controller (FADEC)		[5,000]	
		Liquid or light-end air (LOLA) boost pump		[3,000]	
0203758A	160	DIGITIZATION	28,968		28,968
0203759A	161	FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2)	64,915		64,915
0203761A	162	FORCE XXI, WARFIGHTING RAPID ACQUISITION PROGRAM			
0203801A	163	MISSILE/AIR DEFENSE PRODUCT IMPROVEMENT PROGRAM	43,738		43,738
0203802A	164	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	13,018		13,018
0203808A	165	TRACTOR CARD	8,891		8,891
0208010A	166	JOINT TACTICAL COMMUNICATIONS PROGRAM (TRI-TAC)	14,121		14,121
0208053A	167	JOINT TACTICAL GROUND SYSTEM	2,860		2,860
0301359A	168	SPECIAL ARMY PROGRAM	7,031	4,000	11,031
0303028A	169	SECURITY AND INTELLIGENCE ACTIVITIES	5,438	5,200	10,638
		Language training software		[5,200]	
0303140A	170	INFORMATION SYSTEMS SECURITY PROGRAM	14,844	3,500	18,344
		Integrated information security research		[3,500]	
0303141A	171	GLOBAL COMBAT SUPPORT SYSTEM	71,864		71,864
0303142A	172	SATCOM GROUND ENVIRONMENT (SPACE)	72,244		72,244
0303150A	173	WWMCCS/GLOBAL COMMAND AND CONTROL SYSTEM	17,895		17,895
0305114A	174	TRAFFIC CONTROL, APPROACH AND LANDING SYSTEM-FY 1987 AND PRIOR	977		977

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0305204A	175	TACTICAL UNMANNED AERIAL VEHICLES	46,479	12,100	58,579
		Hunter ground control station (Transfer from DERF)		[12,100]	
0305206A	176	AIRBORNE RECONNAISSANCE SYSTEMS	4,882	3,000	7,882
		Signature-based unattended MASINT sensors (Transfer from DERF)		[3,000]	
0305208A	177	DISTRIBUTED COMMON GROUND SYSTEMS	15,683	21,700	37,383
		Wideband ISR network (Transfer from DERF)		[2,000]	
		MASINT tools (Transfer from DERF)		[2,000]	
		Integrate DCGS-A at EAC (Transfer from DERF)		[5,000]	
		Integrate common data link (CDL) into DCGS-A (Transfer from DERF)		[8,000]	
		MTI / MP-RTIP integration (Transfer from DERF)		[4,700]	
0708045A	178	END ITEM INDUSTRIAL PREPAREDNESS ACTIVITIES	61,025	7,000	68,025
		Manufacturing technologies		[7,000]	
1001018A	179	NATO JOINT STARS	512		512
	179a	Civilian personnel accounting adjustment		-98,161	-98,161
	179b	Financial management savings		-17,700	-17,700
	179c	Contract services savings		-13,700	-13,700
	179d	Operational systems development T&E transfer		-6,000	-6,000
		TOTAL ARMY	**6,918,494**	**382,039**	**7,300,533**

Science and technology for the Objective Force

The Army's ability to meet an accelerated schedule to deploy Future Combat Systems, Objective Force Warrior, and other elements of the Objective Force depends on revolutionary technologies being developed through science and technology investments. The committee strongly supports the goals of Army transformation and therefore recommends an increase of over $200.0 million for science and technology investments to support Army transformation.

The committee recommends an additional $20.0 million in PE 63005A for revolutionary vehicle technologies. Of this amount, $7.5 million would be used to accelerate development of components for hybrid electric drives and hybrid electric vehicles, $5.0 million for robotic follower vehicles for logistics support missions, and $7.5 million for enhanced active protection systems for combat vehicles.

The committee recommends an additional $33.0 million in PE 63001A for Objective Force Warrior technologies. These funds will develop enabling technologies that would reduce the load and increase the lethality of the dismounted soldier. Technologies to be developed include power sources, new materials for body armor, head-mounted sensors, microrobotic vehicles, signature management systems, portable water purification technologies, communications systems, and lightweight weapons and ammunition.

The committee recommends an additional $7.8 million in PE 63710A for advanced night vision technologies. Of this amount, $5.0 million would be used for miniaturized sensors for micro air vehicles, and $2.8 million for enhancing target recognition capabilities of infrared sensor systems.

The committee recommends an additional $20.4 million for new munitions technologies for the Objective Force. Of this amount, $2.4 million would be added in PE 62624A for the development of smaller, lighter, longer range, more lethal warhead technologies, and $3.0 million would be added for the development of revolutionary countermobility systems. An additional $15.0 million would be added to PE 63313A for development of long range, loitering missile technology.

The committee recommends an additional $2.5 million in PE 62786A for new technologies to support heavy airdrop missions. The ability to deliver supplies and other payloads from high altitudes with great precision is a critical part of a lighter, rapidly deployable force.

The committee recommends an additional $7.5 million in PE 62712A for the development of airborne landmine detection systems. Low false alarm rate, airborne minefield detection systems would provide the speed and countermine capabilities necessary for a highly mobile ground force.

Finally, the committee notes that the transformation of the military will demand a transformed defense industrial base. The committee recommends an increase of $7.0 million in PE 78045A for new manufacturing technologies that will help affordably meet the Future Combat System's accelerated schedule. Technologies to be developed include manufacturing processes for low-cost, uncooled infrared sensors, advanced armor systems, microelectromechanical systems (MEMS), and new munitions technologies.

The committee has recommended a number of additional increases for science and technology projects that will support the development of the Objective Force. These are described elsewhere in the report.

The committee notes with concern that the acceleration in the schedule for the fielding of components of the Objective Force was not matched by increases in funding for supporting science and technology programs. The Army must fully fund these programs to ensure that transformation will not be limited, incremental, and unsustainable.

Fundamental research for Army transformation

The budget request included $139.6 million in PE 61102A for programs to perform the critical fundamental research that will provide the foundation for Army transformation. The committee recommends an additional $3.0 million for the development of novel optoelectronic materials and devices for future communication and display technologies; $1.0 million for genetics research using animal models to identify critical physiological differences in personnel that may affect mission performance; and $4.0 million for research on predicting terrain conditions in support of military operations.

The committee directs the Army to continue to support basic research efforts and protect research investments, even in the face of near-term incremental modernization needs and operational costs.

Materials research for the Objective Force

The budget request included $74.9 million in PE 61104A for university and industry research centers. The committee recommends an increase of $4.0 million in basic research to support the development of objective force technologies. Of this amount, $2.5 million would be used for research in modeling and simulation of armor materials design and laser-based materials processing, and $1.5 million would be used for the development of novel ferroelectric materials for miniaturized microwave electronic devices.

Applied materials research for the Objective Force

The budget request included $18.7 million in PE 62105A for applied research in materials technology. The committee recommends an increase of $12.5 million for materials research that would contribute to the development of the Objective Force.

Of this amount, $4.0 million would be used for advanced materials processing research in nanomaterials, polymer composites, metals, ceramics, and superalloys; $2.5 million for research on the reliability of electronic components in smart munitions and ground vehicles; $3.0 million for the development of new multifunctional composite materials and new simulation tools for use in Future Combat Systems; and $3.0 million for low-cost enabling processing technologies for multifunctional materials.

Army missile research

The budget request included $31.9 million in PE 62303A for applied research in missile technology. The committee recommends an increase of $5.0 million for the development of new technologies

for the next generation of Army missile systems. Of this amount, $3.0 million would be used for research on enhanced radar and command and control technologies to improve surveillance and fire control capabilities for short range air defense missions. The remaining $2.0 million would be used for development of lightweight composites for missile chassis to reduce weight and increase the range of future missile systems.

Interactive training technologies

The budget request included $20.6 million in PE 62308A for applied research on advanced concepts and simulation. The committee recommends an additional $2.5 million for the development of interactive technologies to support training and mission rehearsal exercises. The committee notes that this program represents an excellent technology transition opportunity building on the Army's work at the Institute for Creative Technologies.

Advanced coatings research

The budget request included $55.8 million in PE 62601A for applied research on automotive technologies. As part of an overall initiative in corrosion research and development, the committee recommends an increase of $1.5 million for fundamental research to study corrosion and to develop corrosion-resistant coatings.

Fastening and joining research

The budget request included $55.8 million in PE 62601A for applied research on combat vehicles and automotive technologies. The committee recommends an increase of $1.8 million to study and develop new fastening, adhesive, and bonding technologies for improving the safety, quality, and reliability of equipment and machinery in Army systems.

21st Century Truck

The budget request included no funding in PE 62601A for the 21st Century Truck program of the National Automotive Center (NAC). The committee recommends an increase of $22.0 million for this program.

Of this amount, $17.0 million would be provided for the 21st Century Truck base program, and $5.0 million would be provided for continuation of work on hybrid technology under the Commercially-Based Tactical Truck (COMBATT) program.

The 21st Century Truck program is one of several advanced technology programs that is carried out by the NAC and cost-shared with industry in support of the Army's transformation. The primary function of 21st Century Truck is to accelerate development and fielding of advanced, state-of-the-art information and mobility technologies into the military's land warfare systems.

The committee believes the 21st Century Truck program plays a key role in the Army's transformation because of its potential to reduce dramatically the fuel use and emissions of medium and heavy trucks while maintaining or enhancing safety and performance. Integration of advanced commercial technologies, including alternative propulsion technologies, into the Army's land warfare sys-

tems is a critical ingredient for success of the Army's transformation.

Because of the importance of advanced technology development to the Army's transformation and in order to provide a basis for future decisions, the committee directs the NAC to prepare a report that describes how its programs are integrated into the Army's transformation plan. The NAC shall submit the plan to the congressional defense committees by no later than April 30, 2003.

Advanced manufacturing technology

The budget request included $55.8 million in PE 62601A for applied research in combat vehicle and automotive technology. The committee recommends an increase of $5.0 million for research on the development of new automotive manufacturing technologies, including developing advanced materials and manufacturing processes, to support Objective Force vehicle goals.

Tungsten penetrators

The budget request included $38.1 million in PE 62624A for applied research in weapons and munitions technology. The committee recommends an increase of $1.0 million for research on tungsten penetrators for a variety of Future Combat Systems applications. The committee notes that tungsten penetrator materials have the potential to provide an alternative to depleted uranium penetrators without reducing the lethality of munitions.

Portable hybrid power systems

The budget request included $27.4 million in PE 62705A for applied research in electronics and electronic devices. The committee recommends an additional $2.0 million for the development of small, high energy density power systems that support development of personal soldier communications and hybrid electric vehicles. The committee believes that new power technologies are one of the fundamental drivers of Army transformation and are critical to the development of both Future Combat Systems and Objective Warrior technologies.

Landmine detection technologies

The budget request included $13.2 million in PE 62712A for applied research on countermine systems. The Army has a continuing mission to improve the speed and lower the false alarm rate of landmine detection systems. The committee urges the Army to continue to explore all possible technology approaches to landmine detection including acoustic, nuclear, and magnetic techniques. The committee recommends an increase of $2.0 million to develop polymer-based, low-cost, landmine detection systems, and an additional $3.0 million for acoustic technologies for landmine detection.

Environmental restoration technologies

The budget request included $23.0 million in PE 62720A for applied research to develop environmental technologies. The committee recommends an increase of $4.0 million for applied research on remediation technologies associated with recovered unexploded ordnance.

Geosciences and atmospheric research

The budget request included $42.9 million in PE 62784A for Military Engineering Technology. The committee recommends an increase of $2.0 million for research in the environmental sciences, including hydrometeorology, climatology, and remote sensing data fusion techniques. The committee notes that climate and terrain information resulting from geosciences and meteorological research has been critical during operations in Afghanistan.

Stationary fuel cell initiative

The budget request included $42.9 million in PE 62784A for Military Engineering Technology. The committee recommends an additional $10.0 million for the development of stationary fuel cell systems to accelerate the deployment of high efficiency, reliable, high-quality, environmentally benign power through distributed generation systems.

Personal navigation for the Objective Force warrior

The budget request included $50.3 million in PE 63001A for Warfighter Advanced Technology. The committee recommends an increase of $5.0 million to develop microelectromechanical systems (MEMS)-based combination inertial navigation systems and global positioning system (INS/GPS) precision location information systems to support soldiers operating in urban environments. The committee recommends an additional $3.0 million for the development of ultrawideband sensor systems for precise warfighter position and location tracking especially in urban environments.

Unmanned aerial vehicle data links

The budget request included $45.4 million in PE 63003A for Aviation Advanced Technology. The committee notes that recent operations have highlighted the need for better integration of unmanned vehicles into military operations, mobile command and control, and increased situational awareness. Therefore, the committee recommends an increase of $3.0 million to develop data links for unmanned aerial vehicles.

Multi-fuel auxiliary power units

The budget request included $229.8 million in PE 63005A for combat vehicles advanced technology development. The committee recommends an increase of $3.0 million for research to develop auxiliary power units capable of using a variety of military fuels to support the development of smaller, lighter vehicles. The committee notes that reducing the cost and logistical burden of providing power to the battlefield is a key component of Army transformation.

Combat vehicle technology

The budget request included $229.8 million in PE 63005A for Combat Vehicle and Automotive Advanced Technology. The committee recommends an increase of $8.0 million for research and development on advanced combat vehicle technologies to support the goals of Army transformation. Of this amount, $3.0 million would be used for research into corrosion control, lightweight steels,

weight and cost reduction, and vehicle architecture optimization. The remaining $5.0 million would be used for the expansion of the use of standardized product data sets for design and life cycle support activities.

Mobile parts hospital

The budget request included $229.8 million in PE 63005A for advanced automotive technologies. The committee recommends an increase of $8.0 million for the development of a self-contained, mobile manufacturing center that can produce spare parts at the point of need. The committee notes that this type of mobile maintenance and logistics support is critical to the transformation of the Army into a lighter, more rapidly deployable force.

Rapid prototyping

The budget request included $229.8 million in PE 63005A for combat vehicles advanced technology development. The committee recommends an increase of $2.0 million for research to develop new rapid prototyping techniques for the design, development and manufacturing of vehicle parts for future Army systems.

Aircrew coordination training

The budget request included $3.5 million in PE 63007A for advanced technologies for manpower, personnel, and training. The committee recommends an increase of $2.0 million for aircrew coordination training.

Echelon surveillance and reconnaissance

The Defense Emergency Response Fund request included $20.0 million in PE 63125A to demonstrate echelons of surveillance and reconnaissance via sensor suites. The committee recommends a decrease of $5.0 million to this account, reflecting a concern that this program is not part of the overall research and development effort underway by the Army and the Defense Advanced Research Projects Agency (DARPA) to develop Future Combat Systems technology. The committee recommends that counterterrorism and force protection activities to develop sensor networks be coordinated as part of broader joint and Army efforts.

Proton Exchange Membrane Fuel Cell Demonstration

The budget request included $2.9 million for advanced military engineering technologies. The committee recommends an increase of $5.0 million in PE 63734A for the Army Proton Exchange Membrane (PEM) Fuel Cell Demonstration program. New power sources, including fuel cells, are a necessary component of Army transformation.

Low-cost interceptor technology

Army theater air and missile defense long-range interceptors are very capable, but expensive. While some cruise missile threats are sophisticated, most are not, making it more cost effective to deploy large numbers of lower-cost, less capable interceptors for less sophisticated threats. The committee agrees that the Low Cost Interceptor (LCI) technology is necessary for theater air and missile de-

fense. Therefore, the committee recommends an additional $8.0 million for PE 63308A for the research and development of the LCI technology. The proposed funding would promote proof-of-concept LCI flight test demonstrations against a representative low-cost cruise missile threat.

Supercluster Distributed Memory Technology

The computational resources needed to support the Army's Theater Missile Defense (TMD) Computational Fluid Dynamics (CFD) simulations significantly exceed the availability and capability of existing supercomputers. Supercluster Distributed Memory Technology (SDMT) interconnects a number of commercial, high performance workstations into a parallel processing system that would be tailored to the performance requirements of modern CFD codes. CFD software codes have already been written for use with SDMT, which would have the same power as a traditional supercomputer at one-tenth the cost. The committee recognizes the importance of SDMT in the Army's TMD CFD simulations. Therefore, the committee recommends an increase of $4.0 million to PE 63308A for the development and research of SDMT.

Family of Systems Simulation

The budget request included no funding in PE 63308A for Army Family of System Simulation (FOSSIM). The committee understands that FOSSIM provides a common infrastructure for integrating simulation models for use in system level engineering analysis as well as a laboratory environment for simulations that support prototyping. As such, FOSSIM can improve the fidelity of modeling and simulations for Army theater air and missile defense systems and provide more thorough assessments to support both operational effectiveness and acquisition efficiency. To ensure the continuation of this important effort, the committee recommends an increase of $2.0 million for FOSSIM.

Advanced Tank Armament System

The budget request included $124.1 million in PE 63653A for Interim Armored Vehicle (IAV) design refinement efforts and for live fire test and evaluation, initial operational test and evaluation, and production qualification testing on the nuclear, biological and chemical reconnaissance vehicle and the mobile gun system. However, there was no funding requested for the Common Remote Sensor Suite (CRS3) for the reconnaissance vehicle and the fire support vehicle.

The current IAV cupola-mounted system limits the weapon field of fire and the mission equipment package field of view, requiring the soldier to operate both the primary weapon and the mission equipment package from an exposed position. The CRS3, however, allows the soldier to operate both the primary weapon and the mission equipment package from under armor and provides full 360-degree field of fire and field of view for each system. This is a critical capability for soldier protection and mission effectiveness.

Therefore, the committee recommends $3.0 million for the Common Remote Sensor Suite, a total authorization of $127.1 million.

Army technology for environmental enhancement

The budget request included $9.3 million in PE 63779A for demonstrations and validation of environmental quality technology. The committee recommends an additional $1.0 million to complete development and validation of the Managing Army Technologies for Environmental Enhancement (MANATEE) program, an integrated, environmental-monitoring, management and control system. The purpose of MANATEE is to manage facility capabilities to prevent hazardous waste spills and other environmental compliance problems.

Javelin

The budget request included $0.5 million in PE 64611A for Javelin Counter-Active Protection Systems (CAPS) software and hardware improvements. The committee recommends an increase of $6.5 million for the CAPS program, a total authorization of $7.0 million.

Armored systems modernization—engineering development

The budget request included $59.9 million in PE 64645A to begin system development and demonstration of the Future Combat Systems (FCS), the centerpiece of the Army's transformation effort to create the Objective Force. The committee believes that transformation should be the Army's highest priority and is concerned that the Army has not fully funded the necessary research and development effort needed to effect that transformation as quickly as possible. The committee fully supports the Army's attempt to field FCS earlier than previously envisioned, with a first unit equipped date of 2008 and an initial operational capability of 2010. The committee therefore recommends an additional $105.0 million for FCS, a total allocation of $164.9 million. This level of funding still leaves the Army FCS program with a $95.0 million unfunded research and development requirement for fiscal year 2003.

Joint Simulation System Core Program

The budget request included $24.2 million in PE 64738A for the Joint Simulation System (JSIMS), the next generation modeling and simulation tool to support training for the commanders in chief, their components, Joint Task Force staffs, other joint organizations, Department of Defense agencies, and the services. The committee notes that additional funding is required for further development of the Common Component Workstation and therefore recommends an increase of $3.0 million for the Common Component Workstation portion of the JSIMS Core Program, a total authorization of $27.2 million.

Automatic test equipment development

The budget request included $11.8 million in PE 64746A for the development of automatic test equipment, including $7.1 million for the Army Diagnostics Improvement Program (ADIP). ADIP is comprised of embedded diagnostics, the Health and Usage Monitoring System (HUMS), and anticipatory maintenance. HUMS enables self-diagnosis of an aviation platform and the automatic notification of platform degradation or failure to the commander and main-

tenance personnel. HUMS utilizes advances in electronics, sensors, and automation to improve the speed and accuracy of aviation equipment fault isolation resulting in increased savings over the current labor-intensive process. The Army has validated a potential for $1.1 billion in savings once HUMS is procured and fielded. The committee notes that there is a requirement for the HUMS program and urges the Army to accelerate the development of HUMS. Therefore, the committee recommends an increase of $4.0 million for the Health and Usage Monitoring System, a total authorization of $15.8 million.

Multi-mode top attack threat simulators

The budget request included $15.3 million in PE 64256A for threat simulator development. The committee recommends an additional $3.0 million for the development and fielding of realistic, top attack, indirect fire weapons system threat simulators and virtual threat simulations. The committee notes that advanced simulation technologies are critical for the complex technology development and training programs that are integral for Army transformation efforts.

Studies and analyses

The budget request included $22.1 million in PE 65103A for the RAND Arroyo Center. The committee recommends a decrease of $5.0 million to this account. The committee notes that the Army had over $100.0 million in unfunded science and technology requirements to support the development of the Objective Force. The committee believes that these investments should be a higher priority than further studies addressing the national security debate.

Battle Labs cooperative research

The budget request included $22.6 million in PE 65326A for the Concepts Experimentation Program. The committee recommends an increase of $3.0 million for collaboration with university researchers on the development of Future Combat Systems, unmanned robotics, and new and legacy vehicle technologies. The committee notes that collaboration between the Battle Labs and the science and technology community and early experimentation with new technologies and concepts of operation are critical for technology transition and to accelerate the transformation of the Army.

Aerostat for missile defense

Aerostat technology is used in the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor (JLENS) system, an airborne sensor platform which would provide over-the-horizon detection and tracking for land attack cruise missile defense. However, the vulnerability of the JLENS aerostat in extreme climatic conditions is a significant problem for the system. The Aerostat Design and Manufacturing (ADAM) program advances the performance of the aerostat in extreme conditions while reducing costs. The committee agrees that ADAM is important to the JLENS program and recommends an increase of $4.0 million in PE 12419A for ADAM.

Aircraft engine component improvement program

The budget request included $3.7 million in PE 23752A to develop, test, and qualify improvements to aircraft engine components but included no funding to continue the work funded in fiscal year 2002 to further develop the Universal Full Authority Digital Engine Control (FADEC) and the Liquid-or-Light-Air (LOLA) Boost Pump.

The Universal FADEC would apply to all current and future Army turbine engines, significantly reducing procurement costs while enhancing engine and aircraft operability. The Army estimates that qualifying and installing the FADEC would result in cost savings exceeding $100.0 million. More importantly, it would greatly increase the safety of Army aviators through reduced pilot workload.

Similarly, installing the LOLA Boost Pump would increase the safety of Army aviators by preventing potential engine flame-outs and onboard or post-crash fires. Cost savings are estimated at $13.0 million for every $1.0 million invested.

Therefore, the committee recommends an increase of $5.0 million to continue the development and qualification of a Universal FADEC and an increase of $3.0 million to develop the LOLA Boost Pump, a total authorization of $11.7 million.

Technology for language training

The Army is deficient in language specialists for certain critical languages because many specialists are currently dedicated to intelligence functions and therefore are unavailable to interpret for operational personnel. Computer software is being developed to aid these operational personnel so that they can converse with inhabitants in the Central Asia region. The software would translate and develop the vocabulary of the operational personnel while they are deployed. The committee agrees that the ability to communicate effectively with people from Central Asian countries is imperative. Therefore, the committee recommends an increase of $5.2 million in PE 33028A for development of the technology for specialized field communication and language training for non-linguist personnel in Central Asian languages.

Information Systems Security

The budget request included $71.9 million in PE 33140A for the Information Systems Security program. The committee recommends an increase of $3.5 million for the development of information security systems which distribute, protect, and fuse Army digitized information.

Navy

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
		RESEARCH, DEVELOPMENT, TEST & EVALUATION, NAVY			
0601152N	1	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	16,352		16,352
0601153N	2	DEFENSE RESEARCH SCIENCES	393,557	10,000	403,557
		Robotic countermine technologies		[3,000]	
		Marine mammal detection & mitigation		[2,000]	
		Corrosion R&D		[5,000]	
0602111N	3	AIR AND SURFACE LAUNCHED WEAPONS TECHNOLOGY			
0602114N	4	POWER PROJECTION APPLIED RESEARCH	76,612		76,612
0602121N	5	SHIP, SUBMARINE & LOGISTICS TECHNOLOGY			
0602122N	6	AIRCRAFT TECHNOLOGY			
0602123N	7	FORCE PROTECTION APPLIED RESEARCH	89,390	8,500	97,890
		Data fusion processor		[3,000]	
		Corrosion maintenance & airframe readiness technologies		[2,500]	
		Advanced power systems		[2,000]	
		Fiber reinforced polymer composites research		[1,000]	
0602131M	8	MARINE CORPS LANDING FORCE TECHNOLOGY	30,274		30,274
0602232N	9	COMMUNICATIONS, COMMAND AND CONTROL, INTELLIGENCE, SURVEILLANCE			
0602233N	10	HUMAN SYSTEMS TECHNOLOGY			
0602234N	11	MATERIALS, ELECTRONICS AND COMPUTER TECHNOLOGY			
0602235N	12	COMMON PICTURE APPLIED RESEARCH	75,594		75,594
0602236N	13	WARFIGHTER SUSTAINMENT APPLIED RESEARCH	68,852	4,000	72,852
		Ceramic & carbon-based materials		[2,000]	
		Integrated bioenvironmental hazards research program		[2,000]	
0602270N	14	ELECTRONIC WARFARE TECHNOLOGY			

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(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0602271N	15	RF SYSTEMS APPLIED RESEARCH	56,263	12,500	68,763
		Wide bandgap silicon carbide semiconductor research initiative		[2,500]	
		High brightness electron sources		[3,000]	
		Silicon carbide research & technology		[2,500]	
		Advanced semiconductor research		[1,500]	
		Nanoscience & technology		[3,000]	
0602314N	16	UNDERSEA WARFARE SURVEILLANCE TECHNOLOGY			
0602315N	17	MINE COUNTERMEASURES, MINING AND SPECIAL WARFARE			
0602435N	18	OCEAN WARFIGHTING ENVIRONMENT APPLIED RESEARCH	55,180		55,180
0602633N	19	UNDERSEA WARFARE WEAPONRY TECHNOLOGY			
0602747N	20	UNDERSEA WARFARE APPLIED RESEARCH	71,294	3,500	74,794
		Low acoustic signature motors & propulsors		[3,500]	
0602782N	21	MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH	56,813		56,813
0602805N	22	DUAL USE SCIENCE AND TECHNOLOGY PROGRAM			
0603114N	23	POWER PROJECTION ADVANCED TECHNOLOGY	78,247		78,247
0603123N	24	FORCE PROTECTION ADVANCED TECHNOLOGY	57,604	26,000	83,604
		Ship service fuel cell		[2,000]	
		Technology, unmanned surface vehicle (Transfer from DERF)		[24,000]	
0603217N	25	AIR SYSTEMS AND WEAPONS ADVANCED TECHNOLOGY			
0603235N	26	COMMON PICTURE ADVANCED TECHNOLOGY	37,753	7,000	44,753
		Command center visualization (Transfer from DERF)		[7,000]	
0603236N	27	WARFIGHTER SUSTAINMENT ADVANCED TECHNOLOGY	82,542	2,500	85,042
		Corrosion-resistant glass technologies		[2,500]	
0603238N	28	PRECISION STRIKE AND AIR DEFENSE TECHNOLOGY			
0603270N	29	ADVANCED ELECTRONIC WARFARE TECHNOLOGY			

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603271N	30	RF SYSTEMS ADVANCED TECHNOLOGY	65,098	2,000	67,098
		Multifunction antenna systems		[2,000]	
0603508N	31	SURFACE SHIP & SUBMARINE HM&E ADVANCED TECHNOLOGY		6,000	6,000
		Laser welding & cutting demonstration		[6,000]	
0603640M	32	MARINE CORPS ADVANCED TECHNOLOGY DEMONSTRATION (ATD)	51,606		51,606
0603706N	33	MEDICAL DEVELOPMENT			
0603707N	34	MANPOWER, PERSONNEL AND TRAINING ADV TECH DEV			
0603712N	35	ENVIRONMENTAL QUALITY AND LOGISTICS ADVANCED TECHNOLOGY		4,000	4,000
		National Surface Treatment Center		[4,000]	
0603727N	36	NAVY TECHNICAL INFORMATION PRESENTATION SYSTEM	97,872		97,872
0603729N	37	WARFIGHTER PROTECTION ADVANCED TECHNOLOGY	19,040		19,040
0603747N	38	UNDERSEA WARFARE ADVANCED TECHNOLOGY	40,125		40,125
0603758N	39	NAVY WARFIGHTING EXPERIMENTS AND DEMONSTRATIONS	43,460		43,460
0603782N	40	MINE AND EXPEDITIONARY WARFARE ADVANCED TECHNOLOGY	43,725	3,000	46,725
		Mine countermeasures		[3,000]	
0603792N	41	ADVANCED TECHNOLOGY TRANSITION			
0603794N	42	C3 ADVANCED TECHNOLOGY			
0603207N	43	AIR/OCEAN TACTICAL APPLICATIONS	32,549		32,549
0603216N	44	AVIATION SURVIVABILITY	7,486	4,000	11,486
		Aircrew modular helmet		[4,000]	
0603237N	45	DEPLOYABLE JOINT COMMAND AND CONTROL	39,772	7,500	47,272
		Fully fund DJCC centers (Transfer from DERF)		[7,500]	
0603254N	46	ASW SYSTEMS DEVELOPMENT	13,207		13,207
0603261N	47	TACTICAL AIRBORNE RECONNAISSANCE	1,922		1,922
0603382N	48	ADVANCED COMBAT SYSTEMS TECHNOLOGY	3,350		3,350

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603502N	49	SURFACE AND SHALLOW WATER MINE COUNTERMEASURES	155,016		155,016
0603506N	50	SURFACE SHIP TORPEDO DEFENSE	3,244		3,244
0603512N	51	CARRIER SYSTEMS DEVELOPMENT	88,913		88,913
0603513N	52	SHIPBOARD SYSTEM COMPONENT DEVELOPMENT	243,111	10,000	253,111
		Electric start for gas turbine engines		[5,000]	
		COTS-style airbag technology for surface torpedo launch		[5,000]	
0603525N	53	PILOT FISH	72,637		72,637
0603527N	54	RETRACT LARCH	28,482		28,482
0603542N	55	RADIOLOGICAL CONTROL	1,078		1,078
0603553N	56	SURFACE ASW	3,219		3,219
0603559N	57	SSGN CONVERSION	82,527		82,527
0603561N	58	ADVANCED SUBMARINE SYSTEM DEVELOPMENT	107,389	5,900	113,289
		Electromechanical actuator development		[1,900]	
		Electric motor brush technology		[4,000]	
0603562N	59	SUBMARINE TACTICAL WARFARE SYSTEMS	11,601		11,601
0603563N	60	SHIP CONCEPT ADVANCED DESIGN	5,820		5,820
0603564N	61	SHIP PRELIMINARY DESIGN & FEASIBILITY STUDIES	2,983		2,983
0603570N	62	ADVANCED NUCLEAR POWER SYSTEMS	216,091		216,091
0603573N	63	ADVANCED SURFACE MACHINERY SYSTEMS	2,931		2,931
0603576N	64	CHALK EAGLE	20,978		20,978
0603582N	65	COMBAT SYSTEM INTEGRATION	40,464		40,464
0603609N	66	CONVENTIONAL MUNITIONS	22,445	-4,000	18,445
		Reduce unexplained warhead development		[-4,000]	
0603611M	67	MARINE CORPS ASSAULT VEHICLES	272,092		272,092
0603612M	68	MARINE CORPS MINE/COUNTERMEASURES SYSTEMS - ADV DEV	497		497

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603635M	69	MARINE CORPS GROUND COMBAT/SUPPORT SYSTEM	27,777	2,800	30,577
		Lightweight 155mm howitzer testing		[2,800]	
0603654N	70	JOINT SERVICE EXPLOSIVE ORDNANCE DEVELOPMENT	12,877		12,877
0603658N	71	COOPERATIVE ENGAGEMENT	86,144		86,144
0603713N	72	OCEAN ENGINEERING TECHNOLOGY DEVELOPMENT	15,257		15,257
0603721N	73	ENVIRONMENTAL PROTECTION	44,206		44,206
0603724N	74	NAVY ENERGY PROGRAM	5,060	5,000	10,060
		Navy fuel cell technology program		[5,000]	
0603725N	75	FACILITIES IMPROVEMENT	2,124	2,500	4,624
		Continue ongoing demonstration of renewable energy use		[2,500]	
0603734N	76	CHALK CORAL	50,704	16,400	67,104
		Classified program (Transfer from DERF)		[5,000]	
		Classified program (Transfer from DERF)		[11,400]	
0603739N	77	NAVY LOGISTIC PRODUCTIVITY	13,023		13,023
0603746N	78	RETRACT MAPLE	212,506	64,000	276,506
		Classified program (Transfer from DERF)		[64,000]	
0603748N	79	LINK PLUMERIA	82,909		82,909
0603751N	80	RETRACT ELM	21,900		21,900
0603755N	81	SHIP SELF DEFENSE - DEM/VAL	5,930		5,930
0603764N	82	LINK EVERGREEN	55,971		55,971
0603787N	83	SPECIAL PROCESSES	39,756		39,756
0603790N	84	NATO RESEARCH AND DEVELOPMENT	11,581		11,581
0603795N	85	LAND ATTACK TECHNOLOGY	108,693		108,693
0603800N	86	JOINT STRIKE FIGHTER (JSF) - DEM/VAL			
0603851M	87	NONLETHAL WEAPONS - DEM/VAL	24,082	2,000	26,082
		Urban operations environmental research		[2,000]	

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Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603857N	88	ALL SERVICE COMBAT IDENTIFICATION EVALUATION TEAM (ASCIET)	14,414		14,414
0603860N	89	JOINT PRECISION APPROACH AND LANDING SYSTEMS - DEM/VAL	11,932		11,932
0603879N	90	SINGLE INTEGRATED AIR PICTURE (SIAP) SYSTEM ENGINEER (SE)	73,966		73,966
0603889N	91	COUNTERDRUG RDT&E PROJECTS			
0604707N	92	SPACE AND ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT	31,623		31,623
	92a	Dem/val Test and Evaluation transfer		-15,000	-15,000
0603662N	93	FOREIGN COUNTER-INTELLEGENCE (FCI	[ ]	[ ]	[ ]
0603787N	94	SPECIAL PROCESSES	[ ]	[ ]	[ ]
0603831N	95	CLASSIFIED PROGRAMS	[ ]	[ ]	[ ]
0604212N	96	OTHER HELO DEVELOPMENT	31,123	1,500	32,623
		VH-3D/VH-60D comm upgrade (Transfer from DERF)		[1,500]	
0604214N	97	AV-8B AIRCRAFT - ENG DEV	18,565		18,565
0604215N	98	STANDARDS DEVELOPMENT	37,757		37,757
0604216N	99	MULTI-MISSION HELICOPTER UPGRADE DEVELOPMENT	88,969		88,969
0604217N	100	S-3 WEAPON SYSTEM IMPROVEMENT	422		422
0604218N	101	AIR/OCEAN EQUIPMENT ENGINEERING	5,725		5,725
0604221N	102	P-3 MODERNIZATION PROGRAM	2,348		2,348
0604231N	103	TACTICAL COMMAND SYSTEM	81,475	-12,000	69,475
		Reduce FORCEnet effort that duplicates other R&D activities		[-12,000]	
0604234N	104	E-2C RADAR MODERNIZATION	113,681		113,681
0604245N	105	H-1 UPGRADES	241,384		241,384
0604261N	106	ACOUSTIC SEARCH SENSORS	13,929		13,929
0604262N	107	V-22A	420,109		420,109
0604264N	108	AIR CREW SYSTEMS DEVELOPMENT	6,695		6,695
0604270N	109	EW DEVELOPMENT	74,742		74,742
0604280N	110	JOINT TACTICAL RADIO SYSTEM - NAVY (JTRS-NAVY)	20,373		20,373

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0604300N	111	SC-21 TOTAL SHIP SYSTEM ENGINEERING	717,397	3,000	720,397
		Power node control center (PNCC)		[3,000]	
0604307N	112	SURFACE COMBATANT COMBAT SYSTEM ENGINEERING	300,748	5,000	305,748
		DDG optimized manning initiative		[5,000]	
0604311N	113	LPD-17 CLASS SYSTEMS INTEGRATION	10,133		10,133
0604312N	114	TRI-SERVICE STANDOFF ATTACK MISSILE	14,943		14,943
0604329N	115	SMALL DIAMETER BOMB (SDB)	1,989		1,989
0604366N	116	STANDARD MISSILE IMPROVEMENTS	16,288	5,000	21,288
		Advanced optical correlator		[5,000]	
0604373N	117	AIRBORNE MCM	67,240		67,240
0604503N	118	SSN-688 AND TRIDENT MODERNIZATION	98,516		98,516
0604504N	119	AIR CONTROL	4,951		4,951
0604507N	120	ENHANCED MODULAR SIGNAL PROCESSOR	513		513
0604512N	121	SHIPBOARD AVIATION SYSTEMS	24,619		24,619
0604518N	122	COMBAT INFORMATION CENTER CONVERSION			
0604524N	123	SUBMARINE COMBAT SYSTEM			
0604558N	124	NEW DESIGN SSN	238,253		238,253
0604561N	125	SSN-21 DEVELOPMENTS	3,981		3,981
0604562N	126	SUBMARINE TACTICAL WARFARE SYSTEM	13,975	20,000	33,975
		Upgrade combat control software to commercial architecture		[20,000]	
0604567N	127	SHIP CONTRACT DESIGN/LIVE FIRE T&E	184,545	8,100	192,645
		Unexplained increases in manpower & training studies		[-1,900]	
		LHA[R] -- Transfer from LHD-1 AP (SCN 15)		[10,000]	
0604574N	128	NAVY TACTICAL COMPUTER RESOURCES	2,185		2,185
0604601N	129	MINE DEVELOPMENT	1,491		1,491
0604603N	130	UNGUIDED CONVENTIONAL AIR-LAUNCHED WEAPONS	12,142		12,142

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0604610N	131	LIGHTWEIGHT TORPEDO DEVELOPMENT	7,769	5,500	13,269
		Align lightweight & heavyweight torpedo baselines for comonality		[5,500]	
0604618N	132	JOINT DIRECT ATTACK MUNITION	48,861		48,861
0604654N	133	JOINT SERVICE EXPLOSIVE ORDNANCE DEVELOPMENT	7,781		7,781
0604703N	134	PERSONNEL, TRAINING, SIMULATION, AND HUMAN FACTORS	1,331		1,331
0604710N	135	NAVY ENERGY PROGRAM	5,691		5,691
0604721N	136	BATTLE GROUP PASSIVE HORIZON EXTENSION SYSTEM	14,070	5,000	19,070
		Cooperative Outboard logistics update (COBLU) digital upgrade		[5,000]	
0604727N	137	JOINT STANDOFF WEAPON SYSTEMS	16,652		16,652
0604755N	138	SHIP SELF DEFENSE (DETECT CONTROL)	61,966	5,000	66,966
		Continue SEARAM ordnance alteration development		[5,000]	
0604756N	139	SHIP SELF DEFENSE (ENGAGE: HARD KILL)	19,528		19,528
0604757N	140	SHIP SELF DEFENSE (ENGAGE: SOFT KILL/EW)	28,064	11,845	39,909
		AIEWS cancellation - shift to EW improvement		[-25,855]	
		Shipboard electronic warfare improvement		[27,500]	
		NULKA decoy improvements		[9,200]	
		Radar tiles for reduced surface ship signatures		[1,000]	
0604771N	141	MEDICAL DEVELOPMENT	7,154	925	8,079
		Security equipment for medical labs (Transfer from DERF)		[475]	
		Site improvement for medical labs (Transfer from DERF)		[450]	
0604777N	142	NAVIGATION/ID SYSTEM	46,618		46,618
0604784N	143	DISTRIBUTED SURVEILLANCE SYSTEM	35,861		35,861
0604800N	144	JOINT STRIKE FIGHTER (JSF) - EMD	1,727,500		1,727,500
0604910N	145	SMART CARD	711		711
0605013M	146	INFORMATION TECHNOLOGY DEVELOPMENT	8,079		8,079

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0605013N	147	INFORMATION TECHNOLOGY DEVELOPMENT	43,213	7,000	50,213
		Human resource enterprise strategy		[7,000]	
0605014N	148	DEFENSE INTEGRATED MILITARY HUMAN RESOURCES SYSTEM (DIMHRS)	51,297		51,297
0605015N	149	JOINT COUNTER-INTELLIGENCE ASSESSMENT GROUP (JCAG) - RDT&E	2,337		2,337
0605500N	150	MULTI-MISSION MARITIME AIRCRAFT (MMA)	74,531		74,531
0508713N	151	NAVY STANDARD INTEGRATED PERSONNEL SYSTEM (NSIPS)	12,798		12,798
	151a	EMD Test and Evaluation transfer		-32,000	-32,000
0604256N	152	THREAT SIMULATOR DEVELOPMENT	30,599		30,599
0604258N	153	TARGET SYSTEMS DEVELOPMENT	45,562		45,562
0604759N	154	MAJOR T&E INVESTMENT	42,453	64,000	106,453
		Transfer from acquisition programs		[64,000]	
0605152N	155	STUDIES AND ANALYSIS SUPPORT - NAVY	4,071		4,071
0605154N	156	CENTER FOR NAVAL ANALYSES	45,435	-5,000	40,435
		Navy reports, studies, & analyses		[-5,000]	
0605155N	157	FLEET TACTICAL DEVELOPMENT	2,771		2,771
0605502N	158	SMALL BUSINESS INNOVATIVE RESEARCH			
0605804N	159	TECHNICAL INFORMATION SERVICES	929		929
0605853N	160	MANAGEMENT, TECHNICAL & INTERNATIONAL SUPPORT	50,787	2,000	52,787
		Combating terrorism wargaming & research		[2,000]	
0605856N	161	STRATEGIC TECHNICAL SUPPORT	2,340		2,340
0605861N	162	RDT&E SCIENCE AND TECHNOLOGY MANAGEMENT	59,447		59,447
0605862N	163	RDT&E INSTRUMENTATION MODERNIZATION	13,289		13,289
0605863N	164	RDT&E SHIP AND AIRCRAFT SUPPORT	71,519		71,519
0605864N	165	TEST AND EVALUATION SUPPORT	278,838		278,838
0605865N	166	OPERATIONAL TEST AND EVALUATION CAPABILITY	12,642		12,642
0605866N	167	NAVY SPACE AND ELECTRONIC WARFARE (SEW) SUPPORT	3,242		3,242

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0605867N	168	SEW SURVEILLANCE/RECONNAISSANCE SUPPORT	12,120		12,120
0605873M	169	MARINE CORPS PROGRAM WIDE SUPPORT	12,208		12,208
0305885N	170	TACTICAL CRYPTOLOGIC ACTIVITIES			
0909998N	171	PROBLEM DISBURSEMENTS			
0909999N	172	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS			
0603660N	173	ADVANCED DEVELOPMENT PROJECTS	[ ]	[ ]	[ ]
0603661N	174	RETRACT VIOLET	[ ]	[ ]	[ ]
0604805N	175	COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE			
0101221N	176	STRATEGIC SUB & WEAPONS SYSTEM SUPPORT	40,278	69,900	110,178
		Maneuvering reentry vehicle demonstration (Transfer from DERF)		[30,000]	
		Solid rocket motor static test fire demonstrations (Transfer from DERF)		[7,500]	
		Guidance applications program (Transfer from DERF)		[14,400]	
		Radiation hardening program (Transfer from DERF)		[18,000]	
0101224N	177	SSBN SECURITY TECHNOLOGY PROGRAM	34,567		34,567
0101226N	178	SUBMARINE ACOUSTIC WARFARE DEVELOPMENT	1,091		1,091
0101402N	179	NAVY STRATEGIC COMMUNICATIONS	21,452		21,452
0204136N	180	F/A-18 SQUADRONS	204,466	15,000	219,466
		F414 engine durability improvements		[15,000]	
0204152N	181	E-2 SQUADRONS	19,011		19,011
0204163N	182	FLEET TELECOMMUNICATIONS (TACTICAL)	12,576		12,576
0204229N	183	TOMAHAWK AND TOMAHAWK MISSION PLANNING CENTER (TMPC)	94,265	5,000	99,265
		Precision terrain aided navigation		[5,000]	
0204311N	184	INTEGRATED SURVEILLANCE SYSTEM	20,405		20,405
0204413N	185	AMPHIBIOUS TACTICAL SUPPORT UNITS	6,352		6,352
0204571N	186	CONSOLIDATED TRAINING SYSTEMS DEVELOPMENT	31,421		31,421

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0204575N	187	ELECTRONIC WARFARE (EW) READINESS SUPPORT	6,731	31,000	37,731
		Virtual environment for warfighter (VIEW)		[2,000]	
		Retract Barley (Transfer from DERF)		[20,000]	
		Information warfare system (Transfer from DERF)		[9,000]	
0205601N	188	HARM IMPROVEMENT	60,758		60,758
0205604N	189	TACTICAL DATA LINKS	42,667		42,667
0205620N	190	SURFACE ASW COMBAT SYSTEM INTEGRATION	24,424		24,424
0205632N	191	MK-48 ADCAP	22,052		22,052
0205633N	192	AVIATION IMPROVEMENTS	40,915		40,915
0205658N	193	NAVY SCIENCE ASSISTANCE PROGRAM	4,801		4,801
0205667N	194	F-14 UPGRADE			
0205675N	195	OPERATIONAL NUCLEAR POWER SYSTEMS	56,804		56,804
0206313M	196	MARINE CORPS COMMUNICATIONS SYSTEMS	174,664	12,800	187,464
		Technical control & analysis center (TCAC) (Transfer from DERF)		[2,500]	
		MANPACK secondary imagery dissem sys (SIDS) (Transfer from DERF)		[300]	
		Team portable collection system (TPCS) (Transfer from DERF)		[3,400]	
		I-SURSS (Transfer from DERF)		[2,500]	
		Radio reconnaissance equipment program (RREP) (Transfer from DERF)		[300]	
		COTS hardware / software for TENCAP (Transfer from DERF)		[1,500]	
		Tactical exploitation group (TEG) (Transfer from DERF)		[1,000]	
		ISR spares & software updates (Transfer from DERF)		[1,200]	
		Tactical photography equipment (Transfer from DERF)		[100]	
0206623M	197	MARINE CORPS GROUND COMBAT/SUPPORTING ARMS SYSTEMS	36,004	1,900	37,904
		Target location designation & hand-off system (TLDHS)		[1,900]	
0206624M	198	MARINE CORPS COMBAT SERVICES SUPPORT	21,041		21,041
0207161N	199	TACTICAL AIM MISSILES	1,957		1,957

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0207163N	200	ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE (AMRAAM)	8,124		8,124
0301303N	201	MARITIME INTELLIGENCE	[ ]	[ ]	[ ]
0301303N	202	COLLECTION MANAGEMENT	[ ]	[ ]	[ ]
0303109N	203	TECHNICAL RECONNAISSANCE AND SURVEILLANCE	[ ]	[ ]	[ ]
0303109N	204	SATELLITE COMMUNICATIONS (SPACE)	115,903		115,903
0303140N	205	INFORMATION SYSTEMS SECURITY PROGRAM	18,436		18,436
0304111N	206	SPECIAL ACTIVITIES	[ ]	[ ]	[ ]
0305160N	207	NAVY METEOROLOGICAL AND OCEAN SENSORS-SPACE (METOC)	19,801		19,801
0305188N	208	JOINT C4ISR BATTLE CENTER (JBC)	21,970	5,000	26,970
		Strategic interoperability initiative		[5,000]	
0305192N	209	JOINT MILITARY INTELLIGENCE PROGRAMS	6,709		6,709
0305204N	210	TACTICAL UNMANNED AERIAL VEHICLES	206,359	45,300	251,659
		Integrate Global Hawk into tactical control system (TCS)		[10,000]	
		Develop USMC Shadow (Adv) (Transfer from DERF)		[7,000]	
		ISR (BAMS UAV) / classified (Transfer from DERF)		[28,300]	
0305206N	211	AIRBORNE RECONNAISSANCE SYSTEMS	5,469		5,469
0305207N	212	MANNED RECONNAISSANCE SYSTEMS	11,166		11,166
0305208N	213	DISTRIBUTED COMMON GROUND SYSTEMS	4,482	3,000	7,482
		Joint service imagery processing system development (Transfer from DERF)		[3,000]	
0305927N	214	NAVAL SPACE SURVEILLANCE	9,548		9,548
0308601N	215	MODELING AND SIMULATION SUPPORT	7,783	4,700	12,483
		Modeling & simulation initiatives for interoperability		[4,700]	
0702207N	216	DEPOT MAINTENANCE (NON-IF)	7,119		7,119
0708011N	217	INDUSTRIAL PREPAREDNESS	70,631		70,631
0708730N	218	MARITIME TECHNOLOGY (MARITECH)	9,943	4,000	13,943
		Maritime technology research		[4,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
	999	CLASSIFIED PROGRAMS	1,178,723		1,178,723
	218a	Civilian personnel accounting adjustment		-5,565	-5,565
	218b	Financial management savings		-25,600	-25,600
	218c	Contract services savings		-6,900	-6,900
	218d	Operational systems development T&E transfer		-17,000	-17,000
		TOTAL NAVY	**12,501,630**	**427,505**	**12,929,135**

Robotic countermine technology

The budget request included $393.6 million in PE 61153N for general research addressing naval applications. The committee recommends an additional $3.0 million for research specific to autonomous robotic countermine technology. This technology would support the development of effective countermine capabilities in very shallow water and in surf zones.

Marine mammal detection and mitigation

The budget request included $393.6 million in PE 61153N for basic research to support naval applications. The committee recommends an additional $2.0 million for basic research on a system that would detect the presence of marine mammals and take mitigating action to allow Navy sonar training in the open sea and littorals to continue. This research is critical in light of recent Navy studies that have indicated that active sonar training may have a negative effect on marine mammals.

Corrosion research

The committee notes the huge expense incurred by the Department of Defense annually to pay repair and maintenance costs due to the effects of corrosion on platforms, weapons systems, facilities, and other infrastructure. New research in corrosion prevention technologies, including new materials, paints, coatings, sensors for inspection and monitoring, and manufacturing technologies can help to reduce these costs for future systems and develop technologies that can be quickly transitioned into operational systems. Fundamental research on corrosion processes and corrosion mitigation technologies will also serve in developing technologies for use in the commercial sector as well as in training the next generation of corrosion engineers.

In order to support these efforts, and as part of the larger corrosion initiative described in Title III, the committee recommends an increase of $23.5 million across the Department of Defense in corrosion research. This includes an increase of $5.0 million to PE 61153N for fundamental research on corrosion processes and materials technologies to reduce corrosion; $2.5 million in PE 63236N for the development of glass technologies to improve the corrosion resistance of metals; $2.5 million in PE62123N for research on coating technologies and repair techniques to address corrosion maintenance and airframe readiness issues; and an additional $4.0 million in PE 63712N for the development of new technologies and coordination of information on surface coatings and their applications to naval systems.

The committee also recommends an additional $9.5 million in Army and Air Force corrosion and coating research as described elsewhere in the report.

Data fusion

The budget request included $89.3 million in PE 62123N for Force Protection Applied Research. The committee recommends an increase of $3.0 million for the development of a dedicated data fusion processor and its algorithms, which will lead to the ability to fuse hyperspectral and panchromatic data.

Advanced power systems

The budget request included $89.4 million in PE 62123N for applied research in force protection technologies. The committee recommends an additional $2.0 million for research on materials, including power semiconductors and superconductors, and control systems to support the development of the next generation of all-electric power systems for the Navy.

Polymer composites research

The budget request included $89.4 million in PE 62123N for applied research in force protection technologies. The committee recommends an additional $1.0 million for research on the design and manufacturing of fiber reinforced polymer composites for naval applications.

Bioenvironmental hazards research

The budget request included $68.9 million in PE 63236N for Warfighter Sustainment Applied Research. The committee recommends an increase of $2.0 million for bioenvironmental hazards research, including the development of biosensors and biomarkers.

Navy materials research

The budget request included $68.9 million in PE 62236N for applied research on warfighter sustainment technologies. The committee recommends an increase of $2.0 million for applied research on ceramic and carbon-based composite materials for use in strategic missiles and hypersonic vehicles.

Electronics research for naval applications

The budget request included $56.3 million in PE 62271N for applied research in radio frequency systems. The committee recommends an increase of $12.5 million for applied research in materials and electronics that will enable future naval technologies. Of this amount, $2.5 million would be used for research on wide bandgap semiconductor materials and devices for application in advanced power electronics, communications, and sensor systems; $3.0 million for research on high brightness electron sources for vacuum electronics applications; $2.5 million for silicon carbide materials and device research; $1.5 million for advanced semiconductor materials research for high power amplifiers; and $3.0 million for the development of nanoscale magneto-electric structures and devices for data storage and sensing applications.

Low acoustic signature motors and propulsors

The budget request included $71.3 million in PE 62747N for applied research to support the development of undersea warfare technologies. The committee recommends an increase of $3.5 million for research on high power battery systems, motors, propulsors, and power converters for torpedoes.

Ship service fuel cell technology

The budget request included $57.6 million in PE 63123N for Force Protection Advanced Technology. The committee supports the development of energy-efficient power plants for future use on

naval vessels to reduce costs. The committee recommends an increase of $2.0 million for the development of a ship service fuel cell power plant to be deployed on future surface combatants.

Unmanned surface vehicles

The budget request for the Defense Emergency Response Fund, Counter Terrorism/Force Protection activity included $36.0 million for unmanned surface vessels (USVs). These funds would be used to convert three existing rigid hull inflatable boats (RHIBs) into USVs. The Navy believes that such vehicles could be applied to force protection missions and intelligence, surveillance and reconnaissance (ISR) activities. The Navy also believes that such USVs could be outfitted with weapons to provide security functions in naval harbor and port facilities. Although the committee believes that these potential applications are worth exploring, it is not clear why the Navy needs to convert three RHIBs to USVs before developing the concepts of operations and employment and before conducting a more limited demonstration with a couple of such vessels. Therefore, the committee recommends a decrease of $12.0 million in this activity. The committee recommends that the remaining $24.0 million be transferred to PE 63123N, as requested by the Department.

Multifunction antenna systems

The budget request included $65.1 million in PE 63271N for advanced technologies for radio frequency systems. The committee recommends an additional $2.0 million for modeling and hardware to support integrated multifunction antenna technologies for current and future naval platforms.

Laser welding and cutting for ship manufacturing

The budget request included no funds in PE 63508N for demonstration and validation of laser welding and cutting to reduce the cost of building ships. A laser cutting technique was proven through the maritime technology program as a viable means of reducing the costs of preparing materials for naval ship construction welding. The Navy is in the process of taking the next step in applying laser cutting techniques to challenging shapes for components for naval ships.

Improvements in laser welding and cutting technology have the potential to reduce the cost of manufacturing the smaller ship components that require more precision than larger sheets of steel or aluminum. The current process that cuts small components out of I-beams creates an amount of useless scrap and is not precise. More effective use of laser welding and cutting has the potential to reduce the scrap and cut precise parts by cutting components from sheets of metal instead of I-beams. Therefore, the committee recommends an increase of $6.0 million in PE 63508N to continue the development and testing of laser welding and cutting to reduce the cost of ship construction.

Ocean modeling research for mine and expeditionary warfare

The budget request included $43.7 million in PE 63782N for various mine and expeditionary warfare advanced technology efforts, including ocean modeling and simulation to provide concept-based assessments for organic mine countermeasures. The committee recommends an increase of $3.0 million to expand the network of sensors and continue ocean modeling research. The Navy established a limited network of sensors for ocean modeling and simulation to collect key information including current and eddy flow, bottom contour and content, thermal layer behavior, and cold water phenomena. The Navy needs additional sensors to provide effective undersea and expeditionary warfare environmental information in the form of situational awareness predictions for regional commanders in chief (CINCs) and tactical commanders.

Aviation survivability

The budget request included $7.5 million in PE 63216N for aviation survivability but included no funding for developing the Navy's integrated common display helmet concept. This helmet concept would consist of a common inner helmet shell to which mission-specific equipment would attach, making it more efficient for the Navy to field newer technologies. Such a common helmet approach could help reduce stress on aircrews and make it easier for the Navy to field newer technologies more efficiently.

The committee recommends an increase of $4.0 million in PE 63216N for the development and flight evaluation of the Navy common display helmet, a total authorization of $11.5 million for aviation survivability. The committee also encourages the Navy to take Air Force requirements into account in this development to allow for joint service applications.

Gas turbine engine electric start to reduce ship maintenance

The budget request included no funds in PE 63513N for demonstration and validation of an electric start system for gas turbine engines on Navy ships. An electric start capability has the potential to reduce maintenance costs and provide a more flexible emergency start capability for gas turbine generators and propulsion engines. Therefore, the committee recommends an increase of $5.0 million in PE 63513N for the development and test of electric start for gas turbine generators and propulsion engines on Navy ships.

Surface vessel torpedo tubes

The budget request included no funds in PE 63513N for developing better torpedo tube technology for surface ships. The Navy has been managing a Small Business Innovative Research (SBIR) project to develop a modular, gas generator launch canister. This project is employing commercial, off-the-shelf (COTS), automobile-style air bags for launch energy. Employing such long shelf life COTS components could greatly reduce the maintenance burden of keeping air flask-based torpedo tubes in operational condition. Therefore, the committee recommends an increase of $5.0 million

in PE 63513N for the development of an improved launch capability for surface vessel torpedo tubes.

Electromechanical actuators

The budget request included no funds for continuing a Small Business Innovation Research (SBIR) initiative to replace maintenance-intensive, hydraulic valve actuators with electromechanical actuators. The SBIR program demonstrated the potential for electromechanical actuators to increase reliability, decrease maintenance, and reduce total operating costs for ships and submarines. Therefore, the committee recommends an increase of $1.9 million in PE 63561N to continue the SBIR initiative to replace hydraulic actuators with electromechanical actuators.

Reducing maintenance by improving brushes on electric motors

The budget request included $1.7 million in PE 63561N to install a set of advanced metal fiber brushes on a ship service motor generator set in a submarine. Metal fiber brushes have demonstrated, through a Navy-sponsored, phase II Small Business Innovative Research (SBIR) program, the capability to significantly enhance performance and reduce maintenance costs on Navy motors and generators. The systematic approach for certifying the technology requires certification for varying motor and generator capacities. Therefore, the committee recommends an increase of $4.0 million to test and certify advanced metal fiber brush technology to reduce maintenance and improve reliability of motors and generators.

Reducing unspecified development

The budget request included $17.7 million in PE 63609N for conventional fuze and warhead package improvements. Of this amount, $7.0 million is included to initiate unspecified conventional munitions advanced warhead developments. In addition to the efforts included in PE 63609N, conventional munitions warhead development is included in other procurement and research and development efforts for specific weapons authorized elsewhere in this bill.

Warhead improvements to fielded systems based on evolving threats and correction of reported problem areas are strongly supported by the committee. However, the committee is not inclined to support what appears to be funding that is duplicated elsewhere in the budget. Therefore, the committee recommends a decrease of $4.0 million in PE 63609N for unspecified warhead development.

Lightweight 155mm howitzer

The budget request included $11.6 million in PE 63635M for developing and testing the lightweight 155mm howitzer. The Marine Corps is developing this system on its own behalf and on behalf of the Army to provide greater firepower and mobility for its artillery forces.

The Marine Corps plans to begin low-rate initial production in fiscal year 2003, leading to operational testing of production guns in fiscal year 2004. The committee believes that the potential improvements promised by this howitzer program are important and

that the Marine Corps should conduct developmental testing to ensure a smooth transition to a successful operational evaluation. Such testing should include additional firings and other testing to demonstrate that endurance and other maintainability goals will be achieved. Therefore, the committee recommends an increase of $2.8 million in PE 63635M to conduct additional testing within the lightweight 155mm howitzer program.

Navy fuel cell technology demonstration

The budget request included $5.1 million in PE 63724N for the Navy Energy Program. The committee recommends an increase of $5.0 million for the development of proton exchange membrane (PEM) fuel cells. PEM fuel cell systems are highly efficient, low-temperature fuel cells that can operate on traditional hydrocarbon fuels using an electrochemical process that produces near-zero emissions. A residential PEM fuel cell system typically provides 5 kW of base load power, with a 10 kW peak load and a 15 kW surge, which is sufficient to run the electrical systems of a small building. These attributes make this technology well suited for placement at military sites and for serving remote or inaccessible locations.

The committee believes that demonstration of these fuel cell systems in stationary applications will also help to advance the state of technology development for transportation applications, particularly on vehicles that can run on diesel fuel for military applications.

Facilities improvement

The budget request included $2.1 million in PE 63725N for aircrew systems development but included no funding for developing renewable energy sources for major Navy installations. This program provides the Navy with new civil engineering capabilities that are required to overcome specific performance limitations of naval shore facilities while reducing the cost of sustaining the naval shore infrastructure. The program focuses available resources on satisfying facility requirements where: (1) the Navy is a major stakeholder; (2) there are no tested, validated commercial, off-the-shelf (COTS) solutions available; and (3) a timely solution will not emerge without a Navy-sponsored demonstration and validation. The committee understands that the Office of Naval Research has entered into a partnership to demonstrate solar energy as a source of electric power and conduct planning and design for research and demonstration of renewable energy, hydrogen, and fuel cells. From this partnership, the Navy hopes to derive recurring energy cost savings and to have a more reliable source of energy. Therefore, the committee recommends an increase of $2.5 million in PE 63725N to develop renewable energy sources for major Navy installations.

Urban operations environment research

The budget request included $24.1 million in PE 63851M for demonstration and validation of non-lethal weapons. The committee recommends an additional $2.0 million for demonstration and validation of environmental remediation capabilities to mini-

mize the environmental effects of the use of non-lethal weapons systems.

Duplication of research and development efforts

The budget request included $81.5 million in PE 64231N for upgrades to Navy command, control, communications, computers and intelligence (C4I) systems and processes. Included within that amount was $20.0 million to start a new program, Forcenet, to provide the architecture and building blocks to connect Navy systems electronically. The budget justification material indicates that the Navy intends for the program to attempt to create a "highly adaptive, human-centric, comprehensive system that operates from seabed to space, from sea to land." The new program appears to be overly ambitious in the ramp-up of funding for such a broadly described effort. It also appears to be premature based on the limited deployment of a Navy and Marine Corps intranet, the cooperative engagement concept programs, and the research and development still required for the seven projects requested in this program element and the naval fires network. Therefore, the committee recommends a decrease of $12.0 million in PE 64231N for the Forcenet program initiation.

Power node control centers

The budget request included no funds for the continued development of power node control centers (PNCC). PNCCs integrate shipboard power functions, including conversion, switching, distribution, and protection. The technology is applicable to all ship classes and will be a building block of the Navy transition to an all-electric ship. Therefore, the committee recommends an increase of $3.0 million in PE 64300N to install, test, and evaluate PNCCs.

Initiative to reduce destroyer life cycle costs

The budget request included no funds in PE 64307N for development, demonstration, and validation of new initiatives to reduce the manning on Arleigh Burke (DDG–51) class destroyers. Previous initiatives under the 1995 smart ship project fell short of expectations for reducing manning, but resulted in efficiencies which reduced the crews' workload.

The committee believes that the Navy could take steps to reduce the average crew size of 350 personnel by taking advantage of research and development activities already underway as part of the future destroyer program. Although reduction of crew size is a worthy goal, the development and backfit costs could negate the potential savings. For this reason, the Navy should carefully evaluate technologies for risk of development and payback in crew reduction prior to development. Therefore, the committee recommends an increase of $5.0 million in PE 64307N for the development and test of technologies to reduce destroyer life cycle costs by reducing assigned personnel.

Standard missile advanced optical correlator

The budget request included no funds for the standard missile advanced optical correlator. Optical correlation enhances the ability to recognize and track targets. This enhanced ability translates

into significantly better performance of ship self-defense systems. Therefore, the committee recommends an increase of $5.0 million in PE 64366N for continued development of an optical correlator to improve the standard missile performance.

Submarine combat systems modernization

The budget request included $14.0 million in PE 64562N to develop and integrate software upgrades to integrate improved weapons capabilities within the various submarine combat control systems (CCSs). This program also develops improvements to submarine hardware which has become increasingly difficult and costly to maintain.

The thrust of the CCS improvement program is the fleet introduction of an improved CCS system within which the Navy will converge multiple submarine combat system developments into a single effort to minimize submarine life cycle costs. Current plans include converging CCS systems for the SSN–688-class, the SSN–688I-class, and the SSBN–726-class.

Additional funding would allow the Navy to: (1) implement an engineering change proposal to incorporate into the CCS MK2 software architecture the capability to fire Tactical Tomahawk missiles; and (2) continue converting the CCS MK2 software architecture to a fully commercial design.

Therefore, the committee recommends an increase of $20.0 million in PE 64562N to achieve commonality in combat control systems sooner among all the various submarine classes and configurations within those classes.

Elimination of redundant studies

The budget request included $2.9 million in PE 64567N to commence manpower and training studies for an unspecified future ship. The Congress has authorized and appropriated significant funding in previous Navy budget requests for the DD–21 program, the CVN program, the new attack submarine program, the military sealift program, and the smart ship program. All of these programs included components that were supposed to investigate, test and install methods for reducing manpower and improving training on Navy ships. Interviews with program managers have revealed that the Navy does not have an adequate process by which the information gathered and the "lessons learned" from these efforts is made available to the managers of other ship programs. Although the committee has fully supported other manpower reduction and training improvement efforts included in this budget request, the unspecified effort included in this program element appears redundant to previous and ongoing efforts. Therefore, the committee recommends a decrease of $1.9 million in PE 64567N for unspecified manpower and training studies and directs the Secretary of the Navy to ensure that the Navy makes information on manpower reduction and improvements in training generated within specific programs available to other program offices with similar requirements.

Lightweight torpedo development

The budget request included $7.8 million in PE 64610N to design, integrate, and test the lightweight hybrid torpedo (MK–54 MOD 0). This torpedo would be comprised of hardware and software from the MK–46 torpedo, MK–50 torpedo, and MK–48 ADCAP torpedo. The Navy expects the lightweight hybrid torpedo to provide performance improvements in shallow water, littoral, and countermeasure-filled environments.

The committee believes that, with additional funding, the Navy could develop and test hardware and software design changes that would realign the lightweight and heavyweight torpedo baselines to achieve greater commonality. Such commonality could accelerate the process of implementing future block improvement changes and should reduce other operating and support costs. Therefore, the committee recommends an increase of $5.5 million in PE 64610N to achieve these objectives.

Outboard system improvements

The budget request included no funds in PE 64721N for development, demonstration, and validation of improvements to Outboard, the surface ship signals exploitation and information collection system. The cooperative Outboard logistics upgrade (COBLU) program was designed in 1995 using analog commercial, off-the-shelf-based (COTS-based) components. By developing digital enhancements, the Navy could take advantage of digital technology to permit Outboard to detect and exploit a wider range of signals. Therefore, the committee recommends an increase of $5.0 million in PE 64721N for the development, test, and rapid fielding of COBLU system digital enhancements.

SEARAM ship self-defense system

The budget request included no funds in PE 64755N for demonstration and validation of a ship self-defense system which would combine the capabilities of the close-in weapons system (CIWS) and the rolling airframe missile (RAM). On May 4, 2001, the Navy initiated an engineering change proposal (ECP) to upgrade the RAM-guided missile weapons system to a SEARAM configuration. The SEARAM configuration would combine the CIWS radar with an eleven-round RAM missile launching system. The SEARAM system would provide surface ships improved detection and kill capabilities against anti-ship missile threats. Therefore, the committee recommends an increase of $5.0 million in PE 64755N to continue the development and testing of the SEARAM ECP.

NULKA anti-ship missile decoy system

The budget request included $25.9 million for ship self-defense soft-kill systems development in PE 64757N, including $1.0 million to develop an improved capability to prevent loss of the technology through reverse engineering by developing anti-tamper capability for the NULKA payload.

The Navy has identified a series of development activities associated with the NULKA system that are required to understand and deal with emerging threats:

(1) an improved payload that would provide radio frequency coverage of more than one band of the spectrum to deal with anti-ship missiles;

(2) an expanded anti-tampering program effort;

(3) an improved guidance and propulsion system to allow more precise positioning of the decoy during operations;

(4) an effort to design an infrared payload to enable NULKA to deal with newer anti-ship missile homing technologies;

(5) an analysis of NULKA payload effectiveness when operating in a high electromagnetic interference environment against missile seekers employing low probability of intercept technologies; and

(6) systems engineering and software support for updating the NULKA launcher training, system evaluation and test facility.

The committee recommends an increase of $9.2 million for the NULKA development program to continue these efforts.

Radar absorbing tiles for ship self-defense

The budget request included no funds in PE 64757N for development, demonstration, and validation of applying radar-absorbing tiles to improve the self-defense capabilities of Navy ships. Radar-absorbing tiles could reduce the ships' detectability by radars, contributing to ship stealth and self-defense capability. Therefore, the committee recommends an increase of $1.0 million in PE 64757N for the development and test of radar-absorbing tiles for Navy ships.

Navy integrated human resources strategy

The budget request included $43.2 million in PE 65013N for information technology development. The committee recommends an additional $7.0 million to support development of architectures, processes, web-based tools, and the re-engineering of Navy legacy systems to improve information management within the Department of the Navy.

Navy studies and analyses

The budget request included $45.4 million in PE 65154N for the Center for Naval Analyses. The committee recommends a reduction of $5.0 million to this account. In addition, the committee notes that the Navy's science and technology budget was reduced with respect to the fiscal year 2002 budget request and appropriated levels. The committee recommends that the Navy place a higher priority on retaining a stable investment in science and technology than on studies and analyses programs.

Combating terrorism wargaming and research

The budget request included $50.8 million in PE 65853N for management, technical, and international support. The committee recommends an increase of $2.0 million to support the development of new wargaming techniques, research, and collaboration to support Navy activities in combating terrorism.

F/A–18E/F engine durability improvements

The budget request included no funds in PE 24136N for testing and validating improved components and advanced technologies in the F/A–18E/F engine, the F414. Such improvements in the F414 compressor and high-pressure turbine have the potential to increase engine durability and thrust. Increased durability would translate directly to operating and support savings. Increased thrust would improve current flying performance and provide an important hedge against future upgrades of the aircraft. Therefore, the committee recommends an increase of $15.0 million in PE 24136N to test core and high-pressure turbine improvements in the F414 engine.

Precision target aided navigation

The budget request included $94.3 million in PE 24229N for continued development of the Tomahawk weapons system but included no funding for developing an alterative guidance system called precision target aided navigation (PTAN). The Navy believes that the PTAN program could lead to a guidance capability that would be equal to the current system based on the global positioning system (GPS). Missiles using a PTAN-based approach would, however, not be vulnerable to an enemy who might be employing GPS jamming or spoofing defenses. The committee believes that further development of this PTAN capability would be a prudent hedge against such a possibility. Therefore, the committee recommends an increase of $5.0 million in PE 24229N to the PTAN development program.

Improving information provided to the warfighter

The budget request included $6.2 million in PE 24575N for development of information system technologies which directly support the mission planning for tactical commanders. The virtual integration environment for the warfighter uses commercial visualization and related information technologies interfaced with real-time databases to evaluate commercial information technology's integration with databases. Therefore, the committee recommends an increase of $2.0 million in PE 24575N for the virtual integration environment for the warfighter.

Marine Corps ground combat/supporting arms systems

The budget request included $36.0 million in PE 26623M for Marine Corps ground combat/supporting arms systems, including $14.6 million for the Marine Corps ground weaponry product improvement program (PIP). The target location designation and hand-off system (TLDHS) is a modular, man-portable equipment suite that will provide the ability to acquire targets in a wide range of weather conditions, day and night. The TLDHS should greatly improve the ability of Marine Corps operators to call for fire support from aviation, ground, and naval surface fire support assets. In fiscal year 2003, the Marine Corps expects to reach a fielding decision for the target hand-off system component of the TLDHS.

Although previous budgets for the ground weaponry PIP have included requests for the TLDHS program, the budget request for fiscal year 2003 included no funds for TLDHS. Additional funding in

fiscal year 2003 would permit the Marine Corps to undertake a number of important development tasks, including: (1) supporting additional development and testing of the naval surface fire support capability; and (2) incorporating additional close air support features. Therefore, the committee recommends an increase of $1.9 million in PE 26623M for the TLDHS, a total authorization of $37.9 million.

Interoperability support of the warfighter

The budget request included $3.3 million in PE 35188N for joint command, control, communications, computers, intelligence, and surveillance (C4ISR) projects for the joint battle center (JBC). The Navy established a project in fiscal year 2001 to improve interoperability through reducing total cost of ownership, using commercial innovations and services, and developing timely requirements relating to homeland security. The committee believes that the Navy should expand the initial project to support focused actions for the regional commanders in chief, including improving joint task force decision-making and rapidly applying new technology for interoperability. Therefore, the committee recommends an increase of $5.0 million for a strategic interoperability initiative that would allow the Navy to build upon the solid foundation of the work previously completed.

Unmanned Aerial Vehicle Tactical Control System

The budget request included $9.1 million for research and development of the Tactical Control System (TCS), which is being designed to receive, process and disseminate data from all current and future tactical and high-endurance Unmanned Aerial Vehicles (UAVs), such as Predator and Global Hawk. The TCS would also serve as a common command and control system for all UAVs.

The Navy is purchasing Global Hawk UAVs in fiscal year 2003 with the ultimate goal of integrating them into the TCS. The proposed fiscal year budget for TCS, however, does not fund such integration. Therefore, instead of using TCS to support the Global Hawks, the Navy now plans on using the existing, dedicated Global Hawk ground stations which are designed to work exclusively with Global Hawks.

The committee believes that integration of Global Hawk into the TCS should occur as soon as possible to ensure TCS commonality within the set of Navy UAVs and recommends that $10.0 million be added to PE 35204N for this purpose. Furthermore, the committee urges the Air Force to work with the Navy to support the Navy's TCS activities.

Modeling and simulation

The budget request included $7.8 million in PE 38601N for Navy modeling and simulation development activities. The Navy has been using modeling and simulation to provide important information to make smarter acquisition and program decisions, thereby reducing the research, development, test and evaluation costs for Navy programs. The Navy has found that they are able to eliminate a number of acquisition and program possibilities using com-

puter simulation based on validated models. Narrowing the range of possibilities has yielded proven cost savings.

The committee believes that the Navy could benefit from additional funding to expand these important activities. Therefore, the committee recommends an increase of $4.7 million in PE 38601N to continue enhancements to, and usage of, computer modeling and simulation in Navy research and development activities.

Maritime manufacturing technology

The budget request included $9.9 million in PE 78730N for maritime manufacturing technology. The committee recommends an additional $4.0 million for the development of advanced hardware, software, and engineering practices for new design and manufacturing technologies to support shipyard and industry needs.

Air Force

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
		RESEARCH, DEVELOPMENT, TEST & EVALUATION AIR FORCE			
0601102F	1	DEFENSE RESEARCH SCIENCES	219,144		219,144
0602102F	2	MATERIALS	75,272	14,500	89,772
		Metals affordability initiative		[3,000]	
		Free electron laser materials processing		[3,000]	
		Nanostructured protective coatings		[2,000]	
		Hybrid coatings for aircraft systems		[3,000]	
		Composite materials for UAVs		[2,500]	
		Closed cell foam material technology		[1,000]	
0602201F	3	AEROSPACE VEHICLE TECHNOLOGIES	78,789		78,789
0602202F	4	HUMAN EFFECTIVENESS APPLIED RESEARCH	66,000		66,000
0602203F	5	AEROSPACE PROPULSION	107,659	2,000	109,659
		Lithium ion batteries		[2,000]	
0602204F	6	AEROSPACE SENSORS	75,799	3,000	78,799
		Wireless ISR technology		[3,000]	
0602500F	7	MULTI-DISCIPLINARY SPACE TECHNOLOGY	53,592		53,592
		Space-based GMTI & AMTI capability (Transfer from DERF)		[43,000]	
		Space-based radar not S&T - Transfer to PE 63858F (RDAF 57)		[-43,000]	
0602601F	8	SPACE TECHNOLOGY	58,582	6,000	64,582
		Microsatellite cluster technology		[3,000]	
		Lightweight structures for space		[1,000]	
		Integrated control for autonomous space systems		[2,000]	
0602602F	9	CONVENTIONAL MUNITIONS	60,343		60,343
0602605F	10	DIRECTED ENERGY TECHNOLOGY	39,936		39,936

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0602702F	11	COMMAND CONTROL AND COMMUNICATIONS	70,951	8,000	78,951
		Information protection & authentication		[3,000]	
		Cyber security R&D		[5,000]	
0602805F	12	DUAL USE SCIENCE AND TECHNOLOGY PROGRAM	10,626		10,626
0603106F	13	LOGISTICS SYSTEMS TECHNOLOGY			
0603112F	14	ADVANCED MATERIALS FOR WEAPON SYSTEMS	21,138		21,138
0603202F	15	AEROSPACE PROPULSION SUBSYSTEMS INTEGRATION			
0603203F	16	ADVANCED AEROSPACE SENSORS	50,589		50,589
0603205F	17	FLIGHT VEHICLE TECHNOLOGY			
0603211F	18	AEROSPACE TECHNOLOGY DEV/DEMO	22,315	4,000	26,315
		Advanced aluminum aerostructures		[4,000]	
0603216F	19	AEROSPACE PROPULSION AND POWER TECHNOLOGY	85,650		85,650
0603227F	20	PERSONNEL, TRAINING AND SIMULATION TECHNOLOGY			
0603231F	21	CREW SYSTEMS AND PERSONNEL PROTECTION TECHNOLOGY	29,690	1,500	31,190
		Logistics technologies		[1,500]	
0603245F	22	FLIGHT VEHICLE TECHNOLOGY INTEGRATION		2,500	2,500
		Total atmospheric liquefaction system		[2,500]	
0603253F	23	ADVANCED SENSOR INTEGRATION			
0603270F	24	ELECTRONIC COMBAT TECHNOLOGY	23,350	4,000	27,350
		Test detect & avoid (DAA) technology for FAA approval		[4,000]	
0603302F	25	SPACE AND MISSILE ROCKET PROPULSION			
0603311F	26	BALLISTIC MISSILE TECHNOLOGY		4,900	4,900
		Improved guidance, navigation & controls (Transfer from DERF)		[4,900]	
0603333F	27	UNMANNED AIR VEHICLE DEV/DEMO	18,000		18,000
0603401F	28	ADVANCED SPACECRAFT TECHNOLOGY	42,315	10,000	52,315
		Thin film amorphous solar arrays		[10,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603410F	29	SPACE SYSTEMS ENVIRONMENTAL INTERACTIONS TECHNOLOGY			
0603436F	30	TRANSFORMATIONAL WIDEBAND MILSATCOM	195,000	-195,000	
		Engineering-level pre-acquisition effort premature		[-80,000]	
		Transfer to advanced wideband system (AWS) - PE 63845F (RDAF 52)		[-115,000]	
0603444F	31	MAUI SPACE SURVEILLANCE SYSTEM (MSSS)	6,472		6,472
0603500F	32	MULTI-DISCIPLINARY ADVANCED DEVELOPMENT SPACE TECHNOLOGY	50,538		50,538
0603601F	33	CONVENTIONAL WEAPONS TECHNOLOGY	38,001	7,000	45,001
		Low cost autonomous attack system (LOCAAS)		[7,000]	
0603605F	34	ADVANCED WEAPONS TECHNOLOGY	28,271		28,271
0603723F	35	ENVIRONMENTAL ENGINEERING TECHNOLOGY			
0603726F	36	AEROSPACE INFO TECH SYS INTEGRATION			
0603789F	37	C3I ADVANCED DEVELOPMENT	34,288		34,288
0603801F	38	SPECIAL PROGRAMS	97,300		97,300
0603876F	39	SPACE-BASED LASER			
0603260F	40	INTELLIGENCE ADVANCED DEVELOPMENT	4,545		4,545
0603319F	41	AIRBORNE LASER PROGRAM			
0603421F	42	NAVSTAR GLOBAL POSITIONING SYSTEM III	100,217		100,217
0603430F	43	ADVANCED EHF MILSATCOM (SPACE)	825,783	19,000	844,783
		Radiation hardening program (Transfer from DERF)		[19,000]	
0603432F	44	POLAR MILSATCOM (SPACE)	19,554		19,554
0603434F	45	NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYS (SPACE)	237,199		237,199
0603438F	46	SPACE CONTROL TECHNOLOGY	13,814		13,814
0603617F	47	COMMAND, CONTROL, AND COMMUNICATION APPLICATIONS			
0603742F	48	COMBAT IDENTIFICATION TECHNOLOGY	12,434		12,434

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603790F	49	NATO RESEARCH AND DEVELOPMENT	4,355		4,355
0603791F	50	INTERNATIONAL SPACE COOPERATIVE R&D	643		643
0603800F	51	JOINT STRIKE FIGHTER			
0603845F	52	ADVANCED WIDEBAND SYSTEM (AWS)	4,982	115,000	119,982
		Transfer from PE 63436F (RDAF 30) -- not S&T activity		[115,000]	
0603850F	53	INTEGRATED BROADCAST SERVICE (DEM/VAL)	19,870	19,200	39,070
		IBS smart pull technology (Transfer from DERF)		[6,600]	
		Fully fund IBS R&D shortfalls (Transfer from DERF)		[12,600]	
0603851F	54	INTERCONTINENTAL BALLISTIC MISSILE - DEM/VAL	63,025	7,500	70,525
		Solid rocket motor static test fire demonstrations (Transfer from DERF)		[7,500]	
0603854F	55	WIDEBAND GAPFILLER SYSTEM RDT&E (SPACE)	20,009		20,009
0603856F	56	AIR FORCE/NATIONAL PROGRAM COOPERATION (AFNPC)	8,829		8,829
0603858F	57	SPACE-BASED RADAR DEM/VAL	47,859	43,000	90,859
		Space-based radar not S&T - Transfer from PE 62500F (RDAF 7)		[43,000]	
0603859F	58	POLLUTION PREVENTION (DEM/VAL)	2,743		2,743
0603860F	59	JOINT PRECISION APPROACH AND LANDING SYSTEMS - DEM/VAL	13,267		13,267
0604327F	60	HARD AND DEEPLY BURIED TARGET DEFEAT SYSTEM (HDBTDS) PROGRAM	7,482		7,482
0305149F	61	COBRA JUDY (H)	51,000		51,000
	61a	Dem/val Test and Evaluation transfer		-9,000	-9,000
0603840F	62	GLOBAL BROADCAST SERVICE (GBS)	22,589		22,589
0604012F	63	JOINT HELMET MOUNTED CUEING SYSTEM (JHMCS)	1,859		1,859
0604222F	64	NUCLEAR WEAPONS SUPPORT	13,627		13,627
0604226F	65	B-1B	160,688		160,688
0604227F	66	DISTRIBUTED MISSION TRAINING (DMT)			
0604233F	67	SPECIALIZED UNDERGRADUATE PILOT TRAINING	1,909		1,909
0604239F	68	F-22 EMD	627,266		627,266

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0604240F	69	B-2 ADVANCED TECHNOLOGY BOMBER	225,327	33,000	258,327
		Transfer to B-2 procurement -- APAF 24		[-25,200]	
		LO maintenance improvements		[10,000]	
		Unexecutable programs		[-1,800]	
		B-2 radar frequency change (Transfer from DERF)		[50,000]	
0604251F	70	SPACE-BASED RADAR EMD			
0604270F	71	EW DEVELOPMENT	65,082	14,700	79,782
		Precision location & identification (PLAID)		[14,700]	
0604280F	72	JOINT TACTICAL RADIO	17,358		17,358
0604329F	73	SMALL DIAMETER BOMB (SDB) EMD	54,368		54,368
0604421F	74	COUNTERSPACE SYSTEMS	40,053		40,053
0604441F	75	SPACE BASED INFRARED SYSTEM (SBIRS) HIGH EMD	814,927	-100,000	714,927
		Restructured program with FY 07 first launch		[-100,000]	
0604442F	76	SPACE BASED INFRARED SYSTEM (SBIRS) LOW EMD			
0604479F	77	MILSTAR LDR/MDR SATELLITE COMMUNICATIONS (SPACE)	148,936		148,936
0604602F	78	ARMAMENT/ORDNANCE DEVELOPMENT	9,160		9,160
0604604F	79	SUBMUNITIONS	4,739		4,739
0604617F	80	AGILE COMBAT SUPPORT	6,318	8,500	14,818
		Deployable oxygen systems		[2,500]	
		Integrated medical information technology systems (IMITS)		[6,000]	
0604618F	81	JOINT DIRECT ATTACK MUNITION	16,594		16,594
0604703F	82	AEROMEDICAL/CHEMICAL DEFENSE SYSTEMS			
0604706F	83	LIFE SUPPORT SYSTEMS	925	6,500	7,425
		Fixed aircrew standardized seats (FASS)		[2,500]	
		Aircrew rescue signaling systems		[4,000]	
0604727F	84	JOINT STANDOFF WEAPONS SYSTEMS			

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0604731F	85	UNMANNED COMBAT AIR VEHICLE (UCAV)	40,000		40,000
0604735F	86	COMBAT TRAINING RANGES	13,524		13,524
0604740F	87	INTEGRATED COMMAND & CONTROL APPLICATIONS (IC2A)	226		226
0604750F	88	INTELLIGENCE EQUIPMENT	1,326		1,326
0604754F	89	TACTICAL DATA LINK INFRASTRUCTURE			
0604762F	90	COMMON LOW OBSERVABLES VERIFICATION SYSTEM (CLOVERS)	4,781	13,000	17,781
		Restructure EMD program to support FY 04 IOC		[13,000]	
0604779F	91	TACTICAL DATA LINK INTEROPERABILITY			
0604800F	92	JOINT STRIKE FIGHTER EMD	1,743,668		1,743,668
0604805F	93	COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE			
0604851F	94	INTERCONTINENTAL BALLISTIC MISSILE - EMD	133,291		133,291
0604853F	95	EVOLVED EXPENDABLE LAUNCH VEHICLE PROGRAM (SPACE) - EMD	57,562		57,562
0605011F	96	RDT&E FOR AGING AIRCRAFT	19,871		19,871
0605306F	97	RANCH HAND II EPIDEMIOLOGY STUDY			
0207249F	98	PRECISION ATTACK SYSTEMS PROCUREMENT			
0207434F	99	LINK-16 SUPPORT AND SUSTAINMENT	44,146		44,146
0207701F	100	FULL COMBAT MISSION TRAINING	3,731		3,731
0305176F	101	COMBAT SURVIVOR EVADER LOCATOR	14,274		14,274
0401318F	102	CV-22	11,449		11,449
	102a	EMD Test and Evaluation transfer		-27,000	-27,000
0604256F	103	THREAT SIMULATOR DEVELOPMENT	30,351		30,351
0604759F	104	MAJOR T&E INVESTMENT	46,338	99,500	145,838
		Transfer from acquisition programs		[96,000]	
		Maglev upgrade program		[2,500]	
		Joint directed energy combat operations & employment		[1,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0605101F	105	RAND PROJECT AIR FORCE	25,462	-5,000	20,462
		Air Force reports, studies, & analyses		[-5,000]	
0605306F	106	RANCH HAND II EPIDEMIOLOGY STUDY	11,029		11,029
0605502F	107	SMALL BUSINESS INNOVATION RESEARCH			
0605712F	108	INITIAL OPERATIONAL TEST & EVALUATION	27,070		27,070
0605807F	109	TEST AND EVALUATION SUPPORT	398,266		398,266
0605860F	110	ROCKET SYSTEMS LAUNCH PROGRAM (SPACE)	16,237		16,237
0605864F	111	SPACE TEST PROGRAM (STP)	49,882		49,882
0804731F	112	GENERAL SKILL TRAINING	313		313
0909900F	113	FINANCING FOR EXPIRED ACCOUNT ADJUSTMENTS			
0909980F	114	JUDGMENT FUND REIMBURSEMENT	20,000		20,000
1001004F	115	INTERNATIONAL ACTIVITIES	3,878		3,878
0605024F	116	ANTI-TAMPER TECHNOLOGY EXECUTIVE AGENCY	8,000		8,000
0101113F	117	B-52 SQUADRONS	55,794		55,794
0101120F	118	ADVANCED CRUISE MISSILE	2,788		2,788
0101122F	119	AIR-LAUNCHED CRUISE MISSILE (ALCM)	26,713		26,713
0101313F	120	STRAT WAR PLANNING SYSTEM - USSTRATCOM	1,895		1,895
0101815F	121	ADVANCED STRATEGIC PROGRAMS	5,879		5,879
0102326F	122	REGION/SECTOR OPERATION CONTROL CENTER MODERNIZATION PROGRAM	35,000		35,000
0203761F	123	WARFIGHTER RAPID ACQUISITION PROCESS (WRAP) RAPID TRANSITION FUND	25,057		25,057
0207027F	124	AC2ISR CENTER			
0207028F	125	JOINT EXPEDITIONARY FORCE EXPERIMENT	27,161		27,161
0207131F	126	A-10 SQUADRONS	7,650		7,650
0207133F	127	F-16 SQUADRONS	81,338		81,338
0207134F	128	F-15E SQUADRONS	81,726		81,726
0207136F	129	MANNED DESTRUCTIVE SUPPRESSION	23,699		23,699

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0207138F	130	F-22 SQUADRONS	181,239		181,239
0207141F	131	F-117A SQUADRONS	3,525		3,525
0207161F	132	TACTICAL AIM MISSILES	2,943		2,943
0207163F	133	ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE (AMRAAM)	37,008		37,008
0207217F	133a	PODDED RECONNAISSANCE SYSTEMS		13,600	13,600
		Upgrade theater airborne reconnaissance systems (TARS) pods		[13,600]	
0207247F	134	AF TENCAP	10,496	3,000	13,496
		GPS jammer detection & location (JLOC)		[3,000]	
0207248F	135	SPECIAL EVALUATION PROGRAM	110,080	3,200	113,280
		Classified program (Transfer from DERF)		[3,200]	
0207253F	136	COMPASS CALL	3,877		3,877
0207268F	137	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	186,690		186,690
0207277F	138	CSAF INNOVATION PROGRAM	1,920		1,920
0207325F	139	JOINT AIR-TO-SURFACE STANDOFF MISSILE (JASSM)	42,097	15,000	57,097
		Accelerate extended range JASSM (JASSM ER)		[15,000]	
0207410F	140	AEROSPACE OPERATIONS CENTER (AOC)	35,875		35,875
0207412F	141	CONTROL AND REPORTING CENTER (CRC)	6,652		6,652
0207417F	142	AIRBORNE WARNING AND CONTROL SYSTEM (AWACS)	173,956		173,956
0207423F	143	ADVANCED COMMUNICATIONS SYSTEMS	29,133		29,133
0207424F	144	EVALUATION AND ANALYSIS PROGRAM	230,218		230,218
0207433F	145	ADVANCED PROGRAM TECHNOLOGY	104,651	10,000	114,651
		Classified program (Transfer from DERF)		[10,000]	
0207438F	146	THEATER BATTLE MANAGEMENT (TBM) C4I	34,700		34,700
0207445F	147	FIGHTER TACTICAL DATA LINK	39,034		39,034
0207449F	148	MC2C (MULTI-SENSOR COMMAND AND CONTROL CONSTELLATION)	191,089	238,000	429,089
		Accelerate MP-RTIP (Transfer from DERF)		[238,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0207581F	149	JOINT SURVEILLANCE AND TARGET ATTACK RADAR SYSTEM (JOINT STARS)	55,515		55,515
0207590F	150	SEEK EAGLE	16,972		16,972
0207591F	151	ADVANCED PROGRAM EVALUATION	220,088	17,000	237,088
		Classified program (Transfer from DERF)		[17,000]	
0207601F	152	USAF MODELING AND SIMULATION	21,895		21,895
0207605F	153	WARGAMING AND SIMULATION CENTERS	5,278		5,278
0207701F	154	FULL COMBAT MISSION TRAINING			
0208006F	155	MISSION PLANNING SYSTEMS	17,002		17,002
0208021F	156	INFORMATION WARFARE SUPPORT	7,837		7,837
0208031F	157	WAR RESERVE MATERIEL - EQUIPMENT/SECONDARY ITEMS			
0208060F	158	THEATER MISSILE DEFENSES			
0208160F	159	TECHNICAL EVALUATION SYSTEM	135,588	30,000	165,588
		Classified program (Transfer from DERF)		[30,000]	
0208161F	160	SPECIAL EVALUATION SYSTEM	41,518		41,518
0208889F	161	COUNTERDRUG USSOUTHCOM SUPPORT			
0301310F	162	NATIONAL AIR INTELLIGENCE CENTER	[ ]	[ ]	[ ]
030134F	163	COBRA BALL	[ ]	[ ]	[ ]
0301315F	164	MISSILE AND SPACE TECHNICAL COLLECTION	[ ]	[ ]	[ ]
0301324F	165	FOREST GREEN	[ ]	[ ]	[ ]
0301398F	166	MANAGEMENT HEADQUARTERS GDIP	[ ]	[-3,100]	[ ]
		Classified program		[-3,100]	
0302015F	167	E-4B NATIONAL AIRBORNE OPERATIONS CENTER (NAOC)	47,867		47,867
0303110F	168	DEFENSE SATELLITE COMMUNICATIONS SYSTEM (SPACE)	2,046		2,046
0303112F	169	AIR FORCE COMMUNICATIONS (AIRCOM)			
0303131F	170	MINIMUM ESSENTIAL EMERGENCY COMMUNICATIONS NETWORK (MEECN)	2,423		2,423

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0303140F	171	INFORMATION SYSTEMS SECURITY PROGRAM	9,353	11,500	20,853
		Cyber security research		[7,500]	
		Accelerate toolsets development (Transfer from DERF)		[4,000]	
0303141F	172	GLOBAL COMBAT SUPPORT SYSTEM	29,168		29,168
0303150F	173	GLOBAL COMMAND AND CONTROL SYSTEM	3,565		3,565
0303401F	174	COMMUNICATIONS SECURITY (COMSEC)	4,765		4,765
0303601F	175	MILSATCOM TERMINALS	72,712		72,712
0304111F	176	SPECIAL ACTIVITIES	[ ]	[428,300]	[ ]
		Classified program		[405,000]	
		Defense Reconnaissance Support Activities (Space) (Transfer from DERF)		[23,300]	
0304311F	177	SELECTED ACTIVITIES	150,243	72,000	222,243
		Classified - special activities (Transfer from DERF)		[72,000]	
0305099F	178	GLOBAL AIR TRAFFIC MANAGEMENT (GATM)	7,200		7,200
0305110F	179	SATELLITE CONTROL NETWORK (SPACE)	17,542		17,542
0305111F	180	WEATHER SERVICE	14,488		14,488
0305114F	181	AIR TRAFFIC CONTROL, APPROACH, AND LANDING SYSTEM (ATCALS)	9,865		9,865
0305128F	182	SECURITY AND INVESTIGATIVE ACTIVITIES	475		475
0305142F	183	APPLIED TECHNOLOGY INTEGRATION	[ ]	[ ]	[ ]
0305144F	184	TITAN SPACE LAUNCH VEHICLES (SPACE)			
0305148F	185	AIR FORCE TACTICAL MEASUREMENT & SIGNATURE INTELLIGENCE (MASINT) SYSTEM	6,486	9,000	15,486
		ARGUS MASINT (Transfer from DERF)		[9,000]	
0305159F	186	DEFENSE RECONNAISSANCE SUPPORT ACTIVITIES (SPACE)	42,076	122,000	164,076
		Classified program (Transfer from DERF)		[97,000]	
		Classified program (Transfer from DERF)		[25,000]	
0305160F	187	DEFENSE METEOROLOGICAL SATELLITE PROGRAM (SPACE)	3,875		3,875

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0305164F	188	NAVSTAR GLOBAL POSITIONING SYSTEM (USER EQUIPMENT) (SPACE)	86,799		86,799
0305165F	189	NAVSTAR GLOBAL POSITIONING SYSTEM (SPACE AND CONTROL SEGMENTS)	324,098	-30,000	294,098
		Cancel high-power option		[-40,000]	
		Add FY 03 launch		[10,000]	
0305172F	190	COMBINED ADVANCED APPLICATIONS	[ ]	[ ]	[ ]
0305182F	191	SPACELIFT RANGE SYSTEM (SPACE)	82,108	8,000	90,108
		Systems engineering / planning & scheduling / communications		[8,000]	
0305202F	192	DRAGON U-2 (JMIP)	17,442	13,500	30,942
		U-2 SIGINT sensor nonrecurring engineering (NRE) (Transfer from DERF)		[10,800]	
		U-2 SIGINT sensor demonstration unit (Transfer from DERF)		[2,700]	
0305205F	193	ENDURANCE UNMANNED AERIAL VEHICLES	309,743	45,000	354,743
		Predator B engineering & manufacturing development (Transfer from DERF)		[10,000]	
		Global Hawk defensive system (Transfer from DERF)		[30,000]	
		Global Hawk SIGINT (Transfer from DERF)		[5,000]	
0305206F	194	AIRBORNE RECONNAISSANCE SYSTEMS	66,810		66,810
0305207F	195	MANNED RECONNAISSANCE SYSTEMS			
0305208F	196	DISTRIBUTED COMMON GROUND SYSTEMS	20,708	26,200	46,908
		Commerical imagery upgrades (Transfer from DERF)		[2,400]	
		DCGS MASINT (Transfer from DERF)		[5,000]	
		Create geospatial laboratory (Transfer from DERF)		[3,800]	
		DCGS/U-2 SIGINT Network (Transfer from DERF)		[15,000]	
0305906F	197	NCMC - TW/AA SYSTEM	15,639		15,639
0305910F	198	SPACETRACK (SPACE)	21,917		21,917
0305911F	199	DEFENSE SUPPORT PROGRAM (SPACE)	2,090		2,090
0305913F	200	NUDET DETECTION SYSTEM (SPACE)	21,180		21,180
0308601F	201	MODELING AND SIMULATION SUPPORT	1,995		1,995

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0308699F	202	SHARED EARLY WARNING (SEW)	4,027		4,027
0401115F	203	C-130 AIRLIFT SQUADRON	158,978		158,978
0401119F	204	C-5 AIRLIFT SQUADRONS	277,795	26,600	304,395
		Avionics modernization program - Transfer from APAF 33		[26,600]	
0401130F	205	C-17 AIRCRAFT	157,213		157,213
0401132F	206	C-130J PROGRAM	10,000		10,000
0401134F	207	LARGE AIRCRAFT IR COUNTERMEASURES (LAIRCM)	47,539		47,539
0401218F	208	KC-135S	1,497		1,497
0401219F	209	KC-10S	10,506		10,506
0404011F	210	SPECIAL OPERATIONS FORCES			
0702207F	211	DEPOT MAINTENANCE (NON-IF)	1,340		1,340
0708011F	212	INDUSTRIAL PREPAREDNESS	37,581	2,000	39,581
		Bipolar wafer-cell NiMH aircraft battery		[2,000]	
0708012F	213	LOGISTICS SUPPORT ACTIVITIES	10,375		10,375
0708026F	214	PRODUCTIVITY, RELIABILITY, AVAILABILITY, MAINTAIN. PROG OFC (PRAMPO)	4,767		4,767
0708071F	215	JOINT LOGISTICS PROGRAM - AMMUNITION STANDARD SYSTEM			
0708611F	216	SUPPORT SYSTEMS DEVELOPMENT	35,813		35,813
0708612F	217	COMPUTER RESOURCES SUPPORT IMPROVEMENT PROGRAM (CRSIP)	2,094		2,094
0901212F	218	SERVICE-WIDE SUPPORT	4,090		4,090
0901218F	219	CIVILIAN COMPENSATION PROGRAM	7,132		7,132
0901538F	220	FINANCIAL MANAGEMENT INFORMATION SYSTEMS DEVELOPMENT	21,326		21,326
1001018F	221	NATO JOINT STARS			
	999	CLASSIFIED PROGRAMS	5,019,286	425,200	5,444,486

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
	221a	Civilian personnel accounting adjustment		-36,249	-36,249
	221b	Financial management savings		-27,200	-27,200
	221c	Contract services savings		-45,200	-45,200
	221d	Operational systems development T&E transfer		-60,000	-60,000
		TOTAL AIR FORCE	**17,601,233**	**1,002,451**	**18,603,684**

Aerospace materials manufacturing and research

The budget request included $75.3 million in PE 62102F for applied materials research. The committee recognizes the critical role that materials research and materials processing technology play in extending the life of aging equipment, especially by addressing corrosion issues and in developing the new weapons systems and platforms that will transform the military. Therefore, the committee recommends an increase of $14.5 million in funding in this important research area.

Of this amount, $3.0 million would be used for improvements in the manufacturing of specialty aerospace materials; $3.0 million for the development and application of a high power, tunable, ultraviolet laser processing tool for the fabrication of micro-engineered components; $2.0 million for the development of wear-resistant, nanostructured materials that can protect mechanical parts and extend their operational lives; $3.0 million for the development of multifunctional, durable aircraft coating systems; $2.5 million for the development of low-cost composite materials for use on unmanned aircraft; and $1.0 million for the development of fire retardant polymer materials.

Lithium ion batteries for unmanned vehicles

The committee recommends an increase of $2.0 million in PE 62203F for applied research for the development of lithium ion batteries for use in unmanned air vehicles. The committee notes that lighter weight and lower cost batteries would provide unmanned air vehicles programs with many benefits, including increased mission time, increased payload capability, and support future systems enhancements and expansion.

Wireless ISR technology

The budget request included $75.8 million in PE 62204F for applied research on aerospace sensors. The committee recommends an increase of $3.0 million for the development of microelectromechanical systems (MEMS) wireless technology that enables detection, sensing, and monitoring of hostile threats.

Space technology research

The budget request included $58.6 million in PE62601F for applied research in space technology. The committee recommends an additional $6.0 million for this research, which includes $3.0 million for the development of clusters of microsatellites for defense operations; $1.0 million for the development of novel structural materials for large, lightweight space structures; and $2.0 million for the development of control systems for autonomous space systems.

Cyber security research

The committee notes that cyberattacks are an emerging threat to both our nation's defense systems and commercial infrastructure. The private sector has reported billions of dollars of annual losses to computer crimes. Network attacks from terrorists, foreign nations, and domestic hackers have compromised defense operations and threatened the lives of military personnel. The committee notes that a greater emphasis must be placed on the development

of security standards for both commercial and military information systems, including networks and software. This must be matched by strong support for the critical research needed to develop safer and more robust information systems. The committee also notes the critical need to train more information security specialists to design, operate, and maintain government and commercial information systems.

As a result of these threats and needs, the committee recommends an additional investment of $33.0 million in Department of Defense research and training programs in the area of information security. Of this amount, the committee recommends an additional $5.0 million in PE 62702F for applied research in information assurance and network security and $3.0 million for research toward securing national security information through techniques including steganography and digital watermarking. The committee urges the Air Force to robustly fund research in this critical technology area.

The budget request included $9.4 million in PE 33140F for information systems security. The committee notes the critical role that this type of research will play in combating global cyber-terrorist threats. Therefore, the committee recommends an increase of $7.5 million for research on computer system vulnerabilities and threats, including the transition of technology for operational use.

In addition to these programs, the committee also recommends an additional $17.5 million in cybersecurity research and training as described elsewhere in the report.

Aluminum aerostructures

The budget request included $32.7 million in PE 63112F for aerospace technology development and demonstration. The committee recommends an increase of $4.0 million for research on the use of aluminum aerostructures for aerospace components, which improve processing technologies and reduce installment and life cycle costs.

Crew systems and personnel research

The budget request included $29.7 million in PE 63231F for crew systems and personnel protection technology. The committee recommends an increase of $1.5 million to demonstrate new technologies that will enhance logistics and improve design, deployability, performance and support of current and future weapons systems. The committee recommends an additional $2.5 million for the development of systems that deliver nitrogen and oxygen for safe aircraft operation and reduce ground support requirements.

Unmanned Aerial Vehicles in controlled airspace

The committee is encouraged by the Department's substantial commitment to procure Unmanned Aerial Vehicles (UAVs) in fiscal year 2003 and in future years. In parallel with the procurement of UAVs, however, technologies and procedures need to be developed to harmonize the operation of UAVs with the operation of manned aircraft.

Currently, in order to operate UAVs in the National Air Space (NAS), the Department must obtain a Certificate of Authorization from the Federal Aviation Administration (FAA) through a process

that can be cumbersome and time consuming. A primary reason for FAA certification is the prevention of mid-air collisions: FAA rules require that UAVs provide a "see and avoid" capability comparable to that of a manned aircraft. Since UAVs are not currently equipped with an onboard "see and avoid" capability, chase planes are typically required to ferry UAVs through the NAS, thus complicating such flights.

The Department has begun development of Detect and Avoid (DAA) technology, which uses low-cost, lightweight optical sensors to automatically detect aircraft in the vicinity of a UAV, thereby enabling operator action to avoid a collision. The committee is encouraged by this effort and recommends an increase of $4.0 million to PE 63270F to fund continuation of DAA technology development, to demonstrate this technology on the Global Hawk UAV, and to implement an interim system for the Predator UAV that meets FAA standards for flight in the NAS without a chase aircraft.

In addition, the committee strongly supports the Department's efforts to work with the FAA on this issue and is aware of similar efforts underway at the National Air and Space Administration (NASA). Therefore, the Assistant Secretary of Defense for Command, Control, Communications and Intelligence should continue to support the joint Defense Department/FAA study on integrating remotely operated aircraft into civil airspace. In addition, the Secretary should broaden the study's membership to include representatives from NASA and industry and ensure that the study receives the resources required to expeditiously achieve the goal of flying UAVs through controlled airspace using the same quick and efficient procedures that are currently used for manned aircraft.

Advanced spacecraft technology

The budget request for the Air Force included $14.1 million in PE 63401F for advanced spacecraft technology research and development. The committee recommends an additional $10.0 million in PE 63401F for high specific power thin film multi-junction amorphous silicon solar arrays on flexible substrates for space applications. This technology has the potential to produce solar arrays that are ten times cheaper and 3 to 5 times lighter than current solar arrays. The committee further directs the Air Force to study the potential applications for this technology in ongoing and future space applications and to submit a report to the Committees on Armed Services of the Senate and the House of Representatives on the results of the study and to identify the potential future applications of this innovative and transformational technology.

Advanced Wideband System satellite program

The budget request included $195.0 million in PE 63436F and $5.0 million in PE 63845F for research and development for the Advanced Wideband System (AWS) satellite program. This new program is a groundbreaking effort to use laser communications technology in space, thereby increasing the bandwidth of satellite communications by orders of magnitude. The committee strongly supports this program, because the Department's reliance upon satellite communications is expected to continue to grow rapidly over the next decade. The committee is concerned, however, that

$200.0 million is a large amount of initial funding for a new program, regardless of its importance. Air Force documentation indicates that of this funding, $120.0 million is for concept development and for laser technology development and integration. An additional $80.0 million is for detailed engineering level pre-acquisition activities. The committee believes that it is not prudent to conduct detailed pre-acquisition activities for a program prior to completion of concept and technology development. Therefore, the committee recommends a reduction of $80.0 million in PE 63436F.

Furthermore, the committee notes that PE 63436F is an Air Force science and technology funding line. The funding in this program element, however, is clearly intended to develop a major satellite system. The committee believes it is not appropriate to categorize the program element as science and technology funding. Therefore, the committee recommends that the remaining $115.0 million in PE 63436F be transferred to PE 63845F, a Demonstration and Validation line.

Low-cost autonomous attack system

The budget request included $38.0 million in PE 63601F for conventional weapons technology, including $11.0 million for the low-cost autonomous attack system (LOCAAS). Fiscal year 2003 LOCAAS efforts include flight testing with a live warhead, safe aircraft separation, and continued development of automatic target recognition algorithms.

The committee believes that LOCAAS offers the potential to make significant improvements in warfighting capabilities. Therefore, the committee recommends an increase of $7.0 million in PE 63601F to accelerate LOCAAS development.

B–2 Spirit bomber

The budget request included $225.3 million in PE 64240F for research and development for the Air Force for the B–2 Spirit bomber. The Air Force has said $27.0 million is not executable. The committee recommends a $27.0 million decrease, of which $25.2 million is transferred to Aircraft Procurement, Air Force for the B–2 in line 24, to correct a funding mismatch.

The committee recommends a $10.0 million increase in PE 64240F for low-observability maintenance improvements, a total authorization of $208.3 million.

Precision location and identification program

The budget request included $65.1 million in PE 64270F for electronic warfare development, including $10.6 million for engineering and manufacturing development (EMD) for the precision location and identification (PLAID) program. The PLAID program is intended to lead to modernization of several families of radar warning receivers.

Under the previous schedule, the Air Force had planned to begin production of PLAID-derivative hardware in fiscal year 2003. However, delays in receiving funding, among others, have pushed operational testing into early fiscal year 2004. This has resulted in a requirement for additional EMD funding in fiscal year 2003 to conduct further risk reduction activities for PLAID. Because of the po-

tential for this system to contribute to aircrew and passenger protection in higher threat environments, the committee recommends an increase of $14.7 million in PE 64270F to fund additional risk reduction activities.

Space-based Infrared System-High component

The budget request included $814.9 million in PE 64441F for the Space-based Infrared System-High (SBIRS-High) system. SBIRS-High is the replacement for the nation's current space-borne early warning system for ballistic missile launches. This funding level almost doubles last year's appropriated funding level of $438.7 million.

The SBIRS-High program sustained a Nunn-McCurdy cost breach in December 2001 when the unit cost estimate for the program increased by more than 70 percent, indicating more than $2.0 billion in cost growth. The program has also experienced an 18- to 24-month schedule slip. An independent review team established by the Air Force found significant problems with the management of the SBIRS-High program, including less than optimal systems engineering and requirements development processes.

In compliance with the Nunn-McCurdy statute (10 U.S.C. 2433), the Department of Defense reviewed SBIRS-High and re-certified the program with a new overall program cost estimate. The required funding for fiscal year 2003 has not yet been agreed upon by the Department. The committee understands, however, that the Office of the Secretary of Defense's Cost Analysis and Improvement Group (CAIG) recommended re-certification of SBIRS-High assuming a fiscal year 2007 launch for the first satellite. The fiscal year 2003 cost to support such a launch date is approximately $100.0 million less than the amount requested in the budget for SBIRS-High. Therefore, the committee recommends a reduction of $100.0 million in PE 64441F for SBIRS-High.

Deployable oxygen systems

The budget request included $0.3 million in PE 64617F for developing deployable oxygen-generating systems for supporting aeromedical aircraft operations. Passenger aircraft that are used by medical support forces can consume larger quantities of oxygen. As the Armed Forces deploy onboard oxygen-generating systems (OBOGS) to most military aircraft, bases no longer need to maintain oxygen-generating capability for the fighting forces. In order to prevent the strategic airlift forces from having to spend scarce airlift resources carrying large, bulky oxygen-generating systems into theaters of operation just to support aeromedical aircraft operations, the Air Force needs to develop deployable oxygen systems. The committee, therefore, recommends an increase of $2.5 million in PE 64617F to accelerate development of a deployable oxygen-generating capability for supporting aeromedical aircraft operations.

Integrated medical information technology system

The budget request included no funding in PE 64617F to continue the integrated medical information technology system (IMITS). The IMITS development effort is intended to design a new

state-of-the-art clinical network architecture that supports electronic multimedia health records through the Air Force Medical Service. This would include a demonstration of the capability in the National Tele-radiology project and the Biomedical Surveillance project. The committee recommends an increase of $6.0 million in PE 64617F to accelerate IMITS development.

Fixed aircrew standardized seats

The budget request included $0.9 million in PE 64706F for the development of life support systems, but included no funding for the continuing development of fixed aircrew standardized seats (FASS). The FASS program develops modern, standardized aircrew seats capable of meeting the dynamic load standards required of commercial carriers. The Air Force is completing standardized seat design studies and has begun the development of prototype seats. Given the importance of maintaining acceptable safety standards in Air Force aircraft, the committee recommends an increase of $2.5 million in PE 64706F to continue the development of FASS.

Aircrew rescue signaling systems

The budget request included $0.9 million in PE 64706F for the development of life support systems but included no funding for developing systems to improve survivors' visibility to rescuers. The committee understands that the chances of a successful rescue can be greatly improved if air rescuers are given additional opportunities to see survivors.

The committee believes that the Air Force should investigate the potential for acquiring or developing improved capability for survivors to draw the attention of air rescuers, including such approaches as streamers, dye markers, and infrared markers. The committee recommends an increase of $4.0 million in PE 64706F for the Air Force to investigate these issues and conduct testing on potential candidate systems available on the commercial market.

Common low observable verification system

The budget request included $4.8 million in PE 64762F for continuing development of the common low observable verification system (CLOVerS). CLOVerS would provide maintenance personnel with a system to verify an aircraft's stealth capability on the flight line rather than having to rely only on flying an aircraft across an instrumented range. The system is designed to allow maintenance personnel to detect, locate, and resolve small surface defects that could degrade an aircraft's stealth capability.

During engineering and manufacturing development (EMD), the Air Force and the contractor team have realized increased risk in completing the EMD on schedule. The Air Force requires additional funding to restructure the program and complete the EMD program in time to begin low-rate initial production in fiscal year 2004. Therefore, the committee recommends an increase of $13.0 million in PE 64762F to maintain the CLOVerS development schedule.

Maglev upgrade program

The budget request included $46.3 million in PE 64759F for major test and evaluation investment. As part of the committee's overall initiative to support testing and evaluation in the Department of Defense, the committee recommends an additional $2.5 million for the continued development of high-speed test facilities for development and qualification testing, including flight testing and lethality impact testing.

Joint directed energy combat operations and employment

The budget request included $46.3 million in PE 64759F for test and evaluation support. As part of the committee's test and evaluation initiative, the committee recommends an additional $1.0 million for the development of a coordination plan for technology development and test range usage for testing directed energy weapons systems.

Air Force studies and analyses

The budget request included $25.5 million in PE 65101F for RAND Project Air Force. The committee recommends a decrease of $5.0 million to this account. The committee believes that accelerating the modernization of the Air Force by funding science and technology programs at stable levels is a higher priority than continued studies and analyses.

Theater airborne reconnaissance system improvements

The budget request included no funding for continuing a program to upgrade the F–16 theater airborne reconnaissance systems (TARS) capability. The Air Force has identified several improvements that would enhance the ability of the F–16 TARS aircraft to perform more effectively. These include providing a data link, replacing the current mission tape recorders with a solid state recorder, and expanding the ability to operate in adverse weather by integrating a synthetic aperture radar (SAR) into the TARS pod.

The Air Force received funding in fiscal year 2002 to acquire two new pods with solid state recorders and data link capability, one with electro-optical capability and one with a SAR sensor. However, the Air Force needs additional funding to pay for nonrecurring engineering (NRE) for the data link and ground station upgrades. The Air Force also could use additional funds to buy SAR-equipped pods to field an improved all-weather reconnaissance capability. The committee recommends an increase of $25.2 million for accelerating these TARS capability improvements, including $13.6 million in PE 27217F for data link and ground station NRE, and $11.6 million in Aircraft Procurement, Air Force to buy additional TARS pods equipped with SAR sensors.

Global Positioning System Jammer Detection and Location

Military personnel rely on the Global Positioning System (GPS) to support navigation, air control, precision approach and landing, time-critical targeting and precision engagement under all-weather conditions. Because of its dependence on GPS, the military must protect itself from enemy GPS jammers. The GPS Jammer Detection and Location System (JLOC) would identify the location of

enemy jammers in order to neutralize their jamming capabilities. JLOC has completed Phase II of development and is ready to begin the next phase. Therefore, the committee recommends an increase of $3.0 million to PE 27247F for the next phase of development for GPS–JLOC.

Joint air-to-surface standoff missile development

The budget request included $42.1 million in PE 27325F for continued development and testing of the joint air-to-surface standoff missile (JASSM). JASSM has entered low-rate initial production and is scheduled to complete initial operational testing and evaluation (IOT&E) in early fiscal year 2003. Testing to date has had impressive results.

The Air Force had planned to develop an extended range cruise missile (ERCM) to replace the conventional air-launched cruise missile (CALCM) which is available in only limited numbers. Two years ago, the Air Force asked for support in accelerating the ERCM program. Congress provided additional funding for the ERCM program, but for a number of reasons, the program did not move forward.

Now the Secretary of the Air Force has decided to proceed with an extended range version of the JASSM weapon, the JASSM ER, to meet the ERCM requirements. That decision is dependent on several factors, including: (1) successful completion of the JASSM IOT&E; (2) proven JASSM production capability; and (3) the JASSM prime contractor's development of an adequate business case for developing and producing a JASSM ER.

The committee believes that all of the above conditions should be met in early fiscal year 2003. Given the urgency of augmenting the current CALCM inventory, the committee believes that the Air Force should not wait until fiscal year 2004 or later to begin a program to do this. Therefore, the committee recommends an increase of $15.0 million in PE 27325F to begin JASSM ER development.

Multi-sensor command and control constellation

The budget request for the Defense Emergency Response Fund (DERF), Security, Communications and Information Operations activity included $488.0 million for the multi-sensor command and control constellation (MC2C) program. The budget request also included $191.1 million in PE 27449F for the same program, reflecting a total request of $679.1 million.

This is a new program effort that now includes the development of an improved radar system derived from the joint surveillance/target attack radar system (JSTARS) program. The new radar system is called the multi-platform radar technology insertion program (MP–RTIP). The Air Force intends to field this MP–RTIP sensor suite on a number of air vehicles, including the Global Hawk unmanned aerial vehicle (UAV). The Air Force conducted an analysis and concluded that the newer technology affords the opportunity to consolidate a number of battle management and intelligence, surveillance, and reconnaissance missions in a smaller number of platforms types than are currently in service.

The Air Force has concluded that, rather than buying additional JSTARS aircraft, they will transition the JSTARS mission to a

Boeing 767–400ER. The analysis indicates that this aircraft could accommodate the JSTARS ground moving target indicator (GMTI) mission and the airborne warning and control system (AWACS) air moving target indicator (AMTI) mission. The Air Force intends to pursue a spiral acquisition approach to fielding this MC2C capability, with the first spiral fielding GMTI capability and the second spiral fielding AMTI capability.

The DERF budget request included $150.0 million within the $488.0 million in the DERF requests to buy a test bed aircraft and $100.0 million to integrate MP–RTIP into the B–767 aircraft. The budget also included $15.0 million for deciding the configuration of the B–767 that would be common to any fleet of aircraft the Air Force would acquire. Based on Air Force documentation, however, this aircraft will have been delivered as much as two years before the MP–RTIP radar will be delivered and ready to begin aircraft integration, even with an accelerated MP–RTIP development schedule.

The committee believes that the Air Force should continue the accelerated development of MP–RTIP and the other aspects of developing the MC2C program, including deciding on a common configuration. However, the committee sees no reason to support funding to buy an aircraft or conduct MP–RTIP integration until the sensor development schedule indicates the aircraft and the integration effort need to be funded. Therefore, the committee recommends a decrease of $250.0 million in this activity. The committee recommends that the remaining $238.0 million be transferred to the new program element, PE 27449F, as requested by the Department.

Global Positioning System satellite program

The budget request included $324.1 million in PE 35165F for research and development for the Global Positioning System (GPS) satellite program. This funding included $50.0 million to increase the power level of the last six GPS Block IIF satellites, making it more difficult for an enemy to jam the GPS signal. Following the budget submission, however, the Department of Defense decided not to increase the overall power level of these satellites, but rather to add a capability to shift the existing available satellite power between different GPS signals. This, coupled with some modifications to the GPS user equipment, will provide similar anti-jam capability at less cost. Under this new plan, the full $50.0 million requested is no longer needed. Therefore, the committee recommends a reduction of $40.0 million in PE 35165F for Block IIF power level increases.

Furthermore, the impact of shifting the existing available power between different GPS signals on the full range of GPS users is still unclear. Therefore, the committee directs the Under Secretary of Defense for Acquisition, Technology and Logistics, in coordination with the Under Secretary of the Air Force, to assess the potential impacts of power shifting between GPS signals on the full range of GPS receivers, including those carried by ground troops and vehicles, naval and commercial vessels, and military and civilian aircraft.

The committee also understands that recent GPS satellite lifetime calculations have revealed the need to launch an extra GPS satellite in fiscal year 2003 to reduce the risk of the constellation dropping below the desired number of on-orbit satellites. Therefore, the committee recommends an increase of $10.0 million in PE 35165F for a fiscal year 2003 GPS launch, as requested by the Air Force.

Spacelift range system

The budget request included $82.1 million in PE 0305182F for the Air Force for the spacelift range system. The committee recommends an additional $8.0 million for systems engineering support, planning and scheduling systems, and communications systems.

Manufacturing technologies

The budget request included $37.6 million in PE 78011F for manufacturing technology programs. The committee recommends an additional $2.0 million for manufacturing technology development and testing of aircraft batteries. The committee notes that new manufacturing technologies and a robust defense technology industrial base are critical for both the national economy and for the rapid transition of new technologies for the military.

Defense-wide

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
		RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE-WIDE			
0601101D8Z	1	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	2,126		2,126
0601101E	2	DEFENSE RESEARCH SCIENCES	175,646	11,500	187,146
		University optoelectronic centers		[3,000]	
		Nanotechnology for advanced biomedical sensors & devices		[4,000]	
		Molecular electronics		[2,000]	
		Advanced photonic composite research		[2,500]	
0601103D8Z	3	UNIVERSITY RESEARCH INITIATIVES	221,610	14,000	235,610
		Advanced remote sensing		[2,000]	
		Optimization & enterprise sciences for military personnel management		[2,000]	
		Nanotechnology incentive fund		[10,000]	
0601105D8Z	4	FORCE HEALTH PROTECTION	9,973		9,973
0601108D8Z	5	HIGH ENERGY LASER RESEARCH INITIATIVES	12,082		12,082
0601111D8Z	6	GOVERNMENT/INDUSTRY COSPONSORSHIP OF UNIVERSITY RESEARCH	3,467		3,467
0601114D8Z	7	DEFENSE EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEAR	9,864		9,864
0601384BP	8	CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM	64,119		64,119
0602110E	9	NEXT GENERATION INTERNET			
0602173C	10	SUPPORT TECHNOLOGIES - APPLIED RESEARCH			
0602227D8Z	11	MEDICAL FREE ELECTRON LASER		8,000	8,000
		Medical free electron laser program		[8,000]	
0602228D8Z	12	HISTORICALLY BLACK COLLEGES AND UNIVERSITIES (HBCU) SCIENCE	13,970		13,970
0602234D8Z	13	LINCOLN LABORATORY RESEARCH PROGRAM	27,732		27,732
0602301E	14	COMPUTING SYSTEMS AND COMMUNICATIONS TECHNOLOGY	424,940	-5,000	419,940
		Bio-surveillance and genisys		[-5,000]	
0602302E	15	EMBEDDED SOFTWARE AND PERVASIVE COMPUTING	60,000		60,000

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0602383E	16	BIOLOGICAL WARFARE DEFENSE	133,000	11,250	144,250
		Anthrax therapeutic candidate technologies (Transfer from DERF)		[11,250]	
0602384BP	17	CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM	262,177	-300	261,877
		Nanoemulsions for decontamination		[5,000]	
		Nanosystem detection & deactivation of biowarfare agents		[2,000]	
		Detection of chemical, biological & pollutant agents in water		[5,000]	
		Nanoparticle responses to chemical & biological threats		[5,000]	
		Bioinformatics		[3,000]	
		Materials fabrication for bio sensors		[1,000]	
		Chemical agent exposure research		[1,200]	
		Nanotechnology biologial agent sensor		[2,500]	
		Chemical & biological research programs		[-25,000]	
0602702E	18	TACTICAL TECHNOLOGY	180,952	-10,000	170,952
		Hypersonics technology		[-10,000]	
0602708E	19	INTEGRATED COMMAND AND CONTROL TECHNOLOGY			
0602712E	20	MATERIALS AND ELECTRONICS TECHNOLOGY	440,500	-5,000	435,500
		Biologically-based materials & devices		[-5,000]	
0602715BR	21	NUCLEAR SUSTAINMENT & COUNTERPROLIFERATION TECHNOLOGIES			
0602716BR	22	WMD DEFEAT TECHNOLOGY	146,143	40,300	186,443
		Discrete particle method		[3,000]	
		Deep digger		[3,000]	
		CT information network (Transfer from DERF)		[5,500]	
		Vulnerability reduction technology measures (Transfer from DERF)		[9,800]	
		Hazard prediction & decision support tools (Transfer from DERF)		[5,000]	
		Hard target defeat characterization initiative (Transfer from DERF)		[7,000]	
		Enhanced blast weapons effects (Transfer from DERF)		[7,000]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0602717BR	23	STRATEGIC DEFENSE TECHNOLOGIES	131,199		131,199
0602787D8Z	24	MEDICAL TECHNOLOGY			
0602890D8Z	25	HIGH ENERGY LASER RESEARCH	39,310		39,310
0603002D8Z	26	MEDICAL ADVANCED TECHNOLOGY			
0603104D8Z	27	EXPLOSIVES DEMILITARIZATION TECHNOLOGY	8,935		8,935
0603121D8Z	28	SO/LIC ADVANCED DEVELOPMENT	13,800	9,000	22,800
		Special reconnaissance capabilities (Transfer from DERF)		[5,000]	
		Measurement & signatures information (Transfer from DERF)		[4,000]	
0603122D8Z	29	COMBATING TERRORISM TECHNOLOGY SUPPORT	49,015	74,600	123,615
		Blast mitigation testing		[5,000]	
		Entry point screening & perimeter protection (Transfer from DERF)		[11,000]	
		Reconnaissance Tool Kit (Transfer from DERF)		[19,500]	
		Super zoom digital camera (Transfer from DERF)		[6,000]	
		Combating terrorism BAA (Transfer from DERF)		[19,500]	
		Attribution CT tools & deployable communications (Transfer from DERF)		[5,600]	
		Detection of Bio agents in food (Transfer from DERF)		[3,000]	
		Alternate power sources for battery charging (Transfer from DERF)		[5,000]	
0603160BR	30	COUNTERPROLIFERATION ADVANCED DEVELOPMENT TECHNOLOGIES	77,389		77,389
0603173C	31	SUPPORT TECHNOLOGIES - ADVANCED TECHNOLOGY DEVELOPMENT			
0603174C	32	SPACE BASED LASERS (SBL)			
0603175C	33	BALLISTIC MISSILE DEFENSE TECHNOLOGY	121,751	23,700	145,451
		Wafer-scale planarization		[5,000]	
		Bottom anti-reflective coatings (BARC)		[5,000]	
		Nanophotonic systems fabrication facility		[3,700]	
		Wide-bandgap semiconductors		[10,000]	
0603225D8Z	34	JOINT DOD-DOE MUNITIONS TECHNOLOGY DEVELOPMENT	25,420		25,420

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603232D8Z	35	AUTOMATIC TARGET RECOGNITION	7,404		7,404
0603285E	36	ADVANCED AEROSPACE SYSTEMS	246,000		246,000
0603384BP	37	CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM - ADVANCED DEVELOPMENT	249,842	300	250,142
		Biological process development facility		[7,000]	
		Electrostatic decontamination system		[5,000]	
		Chem-bio emergency response technologies		[2,300]	
		Vaccine stabilization		[3,000]	
		Weaponization of nanoparticles for the neutralization of facility threats		[3,000]	
		Agroterrorism prediction & risk assessment		[5,000]	
		Chemical & biological research programs		[-25,000]	
0603704D8Z	38	SPECIAL TECHNICAL SUPPORT	11,168		11,168
0603711BR	39	ARMS CONTROL TECHNOLOGY	37,646	3,000	40,646
		Advanced CBRNE sensor & info fusion (Transfer from DERF)		[3,000]	
0603712S	40	GENERIC LOGISTICS R&D TECHNOLOGY DEMONSTRATIONS	25,451	10,000	35,451
		Vehicle fuel cell program		[10,000]	
0603716D8Z	41	STRATEGIC ENVIRONMENTAL RESEARCH PROGRAM	60,468	3,000	63,468
		UXO remediation technology development		[3,000]	
0603727D8Z	42	JOINT WARFIGHTING PROGRAM	9,610		9,610
0603728D8Z	43	AGILE PORT DEMONSTRATION			
0603738D8Z	44	COOPERATIVE DOD/VA MEDICAL RESEARCH			
0603739E	45	ADVANCED ELECTRONICS TECHNOLOGIES	150,400		150,400
0603750D8Z	46	ADVANCED CONCEPT TECHNOLOGY DEMONSTRATIONS	199,580		199,580
0603755D8Z	47	HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM	188,642		188,642
0603760E	48	COMMAND, CONTROL AND COMMUNICATIONS SYSTEMS	130,101		130,101
0603762E	49	SENSOR AND GUIDANCE TECHNOLOGY	224,000		224,000
0603763E	50	MARINE TECHNOLOGY	33,000		33,000

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603764E	51	LAND WARFARE TECHNOLOGY	162,100	8,000	170,100
		Wolfpack program for terrorist communications (Transfer from DERF)		[8,000]	
0603765E	52	CLASSIFIED DARPA PROGRAMS	275,899	19,000	294,899
		Chem / bio agent defense improvements (Transfer from DERF)		[19,000]	
0603769D8Z	53	DISTRIBUTED LEARNING ADVANCED TECHNOLOGY DEVELOPMENT	14,000		14,000
0603781D8Z	54	SOFTWARE ENGINEERING INSTITUTE	22,983		22,983
0603805S	55	DUAL USE APPLICATION PROGRAMS			
0603826D8Z	56	QUICK REACTION SPECIAL PROJECTS	25,430	25,000	50,430
		Technology transition initiative		[25,000]	
0603832D8Z	57	JOINT WARGAMING SIMULATION MANAGEMENT OFFICE	49,929	4,000	53,929
		Information technology for WMD medical response		[4,000]	
0603924D8Z	58	HIGH ENERGY LASER ADVANCED TECHNOLOGY PROGRAM	13,567		13,567
0605160D8Z	59	COUNTERPROLIFERATION SUPPORT	1,806	16,000	17,806
		SOF support defeat terrorist (Transfer from DERF)		[11,000]	
		Anti-biological weapon defeat device (Transfer from DERF)		[5,000]	
0603228D8Z	60	PHYSICAL SECURITY EQUIPMENT	33,553	10,000	43,553
		Classified program (Transfer from DERF)		[10,000]	
0603709D8Z	61	JOINT ROBOTICS PROGRAM	11,305		11,305
0603714D8Z	62	ADVANCED SENSOR APPLICATIONS PROGRAM	15,994		15,994
0603736D8Z	63	CALS INITIATIVE	1,647		1,647
0603851D8Z	64	ENVIRONMENTAL SECURITY TECHNICAL CERTIFICATION PROGRAM	28,334	5,000	33,334
		UXO remediation		[5,000]	
0603868C	65	NAVY THEATER WIDE MISSILE DEFENSE SYSTEM			
0603869C	66	MEADS CONCEPTS - DEM/VAL			
0603871C	67	NATIONAL MISSILE DEFENSE - DEM/VAL			

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603873C	68	FAMILY-OF SYSTEMS ENGINEERING AND INTEGRATION (FOS E&I)			
0603874C	69	BMD TECHNICAL OPERATIONS			
0603875C	70	INTERNATIONAL COOPERATIVE PROGRAMS			
0603876C	71	THREAT AND COUNTERMEASURES			
0603880C	72	BALLISTIC MISSILE DEFENSE SYSTEM SEGMENT	1,065,982	-332,000	733,982
		Systems engineering & integration (SE&I)		[-140,000]	
		Maintain T&E funding level		[30,000]	
		Duplication/lack of justification/execution		[-222,000]	
0603881C	73	BALLISTIC MISSILE DEFENSE TERMINAL DEFENSE SEGMENT	169,974	26,000	195,974
		Arrow		[40,000]	
		Program operations		[-14,000]	
0603882C	74	BALLISTIC MISSILE DEFENSE MIDCOURSE DEFENSE SEGMENT	3,195,104	-161,000	3,034,104
		High power discriminator radar development		[40,000]	
		Systems engineering & integration (SE&I)		[-45,000]	
		Small kill vehicle technology development		[10,000]	
		Concept development, studies & risk reduction		[-52,000]	
		SE&I -- non-system specific		[-50,000]	
		Program operations		[-64,000]	
0603883C	75	BALLISTIC MISSILE DEFENSE BOOST DEFENSE SEGMENT	796,927	-250,000	546,927
		Sea-based boost -- undefined, unexecutable experiment		[-55,000]	
		Space-based boost -- undefined, unexecutable experiment		[-30,000]	
		Airborne laser		[-135,000]	
		Space-based laser		[-10,000]	
		Program operations		[-20,000]	
0603884BP	76	CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM - DEM/VAL	144,790	2,600	147,390
		Miniature chemical analysis sys for detection of chembio agents in the chemlab (Transfer from DERF)		[2,600]	

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0603884C	77	BALLISTIC MISSILE DEFENSE SENSORS	373,447	-33,000	340,447
		Airborne infrared surveillance (AIRS) system		[22,000]	
		Russian-American observation satellite (RAMOS) solar array development		[10,000]	
		SBIRS-Low -- fund a single contractor		[-55,000]	
		Program operations		[-10,000]	
0603910D8Z	77a	Strategic Capability Modernization		125,000	125,000
		Hard & deeply buried target capabilities upgrades (Transfer from DERF)		[125,000]	
0603920D8Z	78	HUMANITARIAN DEMINING	13,355		13,355
0603923D8Z	79	COALITION WARFARE	12,444		12,444
0604722D8Z	80	JOINT SERVICE EDUCATION AND TRAINING SYSTEMS DEVELOPMENT			
0303191D8Z	81	JOINT ELECTROMAGNETIC TECHNOLOGY (JET) PROGRAM	5,085		5,085
0901585C	82	PENTAGON RESERVATION			
	82a	Dem/val Test and Evaluation transfer		-37,000	-37,000
0604384BP	83	CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM - EMD	169,018		169,018
0604709D8Z	84	JOINT ROBOTICS PROGRAM - EMD	13,643		13,643
0604764K	85	ADVANCED IT SERVICES JOINT PROGRAM OFFICE (AITS-JPO)	28,393		28,393
0604771D8Z	86	JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS)	10,797		10,797
0604861C	87	THEATER HIGH-ALTITUDE AREA DEFENSE SYSTEM - TMD - EMD	932,171	-40,000	892,171
		Missiles excess to the THAAD test program		[-40,000]	
0604865C	88	PATRIOT PAC-3 THEATER MISSILE DEFENSE ACQUISITION - EMD			
0604867C	89	NAVY AREA THEATER MISSILE DEFENSE - EMD			
0605013BL	90	INFORMATION TECHNOLOGY DEVELOPMENT	3,938		3,938
0605013D8Z	91	PROTOTYPE ACCOUNTING SYSTEMS	700		700
0605014SE	92	INFORMATION TECHNOLOGY DEVELOPMENT			
0605015BL	93	INFORMATION TECHNOLOGY DEVELOPMENT-STANDARD PROCUREMENT SYSTEM (SPS)	10,427		10,427

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0605016D8Z	94	FINANCIAL MANAGEMENT SYSTEM IMPROVEMENTS	96,250		96,250
0303129K	95	DEFENSE MESSAGE SYSTEM	11,803		11,803
0303140K	96	INFORMATION SYSTEMS SECURITY PROGRAM	17,620		17,620
0303141K	97	GLOBAL COMBAT SUPPORT SYSTEM	17,239		17,239
0305840K	98	ELECTRONIC COMMERCE	24,265		24,265
	98a	EMD Test and Evaluation transfer		-8,000	-8,000
0603858D8Z	99	UNEXPLODED ORDNANCE DETECTION AND CLEARANCE	1,185		1,185
0604943D8Z	100	THERMAL VICAR	7,058		7,058
0605104D8Z	101	TECHNICAL STUDIES, SUPPORT AND ANALYSIS	30,023	-5,000	25,023
		OSD reports, studies, & analyses		[-5,000]	
0605110BR	102	CRITICAL TECHNOLOGY SUPPORT	1,862		1,862
0605114E	103	BLACK LIGHT	5,000	10,000	15,000
		Classified program (Transfer from DERF)		[10,000]	
0605116D8Z	104	GENERAL SUPPORT TO C3I	14,979	4,900	19,879
		Tech demos & coordinated IT planning for homeland security (Transfer from DERF)		[2,000]	
		GIS-based maps for installation consequence management (Transfer from DERF)		[2,900]	
0605117D8Z	105	FOREIGN MATERIAL ACQUISITION AND EXPLOITATION	32,382	2,000	34,382
		Classified program		[2,000]	
0605123D8Z	106	INTERAGENCY EXPORT LICENSE AUTOMATION	10,702		10,702
0605124D8Z	107	DEFENSE TRAVEL SYSTEM	30,358		30,358
0605126J	108	JOINT THEATER AIR AND MISSILE DEFENSE ORGANIZATION	72,919		72,919
0605128D8Z	109	CLASSIFIED PROGRAM USD(P)			
0605130D8Z	110	FOREIGN COMPARATIVE TESTING	31,670		31,670
0605384BP	111	CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM	42,959		42,959
0605502C	112	SMALL BUSINESS INNOVATIVE RESEARCH - BMDO			
0605502E	113	SMALL BUSINESS INNOVATIVE RESEARCH			

Title II-RDT and E

(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0605710D8Z	114	CLASSIFIED PROGRAMS - C3I	60,708	52,060	112,768
		Information security scholarships		[10,000]	
		Hard & deeply buried target analysis upgrades (Transfer from DERF)		[3,200]	
		National Infrastructure Protection Center (NIPC) Crucial Player (Transfer from DERF)		[1,600]	
		Space Policy activities supporting Operation Enduring Freedom (Transfer from DERF)		[4,500]	
		Collaborative planning tools (Transfer from DERF)		[32,760]	
0605790D8Z	115	SMALL BUSINESS INNOVATION RESEARCH/CHALLENGE ADMINISTRATION	2,103		2,103
0605798S	116	DEFENSE TECHNOLOGY ANALYSIS	5,201		5,201
0605799D8Z	117	FORCE TRANSFORMATION DIRECTORATE	20,000		20,000
0605801K	118	DEFENSE TECHNICAL INFORMATION SERVICES (DTIC)	45,249		45,249
0605803SE	119	R&D IN SUPPORT OF DOD ENLISTMENT, TESTING AND EVALUATION	8,963		8,963
0605804D8Z	120	DEVELOPMENT TEST AND EVALUATION	48,913		48,913
0605898E	121	MANAGEMENT HEADQUARTERS (RESEARCH AND DEVELOPMENT)DARPA	43,572		43,572
0901585C	122	PENTAGON RESERVATION	7,457		7,457
0901598C	123	MANAGEMENT HEADQUARTERS-BMDO	27,909		27,909
0909999E	124	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS			
0604805D8Z	125	COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE	10,320		10,320
0605127T	126	PARTNERSHIP FOR PEACE (PFP) INFORMATION MANAGEMENT SYSTEM	1,920		1,920
0208045K	127	C4I INTEROPERABILITY	43,199		43,199
0208052J	128	JOINT ANALYTICAL MODEL IMPROVEMENT PROGRAM	12,531		12,531
0300205R	129	INFORMATION TECHNOLOGY SYSTEMS	550		550

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0301011G	130	CRYPTOLOGIC ACTIVITIES	[ ]	[28,400]	[ ]
		Classified program		[-12,000]	
		Classified program		[-45,000]	
		Secure Bandwidth (Transfer from DERF)		[30,000]	
		Mobile Secure Communications (Transfer from DERF)		[20,400]	
		Classified - Cryptologic activities (Transfer from DERF)		[7,000]	
		NC-2 COMSEC (Transfer from DERF)		[10,000]	
		Coalition Interoperability and Coalition Information Security (Transfer from DERF)		[18,000]	
0301301L	131	GENERAL DEFENSE INTELLIGENCE PROGRAM	[ ]	[4,800]	[ ]
		Hard & deeply buried target intelligence support (Transfer from DERF)		[5,800]	
		Classified program		[-10,000]	
		Classified program (Transfer from DERF)		[9,000]	
0301398L	132	MANAGEMENT HEADQUARTERS GDIP, DIA	[ ]	[ ]	[ ]
0302016K	133	NATIONAL MILITARY COMMAND SYSTEM-WIDE SUPPORT	1,053		1,053
0302019K	134	DEFENSE INFO INFRASTRUCTURE ENGINEERING AND INTEGRATION	7,554		7,554
0303126K	135	LONG HAUL COMMUNICATIONS (DCS)	1,407		1,407
0303127K	136	SUPPORT OF THE NATIONAL COMMUNICATIONS SYSTEM	15,046		15,046
0303131K	137	MINIMUM ESSENTIAL EMERGENCY COMMUNICATIONS NETWORK (MEECN)	7,199		7,199
0303140G	138	INFORMATION SYSTEMS SECURITY PROGRAM	394,257	4,000	398,257
		Information systems protection research		[4,000]	
0303149J	139	C4I FOR THE WARRIOR	10,190		10,190
0303149K	140	C4I FOR THE WARRIOR	20,536	4,500	25,036
		Improve network infrastructure (Transfer from DERF)		[4,500]	
0303150K	141	GLOBAL COMMAND AND CONTROL SYSTEM	15,604		15,604
0303153K	142	JOINT SPECTRUM CENTER	19,102		19,102
0303610K	143	TELEPORT PROGRAM	6,678		6,678

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0304210BB	144	SPECIAL RECONNAISSANCE CAPABILITIES (SRC) PROGRAM			
0304345BQ	145	NATIONAL IMAGERY AND MAPPING PROGRAM	[ ]	[9,000]	[ ]
		Classified program		[9,000]	
0305102BQ	146	DEFENSE IMAGERY AND MAPPING PROGRAM	143,488	21,100	164,588
		Feature-level database development		[4,100]	
		Intelligent spatial technologies for smart maps		[1,000]	
		Broadcast-request imagery technology development (BRITE)		[4,000]	
		Integrate airborne information into collection manage & exploit system (Transfer from DERF)		[8,300]	
		Softcopy exploitation infrastructure acceleration (Transfer from DERF)		[1,000]	
		Increase storage capacity for command information libraries (Transfer from DERF)		[1,000]	
		Improve mensuration to support PGM accuracy needs (Transfer from DERF)		[1,700]	
0305127D8Z	147	FOREIGN COUNTERINTELLIGENCE ACTIVITIES	13,916	15,300	29,216
		Classified program		[15,300]	
0305127V	148	FOREIGN COUNTERINTELLIGENCE ACTIVITIES	474		474
0305146D8Z	149	DEFENSE JOINT COUNTERINTELLIGENCE PROGRAM (JMIP)	6,058	48,000	54,058
		Adv info systems & contractor support for critical asset protection (Transfer from DERF)		[48,000]	
0305190D8Z	150	C3I INTELLIGENCE PROGRAMS	75,682	38,800	114,482
		Hard & deeply buried target intelligence technology (Transfer from DERF)		[3,200]	
		Modernize electronic warfare capabilities (Transfer from DERF)		[25,000]	
		Develop & test systems for horizontal fusion analysis (Transfer from DERF)		[5,600]	
		Coalition-Intelligence Information Sharing (CENTRIX) (Transfer from DERF)		[5,000]	
0305191D8Z	151	TECHNOLOGY DEVELOPMENT	120,458	142,600	263,058
		Classified program (Transfer from DERF)		[110,500]	
		Classified program (Transfer from DERF)		[32,100]	
0305202G	152	DRAGON U-2 (JMIP)	3,353		3,353
0305206G	153	AIRBORNE RECONNAISSANCE SYSTEMS	11,934		11,934

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
0305207G	154	MANNED RECONNAISSANCE SYSTEMS	4,649		4,649
0305208BQ	155	DISTRIBUTED COMMON GROUND SYSTEMS	[ ]	[ ]	[ ]
0305208G	156	DISTRIBUTED COMMON GROUND SYSTEMS	[ ]	[ ]	[ ]
0305208L	157	DISTRIBUTED COMMON GROUND SYSTEMS	1,000		1,000
	158	INTELLIGENCE PLANNING AND REVIEW ACTIVITIES	[ ]	[ ]	[ ]
0305885G	159	TACTICAL CRYPTOLOGIC ACTIVITIES	113,159		113,159
0305889G	160	COUNTERDRUG INTELLIGENCE SUPPORT			
0305917D8Z	161	NATIONAL SECURITY SPACE ARCHITECT (NSSA)	11,185		11,185
0708011S	162	INDUSTRIAL PREPAREDNESS	13,072	5,000	18,072
		Laser additive manufacturing program		[5,000]	
0902298J	163	MANAGEMENT HEADQUARTERS (OJCS)	12,887		12,887
0902740J	164	JOINT SIMULATION SYSTEM			
1160279BB	165	SMALL BUSINESS INNOVATIVE RESEARCH/SMALL BUS TECH TRANSFER PILOT PROG			
1160401BB	166	SPECIAL OPERATIONS TECHNOLOGY DEVELOPMENT	6,741	5,000	11,741
		Advanced technologies for Spec Ops		[5,000]	
1160402BB	167	SPECIAL OPERATIONS ADVANCED TECHNOLOGY DEVELOPMENT	62,276		62,276
1160404BB	168	SPECIAL OPERATIONS TACTICAL SYSTEMS DEVELOPMENT	281,443	-10,400	271,043
		Use excess FY 02 funds for FY 03 requirements		[-12,200]	
		Joint threat warning system		[1,800]	
1160405BB	169	SPECIAL OPERATIONS INTELLIGENCE SYSTEMS DEVELOPMENT	1,590	2,200	3,790
		Embedded integrated broadcast service (IBS) receivers		[2,200]	
1160407BB	170	SOF MEDICAL TECHNOLOGY DEVELOPMENT	1,962		1,962
1160408BB	171	SOF OPERATIONAL ENHANCEMENTS	77,308	9,100	86,408
		Classified program adjustments		[9,100]	
	999	CLASSIFIED PROGRAMS	2,534,247	62,200	2,596,447

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
	171a	Civilian personnel accounting adjustment		-14,688	-14,688
	171b	Financial management savings		-36,600	-36,600
	171c	Contract services savings		-25,200	-25,200
	171d	Operational systems development T&E transfer		-25,000	-25,000
		TOTAL DEFENSE WIDE	**16,613,551**	**-122,178**	**16,491,373**

Title II-RDT and E
(Dollars in Thousands)

Program Element	Line No	Program Title	FY2003 Request	Change	Recommended
		DEVELOPMENTAL TEST & EVALUATION, DEFENSE			
0604940D8Z	1	CENTRAL TEST AND EVALUATION INVESTMENT DEVELOPMENT (CTEIP)			
0605130D8Z	2	FOREIGN COMPARATIVE TESTING			
0605804D8Z	3	DEVELOPMENT TEST AND EVALUATION			
		TOTAL DEVELOPMENTAL TEST			
		OPERATIONAL TEST & EVALUATION, DEFENSE			
0603941D8Z	1	TEST & EVALUATION SCIENCE TECHNOLOGY	6,010	5,000	11,010
		Test & evaluation science & technology		[5,000]	
0604940D8Z	2	CENTRAL TEST AND EVALUATION INVESTMENT DEVELOPMENT (CTEIP)	123,276	128,000	251,276
		Central T&E improvement program		[50,000]	
		Transfer from acquisition programs		[70,000]	
		Digital video laboratory		[3,000]	
		Big Crow test support activities		[5,000]	
0605118D8Z	3	OPERATIONAL TEST AND EVALUATION	19,725		19,725
0605131D8Z	4	LIVE FIRE TESTING	10,102	6,500	16,602
		Live fire test & training program		[5,000]	
		Fire fighting training system		[1,500]	
0605804D8Z	5	DEVELOPMENT TEST AND EVALUATION	62,941		62,941
		TOTAL OPERATIONAL TEST	**222,054**	**139,500**	**361,554**

Defense Advanced Research Projects Agency fundamental research

The budget request included $175.6 million for basic research at the Defense Advanced Research Projects Agency (DARPA). Because of the importance of DARPA's fundamental research activities, the committee recommends an increase of $11.5 million for basic research at universities and in industry. Of this amount, $3.0 million shall be available for optoelectronics research, $4.0 million for nanotechnology research for advanced biomedical devices and sensors, $2.0 million for the development and modeling of nanotechnology-based logic circuits, and $2.5 million for photonic materials and device research.

Many of the technologies that have enabled our current economic prosperity and increased our national security have their roots in university research supported by the DARPA. For example, the Internet, graphical user interfaces, and global positioning systems are all the result of long-term, cutting-edge, university-based research, supported decades ago by DARPA. DARPA has been recognized as the high-risk, high-payoff defense agency ever since its inception. The committee, however, is concerned about recent trends in the agency-sponsored research that appear more shortsighted in their approach, particularly the emphasis on 12- and 18-month reviews in order to attempt to eliminate non-promising technologies.

The committee supports effective internal oversight and commends DARPA for pursuing truly innovative technologies. However, annual reviews may not be appropriate for all basic and applied defense-related research programs. Additionally, these reviews have a discouraging effect on the intended long-term payoff of the research and are especially inconsistent with the time frames and pace of university research. The committee is concerned that this near-term approach to basic and applied research will have detrimental consequences on the ability to develop innovative solutions to future threats. Therefore, the committee urges DARPA to re-evaluate its policies for reviewing and terminating awards in scientific and technical areas where the Department of Defense is dependent on DARPA's ability to do revolutionary research that requires some time to develop and mature.

The committee notes that the DARPA budget was significantly increased in the President's Budget Request and now represents approximately 25 percent of the overall defense science and technology program. The committee believes that this amount of funding and the critical role that DARPA now plays in transitioning new technologies, such as Future Combat Systems and Unmanned Combat Air Vehicles, to the services and in developing revolutionary new capabilities, for example in nanotechnology and artificial intelligence, demand extensive planning and coordination throughout the Department. In a 1999 report, the Defense Science Board recommended that DARPA "plan deliberately for the future", including establishing a "systemic approach to strategic planning that provides clear definition of long-term Agency objectives in support of evolving national defense threats." This is especially important in light of new Department activities supporting efforts in combating terrorism and homeland security.

The committee supports this recommendation and directs that DARPA develop a strategic plan and investment strategy as described by the Defense Science Board. The committee directs that DARPA communicate that plan to the Director of Defense Research and Engineering and the Joint Staff and provide a copy of the plan to Congress with the fiscal year 2004 budget request.

University research initiatives

The budget request included $221.6 million in PE 61103D8Z for university-based research programs. Fundamental research performed at universities provides the foundation for the next generation of defense technologies and trains the next generation of scientists, engineers, and technology entrepreneurs. Therefore, the committee recommends an additional $4.0 million to support university research in support of military transformation. The committee recommends an additional $2.0 million for the development of advanced remote sensing systems for environmental monitoring and analysis and an additional $2.0 million for the development of technologies for the optimization of military personnel management.

Nanotechnology incentive fund

The budget request included $175.6 million in PE 61103D8Z for university research initiatives. As part of the nanotechnology research and development program authorized in section 245, the committee recommends an additional $10.0 million in this account for use as a nanotechnology incentive fund to sponsor research performed at universities, in industry, and at government laboratories and test centers in support of meeting the challenges and goals established by the program.

The committee requires the Director of Defense Research and Engineering to use this funding for research projects in nanoscale science and technology. The incentive fund should be used to provide supplemental funding to services and agencies that collaborate on interagency research teams, projects, and activities in research areas central to the accomplishment of the challenges and goals of the program.

Medical free electron laser

The budget request included no funding in PE 62227D8Z for the medical free electron program due to a transfer of the program to the National Institutes of Health (NIH). This transfer occurred despite the fact that this program has been developing valuable technology for military medical applications for 18 years, and NIH did not request or recommend this programmatic change.

Laser medical research is not an area previously managed by NIH. The committee is concerned that NIH does not have the expertise or institutional culture to manage this unique and important program. The committee directs the Department of Defense to work with the National Institutes of Health (NIH) to ensure that future funding for this program is requested in the defense budget. Therefore, the committee recommends an increase of $8.0 million for continued work by the Department of Defense on medical free electron lasers.

Computing systems and communications technology

The budget request included $424.9 million in PE 62301E for computing systems and communications technology, which represents an increase of over $65.0 million to this account. The committee recommends a decrease of $5.0 million to this account. The committee believes that the Bio-Surveillance program is redundant with other efforts currently underway within the government. The committee also recommends that the new start in the Genisys database development program be reduced.

Chemical-Biological Defense Program funding

The budget request included $932.9 million for research, development, test and evaluation for the Chemical-Biological Defense Program (CBDP), including $262.2 million in PE 62384BP and $249.8 million in PE 63384BP. This represents an increase of $425.2 million, almost 85 percent above the fiscal year 2002 requested level. This significant funding increase for homeland security projects is planned for only one year, with planned funding returning to $503.4 million in fiscal year 2004 and dropping to $408.1 million by fiscal year 2007.

The committee recommends a number of specific adjustments to the chemical and biological defense program funding account. These adjustments would provide for an overall authorization of $932.9 million, the amount requested for Chemical-Biological Defense research and development in the budget request.

The committee is concerned that the one-year spike in requested funding will not be executable in one fiscal year, especially with no follow-on funding planned through the Future Years Defense Program (FYDP). Therefore, the committee recommends an overall reduction of $25.0 million in PE 62384BP for applied microbial threat assessment research and an overall reduction of $25.0 million in PE 63384BP for new homeland security projects for the biological counterterrorism research program. The committee also recommends that the Department of Defense adjust its spending plans to be better defined and more executable across future years.

The committee recommends an increase of $5.0 million in PE 602384BP for continued testing of non-toxic, non-corrosive, bio-defense nanoemulsion decontamination material that can act as a decontaminant for equipment, personnel, structures, terrain and humans to respond to the threat of biological warfare agents. Such decontaminants would be less caustic and damaging than current decontamination solutions.

The committee recommends an increase of $2.0 million in PE 62384BP for research on efforts to combine nanotechnology and micro-manufacturing to produce systems for effective detection and deactivation of biological warfare agents and an increase of $2.5 million to support continued Navy research on portable biological agent sensors based on nanotechnology. Such nanotechnology holds promise for wide application in chem-bio defense.

The committee recommends an increase of $5.0 million in PE 62384BP to support the Army's development of a rapid detection system to identify the presence of chemical or biological threat agents and other toxic pollutants in water. This system would help

ensure the safety of water for both military personnel and civilian populations.

The committee recommends an increase of $3.0 million in PE 62384BP for continued work on bioinformatics. This funding would continue an effort to integrate genomic and other biological data about high-priority pathogens, underlying scientific research and bioinformatics tools.

The committee recommends an increase of $1.0 million in PE 62384BP for materials fabrication to develop affordable, rapid and sensitive detectors for biological warfare agents.

The committee recommends an increase of $1.2 million in PE 62384BP for expanded research in diagnosing and treating the symptoms of exposure to organophosphorus compounds and nerve agents using ultra-sensitive ion-trap technology and biomarkers to analyze chemical agents.

The committee recommends an increase of $5.0 million in PE 62384BP to support Marine Corps efforts to develop, test and field nanoparticle-based countermeasures, decontamination agents, and protection technologies for chemical and biological threats.

The committee recommends an increase of $7.0 million in PE 63384BP for equipping and validating a biological process development facility using current Good Manufacturing Practices that can produce biological materials for Phase I and II clinical testing of candidate vaccines and therapeutic products to defend against biological warfare agents. Such a facility would help accelerate the testing of potential medical defenses to biological warfare.

The committee recommends an increase of $5.0 million in PE 63384BP to support continued rapid development and testing by the Combating Terrorism Technical Support Working Group of electrostatic decontamination system technology. This technology holds potential for rapid and man-portable decontamination of surfaces and sensitive equipment with a non-corrosive, non-toxic technology and could serve both military and non-military users.

The committee recommends an increase of $2.3 million to PE 63384BP to support continued Marine Corps efforts to develop and demonstrate emergency response technologies for use by first response units such as its Chem-Bio Incident Response Force (CBIRF). These technologies may also have utility to state and local first response units.

The committee recommends an increase of $3.0 million to PE 63384BP to develop more stable vaccines that are less susceptible to degradation from temperature and other environmental factors. Stabilized vaccines would be particularly useful in remote locations where environmental controls are lacking.

The committee recommends an increase of $3.0 million in 63384BP to support Marine Corps efforts for environmental testing, concept-of-operations development, and research and development to rapidly field operational systems utilizing nanotechnologies that are capable of clearing facilities of chemical and biological agent contamination.

Finally, the committee recommends an increase of $5.0 million to PE 63384BP for biological terrorism and agroterrorism risk assessment and prediction, including a comprehensive assessment of po-

tential biological agents that could be of interest to terrorists for human or agricultural attacks.

Tactical technology

The budget request included $181.0 million in PE 62702E for applied research in tactical technologies. The committee recommends a decrease of $10.0 million to this account and recommends that programs in hypersonics technology and aeronautics technology be reduced or delayed.

Materials and electronics technology

The budget request included $440.5 million in PE 62712E for applied research in materials and electronics technology, which represents an increase of nearly $100.0 million to this account. The committee recommends a decrease of $5.0 million to this account. The committee also recommends that new starts in biologically-based materials and devices and microelectronic device technologies be reduced.

Weapons of mass destruction defeat technology

The budget request included $146.1 million in PE 62716BR for applied research to develop weapons of mass destruction (WMD) defeat technologies. The committee recommends an increase of $3.0 million for research on enhancing the blast resistance of concrete and other structures against terrorist attack. The committee also recommends an increase of $3.0 million for the development and proof of concept demonstration of technology for penetrating and neutralizing hard and deeply buried targets such as command centers or weapons storage facilities for weapons of mass destruction.

Combating Terrorism Technology Support Working Group

The budget request included $49.0 million in PE 63122D8Z for the activities of the Combating Terrorism Technology Support Working Group (TSWG). The committee recommends an additional $5.0 million for blast mitigation testing, including the development of new materials for protecting buildings and other infrastructure and new testing techniques and technologies for the qualification of new structural designs.

The committee commends TSWG for its leadership in developing the leading-edge technologies that the Nation uses in the war against terrorism. TSWG's successful interagency coordination and rapid transition of technologies into the hands of warfighters, first responders, and other personnel should be models for the rest of the Department of Defense and the Federal Government.

The committee notes the key role the TSWG has played in attempting to find the best technology, including from small businesses and non-traditional defense contractors, available for use in the fight against terrorism. The committee commends TSWG's role in the very successful combating terrorism broad agency announcement of 2001 and urges the group to continue its efforts to evaluate and fund those proposals it deems meritorious. The committee notes that many of these proposals would be funded out of the Defense Emergency Response Fund.

Wafer-scale planarization technology

Future defense electronic systems require new methods to place more transistors on ever-shrinking silicon and gallium arsenide chips. Multiple technologies are being developed for this purpose, but advancement of planarization technology is not being adequately addressed. Therefore, the committee recommends an increase of $5.0 million to PE 63175C for research and development in wafer-scale planarization technology.

Bottom Anti-Reflective Coatings for circuit boards

Bottom Anti-Reflective Coatings (BARC) are used for ultra high-density circuits to reduce the feature size on circuit boards. If the BARC program is successful, printed circuit cards could be reduced in size by as much as 40 percent, ultimately allowing the size and weight of computers in missile defense components, such as interceptors, to be reduced commensurately. The committee recommends an increase of $5.0 million in PE 63175C for BARC.

Nanophotonics system fabrication facility

Nanophotonics is a combination of nanofabrication and photonics focused on the development of devices embedded in semiconductor chips that control photons, or light, at the nanometer level. Photonic hit indicators are used on ballistic missile defense test targets to determine precisely where the interceptor hits the target. The nanophotonics systems fabrication facility would focus on the development, integration, and packaging of devices for photonic systems, with methods based on those utilized in the integrated circuit industry. The committee believes in the potential of photonic systems and recommends an increase of $3.7 million in PE 63175C for the development of a nanophotonics systems fabrication facility.

Wide-bandgap semiconductor

There is an increasing need for semiconductors that can withstand high electricity and high temperature, especially for the compact, lightweight electronics required for ballistic missile defense systems. The wide-bandgap semiconductor program researches the use of Gallium Nitride, which can function at higher temperatures than conventional materials. The committee agrees on the importance of Gallium Nitride as a semiconductor for the projects within the Missile Defense Agency and in other areas. Therefore, the committee recommends an increase of $10.0 million in PE 63175C for the wide-bandgap semiconductor program.

Vehicle fuel cell program

The budget request included $25.5 million in PE 63712S for logistics technology demonstrations. As a component of the legislative initiative described elsewhere in this title, the committee recommends an additional $10.0 million to carry out a cost-shared program to identify and support technological advances that are necessary to develop fuel cell technology for use in vehicles. The committee directs that this program be coordinated with the Secretary of Energy, other appropriate federal agencies, and private industry. The committee also directs the Secretary of Defense to

ensure that at least half of the total cost of the program be borne by industry, either in cash or in kind.

The vehicle fuel cell program shall include continued development of fuel cell auxiliary power units and vehicle propulsion technologies as well as pilot demonstration of such technologies as appropriate. The program shall also include development of technologies necessary for a hydrogen fuel infrastructure.

Technology transition initiatives

The budget request included $25.4 million in PE 63826D8Z for Quick Reaction Special Projects. The committee supports the Department of Defense's attempts to establish innovative programs to rapidly transition technologies into operational systems. Section 242 of this title would add an additional $25.0 million in this account only for use as part of the Technology Transition Initiative authorized by that provision.

The committee directs the Director of Defense Research and Engineering to report to Congress on the execution of the Quick Reaction and Transition Initiative funds, document technology transition successes that resulted as a consequence of the funds, and make recommendations for new funding mechanisms to further promote rapid and efficient technology transition.

Instructional technologies for first responders

The budget request included $49.9 million in PE 63832D8Z for the Joint Wargaming Simulation Management Office. The committee recommends an additional $4.0 million for planning, designing, and developing a national network for delivering Weapons of Mass Destruction (WMD) training and to support research on simulation-based training systems that can improve WMD training.

The committee notes that preparing military medical personnel to respond effectively to incidents involving use of weapons of mass destruction is an essential part of a balanced response to new threats. The Department of Defense must be able to provide continuous training, as well as rapid training updates, to large numbers of globally distributed personnel, including medics and personnel in military hospitals. New information technologies are essential to serve this critical mission.

The committee recommends that the Director of Defense Research and Engineering direct and manage this program. The committee also recommends the formulation of a national strategy to develop and deliver training materials for this mission. The program's activities should leverage new information technologies and adapt to newly available capabilities as well as conform as appropriate to the best commercial and university practices available, both for the development of the content of the material and for the technical standards used. Due to recent acceleration of government-wide efforts in homeland security, the committee directs the Department to work closely with other agencies supporting WMD training to take advantage of their ability to provide training content and certification and to ensure interoperability of technologies employed.

Unexploded ordnance remediation

The budget request included $28.3 million in PE 63851D8Z for the Environmental Security Technical Certification Program. The committee recommends an increase of $5.0 million to develop technologies to remediate unexploded ordnance (UXO) and related constituents at active, inactive, closed, transferred, and transferring ranges.

The budget request included $60.5 million in PE 63716D8Z for the Strategic Environmental Research Program. The committee recommends an increase of $3.0 million for science and technology efforts to enhance UXO remediation capabilities.

Ballistic missile defense systems engineering

The budget request included $371.1 million in PE 63880C for ballistic missile defense systems engineering and integration, an 83 percent increase over last year's funding level. While the committee accepts the value of systems engineering, it is not clear why such a large increase is necessary over last year's level. Furthermore, despite repeated queries, the Missile Defense Agency has not adequately explained why such a high funding level is required for systems engineering and integration or what products are to be delivered with the funding.

Therefore, the committee recommends a reduction of $140.0 million in PE 63880C for systems engineering and integration. The remaining funding level of $231.0 million represents 10 percent growth from the current level.

Ballistic missile defense test and evaluation

The budget request included $382.0 million in PE 63880C for ballistic missile defense test and evaluation, a decrease of more than $40.0 million from the amount appropriated in fiscal year 2002. The Department of Defense, however, has decided to put a high priority on ballistic missile defense testing, which the committee strongly supports. It is not clear to the committee why the requested test and evaluation funding has decreased so substantially given this priority. Therefore, the committee recommends an increase of $30.0 million in PE 63880C for test and evaluation.

Arrow

The budget request included $66.0 million in PE 63881C for the Arrow ballistic missile defense system. The Arrow program is a U.S.-Israeli joint program critical to the defense of Israel against existing and growing regional ballistic missile threats. The system would also serve to protect U.S. forces in the region during a conflict and is intended to be interoperable with U.S. theater missile defense systems. Therefore, the committee recommends an increase of $40.0 million in PE 63881C for the Arrow program. The committee urges the Department to direct this extra funding toward Arrow capability and interoperability upgrades.

High power discriminator radar

For a number of years the Department of Defense has pursued two separate radar development efforts for the Navy Theater-Wide ballistic missile defense system, now called the Sea-based Mid-

course system. Both efforts, one focusing on X-band radar technology and the other on S-band technology, have lacked a coherent focus and plan. Congress has repeatedly requested that the Department provide the overall plan for Sea-based Midcourse radar development. Last year's committee report urged the Ballistic Missile Defense Organization, now the Missile Defense Agency (MDA), to focus the radar development efforts and funding on the radar technology that the MDA determines is best suited for ballistic missile defense. The report also discussed the unique value of X-band radar technology for ballistic missile defense and quoted Lieutenant General Ronald Kadish, Director of the Missile Defense Agency, who stated that "in order to do the [ballistic missile defense] countermeasure problem you are going to need the kind of fine discrimination capability afforded by the X-band."

Despite urging by Congress during fiscal year 2002, the Department did not focus on a single radar technology and instead continued to fund both S- and X-band efforts. Furthermore, the X-band effort was not funded at a level commensurate with making adequate progress. The X-band high power discriminator radar effort received only $12.0 million in fiscal year 2002, resulting in the termination of many of the engineers working on the program, despite the fact that the high power discriminator technology is mature enough to be installed and demonstrated on a ship.

The budget request for fiscal year 2003 included only $15.0 million in PE 63882C for X-band high power discriminator radar development. The committee believes that the X-band high power discriminator radar is essential to any robust near-term Sea-based Midcourse capability and is concerned that the proposed funding level is significantly lower than the level required to conduct prototype development and installation on a ship, the logical next step for the program. Therefore, the committee recommends an increase of $40.0 million in PE 63882C for X-band high power discriminator development, leading toward installation of a prototype X-band high power discriminator radar on an Aegis ship.

Midcourse systems engineering and integration

The budget request included $95.0 million in PE 63882C for Midcourse Defense Segment systems engineering and integration, more than double the amount appropriated in fiscal year 2002 for this activity. The committee finds it difficult to justify such a large increase in funding when more than $400.0 million of systems engineering and integration funding is already proposed for fiscal year 2003 in the Ballistic Missile Defense System Segment and within the individual programs which comprise the Midcourse Defense Segment. Furthermore, the fiscal year 2003 funding request would support the same activities that were funded in fiscal year 2002, so such a large increase seems unnecessary. Therefore, the committee recommends a reduction of $45.0 million in PE 63882C for Midcourse Defense Segment systems engineering and integration which would still provide a 10 percent increase, after inflation, for that activity.

Small kill vehicle technology development

The potential for enemy decoys and countermeasures poses a significant problem for ballistic missile defense systems. These decoy devices are often difficult to distinguish from the actual warheads themselves. However, by placing many small kill vehicles on a single interceptor missile, it may be possible to engage both the warhead and any decoys present; each small kill vehicle is designed to destroy a different object. To further the development of this concept, the committee recommends an increase of $10.0 million to PE 63882C for small kill vehicle technology development.

Sea-based boost defense

The budget request included $55.0 million in PE 63883C for a sea-based boost "critical experiment" in fiscal year 2003. However, the Missile Defense Agency could not identify the experiment, so it is unlikely that it would actually occur as early as fiscal year 2003. Therefore, the committee recommends a reduction of $55.0 million in PE 63883C for the undefined fiscal year 2003 experiment.

Space-based boost defense

The budget request included $30.0 million in PE 63883C for a space-based boost "critical experiment" in fiscal year 2003. However, the Missile Defense Agency could not identify the experiment, so it is unlikely that it would actually occur as early as fiscal year 2003. Therefore, the committee recommends a reduction of $30.0 million in PE 63883C for the undefined fiscal year 2003 experiment.

Airborne Laser

The budget request included $30.0 million in PE 63883C for purchase of the second Airborne Laser prototype aircraft. The committee notes, however, that the first Airborne Laser prototype aircraft is not scheduled to be tested until fiscal year 2005. Furthermore, the first prototype is only a half-power version, and the Missile Defense Agency is not yet able to determine when a full-power version will become available. Finally, the Airborne Laser program has experienced significant cost growth, with the cost of the first prototype aircraft rising to over $1.0 billion from an original estimated cost of less than half that amount.

The committee fully supports the research, development and testing of the first Airborne Laser aircraft, and believes that a fully-tested, full power version would be a truly revolutionary weapons system. The committee also believes, however, that the Missile Defense Agency should focus on test completion of the first prototype aircraft before buying the second prototype aircraft. Therefore, the committee recommends a reduction of $30.0 million in PE 63883C for the second Airborne Laser aircraft.

Airborne Infrared Surveillance system

The proposed Airborne Infrared Surveillance system (AIRS) would integrate a high-performance, infrared telescope and data collection system on a Global Hawk Unmanned Aerial Vehicle (UAV) or Gulfstream V high altitude aircraft to detect, track and

discriminate ballistic missile warheads in the midcourse phase of flight. The system would also provide infrared detection and detailed imaging of ground targets. The U.S. currently has no near-term plans to provide infrared tracking and discrimination data to missile defense systems. The Space-based Infrared System-Low (SBIRS-Low) satellite system will eventually perform that function; however, the data quality and resolution of SBIRS-Low may not be as high as that of AIRS. The Missile Defense Agency also recently delayed the planned deployment date for SBIRS-Low.

Furthermore, no systems currently provide intelligence data on the infrared signatures of foreign missile warheads in midcourse. Such data would be essential in helping predict the difference between an incoming warhead and the decoys surrounding it. Both the intelligence community and the Missile Defense Agency have commented on the severe shortage of infrared signature data on foreign warheads, and the Central Measurements and Signals Intelligence Organization has endorsed AIRS as a near-term solution to this problem.

The telescope and data collection systems for AIRS have already been successfully integrated and tested on a test aircraft, and they performed well during a recent Integrated Flight Test of the Ground-based Midcourse national missile defense system. Therefore, the committee recommends that $22.0 million be added to PE 63884C for engineering and concept studies for AIRS. The committee also urges the Missile Defense Agency to aggressively pursue this program.

Russian-American Observation Satellite (RAMOS) solar arrays

The committee recommends an additional $10.0 million in PE 63884C to further develop lightweight and flexible amorphous silicon alloy triple-junction thin film technology for lightweight, low-cost, radiation hardened solar arrays with a stainless steel substrate. The committee encourages the Department of Defense to conduct this effort as a joint U.S.-Russian partnership within the RAMOS program.

The committee also notes that of the $54.5 million appropriated for RAMOS in fiscal year 2002, only $2.0 million has been provided to Russia, primarily because of the lack of an official agreement to proceed between Russia and the United States. The committee urges the Department of Defense to work with Russia to sign the agreement with the Russian Federation on RAMOS as soon as possible so that this important joint program can continue to proceed toward the planned launch of two satellites in 2006.

Technical studies and analyses

The budget request included $30.0 million in PE 65104D8Z for technical studies, support and analysis. The committee recommends a reduction of $5.0 million to this account. The committee notes that the Department has requested that Congress substantially reduce reporting requirements. The committee also notes that the goal of defense transformation places modernization programs at a higher priority than studies and analyses.

Information security scholarship program

The budget request included $5.0 million in PE 65710D8Z, Research, Development, Test and Evaluation, Defense-Wide for the information assurance scholarship program. This program was established by section 922 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001.

The committee strongly supports moving forward with this program. Department of Defense officials have indicated that they fully support the intent of the program to bolster the number of, and training for, personnel in the Defense Department's information assurance career field. The committee believes that the Department is being too tentative in its implementation and that making more funds available would result in more near-term progress.

The committee recommends an additional $10.0 million to increase the number of grants and scholarships that the Department would be able to implement during fiscal year 2003.

Information security

The budget request included $394.3 million in PE 33140G for the Information Systems Security Program. The committee notes that the Nation's military and commercial information systems continue to be extremely vulnerable to attack; the capability for launching a catastrophic attack has spread throughout the world to nations, terrorist groups, and even private individuals. Therefore, the committee recommends an additional $33.0 million across the Department's research and development activities to enhance research and training to meet these emerging threats.

The committee also recommends an additional $4.0 million in PE 33140G to facilitate cooperation for protecting information and information systems so as to increase national awareness of the dynamic threat and strengthen common defense across the Nation.

National Imagery and Mapping Agency feature level database

The U.S. military increasingly relies on data from surveillance platforms such as Unmanned Aerial Vehicles and satellites. Data from these platforms is most useful to the military if it can be fused together. This enables each individual surveillance platform to be interoperable with the other platforms, greatly enhancing the usefulness and accuracy of the surveillance data. To support such interoperability, the National Imagery and Mapping Agency (NIMA) is developing a feature level database to enable the fusion of data from disparate surveillance platforms. The committee supports this effort and recommends an increase of $4.1 million in PE 35102BQ for feature level database development.

Intelligent spatial technologies

The budget request included $115.2 million in PE 35102BQ for the Defense Imagery and Mapping Program but did not include continued funding for intelligent spatial technologies for smart maps, a promising technology that will allow military operators and planners to better use and integrate geospatial data. The National Imagery and Mapping Agency (NIMA) has been very sup-

portive of this program, assessing it to be of high military value. However, competing priorities precluded NIMA from continuing funding for this important capability. The committee recommends an increase of $1.0 million in PE 35102BQ for the continued development of geospatial data integration technologies.

Broadcast-Request Imagery Technology Experiment

At the request of U.S. Special Operations Command (SOCOM), the National Reconnaissance Office (NRO) began development of the Broadcast-Request Imagery Technology Experiment (BRITE), a unique capability to disseminate timely, tailored imagery products to forward-deployed special operations elements via existing communications architectures. Once development of BRITE was completed, the NRO transferred responsibility for the program to the National Imagery Mapping Agency (NIMA) for fielding and sustainment. Now in use in Afghanistan, this system allows soldiers to view satellite imagery data in near real-time and has been a key asset in our continuing military effort in that region. Despite its effectiveness, NIMA has not yet funded the fielding of the BRITE system.

The committee strongly supports BRITE and recommends an increase of $4.0 million to PE 35102BQ to facilitate timely fielding of BRITE to operational elements. In addition, the committee urges NIMA to fund the fielding of this system in future budget submissions.

Laser additive manufacturing initiative

The budget request included $13.1 million in PE 78011S for manufacturing technology programs. The committee recommends an increase of $5.0 million to develop laser additive manufacturing technologies to produce high performance military and commercial titanium components.

Advanced technologies for special operations

The budget request included $6.7 million in PE 1160279BB for special operations technology development. In testimony to the Emerging Threats and Capabilities Subcommittee, Special Operations Command officials stated that, "Special Operations Forces depend on leading edge technology to provide the critical advantage and to support participation in a growing number of technologically complex missions and operations." Therefore, the committee recommends an increase of $5.0 million for the development of new technologies in established technology thrust areas including signature reduction, communications, unmanned systems, power systems, remote sensing, advanced training systems, bioengineering, and directed energy weapons.

The committee notes and commends the recent efforts of the U.S. Special Operations Command (SOCOM) to leverage the science and technology efforts of the military services and defense agencies. The committee also commends SOCOM on its success in rapidly transitioning new technologies from both inside and outside the Department of Defense into the hands of warfighters. This transition success may provide a useful model for many other organizations within the Department.

Joint Threat Warning System

The budget request included no funding for research and development on the Joint Threat Warning System (JTWS) in PE 116404BB. The JTWS is a system that provides force protection, integrated threat warning, and situational awareness equipment for Special Operations Forces (SOF). The system supports worldwide ground, maritime, and airborne missions, providing information to operators through the Integrated Broadcast System. The system will replace current, non-standard, sometimes unsupportable equipment serving air, maritime, and ground operations. Replacing the old systems with JTWS is a Special Operations Command priority. Therefore, the committee recommends an increase of $1.8 million for PE 116404BB for research and development of the JTWS.

Embedded Integrated Broadcast Service Receivers

The budget request included no funding for research and development on the embedded Integrated Broadcast Service (IBS) receivers. The embedded IBS receivers offer tactical, real-time intelligence broadcast data to warfighters for threat avoidance and situational awareness. The IBS receivers will replace the current Multi-mission Advanced Tactical Terminal (MATT) system, which is approaching the end of its service life due to aging design, parts obsolescence, producibility issues, and exposure to a harsh operating environment. Replacing the old system with these receivers is a Special Operations Command priority. Therefore, the committee recommends an increase of $2.2 million for PE 116405BB for Special Operations Intelligence Systems Development/Project S400.

Test and evaluation science and technology program

The budget request included $6.0 million in PE 63941D8Z for test and evaluation science and technology programs. As part of the committee's overall initiative to support testing and evaluation, the committee recommends an additional $5.0 million for the development of new technologies to support test and evaluation. This program will allow test technologies to keep pace with evolving weapons technology and is critical to ensuring the capability to test future weapons systems.

Central test and evaluation investment program

The budget request included $123.3 million for the central test and evaluation investment program (CTEIP). As a component of the test and evaluation initiative described in this title, section 233 would add $50.0 million and section 232 would transfer an additional $70.0 million to this critical program, which has developed a coordinated process for making test and evaluation investments that leverage service programs and encourage joint development and use of new test capabilities. The committee commends CTEIP for its efforts to develop new test technologies and instrumentation, improve interoperability between service efforts, integrate modeling and simulation into test activities, and provide resources to respond to near-term shortfalls in operational test capabilities.

In addition, the committee recommends an increase of $8.0 million for technology development to support test and evaluation. Of this amount, $3.0 million shall be used for the development of digital imagery motion tools to support testing activities.

The committee also recommends an additional $5.0 million to support the activities of the Big Crow program. The committee notes the important role that the Big Crow support aircraft played in recent operations in Afghanistan. The committee directs the Secretary of Defense to update Congress on Department plans for future funding of this important asset, so that it can be a test resource and operational electronic warfare platform for the services.

Live fire test and training

The budget request included $10.1 million in PE 65131D8Z for live fire testing. As part of the initiative to robustly fund testing and evaluation in the Department of Defense, the committee recommends an increase of $5.0 million for the Live Fire Test and Training Program. The committee recommends an additional $1.5 million for testing and development of fire fighting training systems.

OTHER ITEMS OF INTEREST

Crusader artillery system

The budget request included $475.6 million for the Crusader artillery system to complete program definition and risk reduction and begin system development and demonstration.

During the committee's markup of the National Defense Authorization Act for Fiscal Year 2003, the Secretary of Defense suddenly announced his decision to terminate the Crusader program. The Director of the Office of Management and Budget has informed the committee of the President's intention to amend the fiscal year 2003 budget request as it pertains to the Crusader program. The committee has not had an opportunity to review the reasons for the decision to terminate the Crusader program with Office of the Secretary of Defense officials or the impact of the decision on the Army's future modernization plans with Army officials.

The committee bill recommends $475.6 million for continued research and development of the Crusader, the amount requested in the fiscal year 2003 budget. The committee will carefully review the decision to terminate the Crusader program with the Secretary of Defense and the Chief of Staff of the Army in an upcoming hearing and will meet to determine whether to offer a committee amendment at the time this bill is debated on the Senate floor.

Future launch and spacelift concepts

The committee is aware that the Department of Defense has identified responsive, low-cost space launch as a key to meeting a variety of military needs. Recently, the Air Force completed the Operationally Responsive Spacelift Mission Need Statement, the first step in the formal requirements process for future launch and on-orbit systems. The Air Force believes that operationally responsive spacelift is the key enabler for conducting a broad range of future space missions.

Working together, the Air Force and the National Aeronautics and Space Administration (NASA) also completed a number of joint studies to help identify and define operational requirements and concepts and to develop a technology roadmap. Included in the technology concept study was a range of potential vehicle options to meet the range of future Air Force and NASA needs. One of the tasks of the study was to harmonize Air Force and NASA reusable launch vehicle technology programs against Air Force and NASA requirements and architectures. The study concluded that, although the needs of the two organizations differ, both can receive significant benefits by working together toward future launch requirements.

The committee directs the Secretary of the Air Force to continue the process of defining requirements for future operationally responsive spacelift and report back to this committee. The report shall be provided to the committee no later than February 15, 2003. In the report, the Secretary should assess whether any such requirement can be met with evolutions of the evolved expendable launch vehicle (EELV), the shuttle transport system, current generation light launch vehicles, and the current launch infrastructures. In carrying out the assessment, the Secretary should also look at the comparative maturity, utility, and potential development and operational costs of expendable and reusable launch vehicles alternatives with current launch vehicles. The comparative analysis should also include launch processes and infrastructure.

In conducting the review the committee directs the Secretary to continue the cooperative relationship with NASA and explore the possibility of a joint development project that could meet requirements of each organization. The committee would welcome a jointly funded proposal to begin such an effort for future spacelift requirements.

Hybrid engine military vehicles

The committee notes that the cost of delivery of fuel within theaters of operation is now estimated at $150 per gallon. The Defense Science Board has identified this problem as one that the Department of Defense needs to address in order to reduce fuel cost burdens, specifically through aggressive high-level leadership, development of incentives for production and acquisition, and advanced technology development.

Hybrid engine technology can significantly increase fuel economy and reduce pollution for military vehicles. Hybrid engine technology is also consistent with efforts to transform the military into a lighter, lethal, more deployable force. The committee notes that significant improvements have been made in hybrid technology, but the transition of this technology into operational systems is limited by economic factors, including the initial costs of developing new systems and replacing existing standard engines. The conversion to hybrid electric systems could benefit all of the services and will likely require the military to make initial investments.

In order to promote a Department-wide effort to develop military hybrid vehicle systems, the committee directs the Under Secretary of Defense for Acquisition, Technology and Logistics to conduct a study of the feasibility of (1) converting 10 percent of the non-com-

bat defense fleet to hybrid vehicles by fiscal year 2009; and (2) converting to an all-hybrid engine fleet for both non-combat and combat vehicles over a longer period. The feasibility study should include a projection of funding requirements, technical milestones and goals, and planned technology insertions, and should be submitted to Congress along with the fiscal year 2004 budget request.

Magdalena Ridge Observatory

The Magdalena Ridge Observatory is a facility supporting missile defense testing and evaluation. The facility is used to provide detailed imagery to understand lethality and kill mechanisms during intercept tests for the national missile defense, Theater High Altitude Area Defense, and Patriot Advanced Capability-3 missile systems at the White Sands Missile Range and Fort Wingate Launch Range. The committee is supportive of continued research and development on telescopes and other equipment to support these Department of Defense missions.

Patents and licensing

The ability of the private sector to license and exploit technologies developed internally by Department of Defense (DOD) research and engineering organizations has been a cornerstone of the nation's high-tech industry. The licensing agreements established under legislation such as the Bayh-Dole Act and the Stevenson-Wydler Act have helped fuel our nation's technical innovation and have produced many of the defense technologies that the military uses today.

The committee notes that a recent study by the Director of Defense, Research, and Engineering examined the value of licensing and patent marketing to DOD laboratories. The report concludes that licensing of DOD inventions provides three major benefits: new commercial products available to DOD, new working relationships with private industry, and revenue for DOD laboratories. In addition, royalty income can provide an excellent incentive to inventors at DOD laboratories and can stimulate technical innovation.

The study also concluded, however, that the Department of Defense does a poor job in managing and marketing its intellectual property. It notes that DOD receives less than $2.0 million annually from its licensing agreements as compared to the National Institutes of Health, which earns over $45.0 million in royalties annually. The study concludes that "with more aggressive patent marketing by the DOD laboratories that licensing could increase, leading to an increase in royalty income for the labs." This is particularly true for biomedical, advanced electronics, and computer technologies currently being developed by defense laboratories.

The committee directs the Department to develop a plan and to report to Congress on specific strategies for marketing its intellectual property more aggressively and for exploiting the findings of the Director of Defense Research and Engineering's report. The plan and subsequent report to the committee should include recommendations on staffing levels for appropriate intellectual property experts, discussion on the role of the Offices of Research and Technology Applications (ORTAs), descriptions of planned coopera-

tive activities with the private sector and other government agencies, and analyses of any regulatory or statutory barriers to fully marketing DOD intellectual property. The report should also forecast the potential for increased revenues to the Department's laboratories as a result of more aggressive marketing efforts.

National Consortium for Biodefense

The committee recognizes that the threat of bioterrorism and biowarfare is real and growing. Accordingly, the committee urges the Department of Defense (DOD) to study the feasibility of establishing, on a national basis, a university, public health, and industry consortium on biodefense research and analysis. The consortium would be intended to serve various functions: to evaluate the potential of various biological threat agents to humans, animals, and crops; to provide analysis of possible genetic engineering of biological agents; to evaluate possible production and deployment methods used by terrorists, including the signatures of possible production facilities; to conduct research in, but not limited to, the areas of medical microbiology, molecular biology, epidemiology, and immunological methods for the development of protection against biological agents; to research early detection, warning, and monitoring of biological outbreaks; to study disinfection of large contaminated areas or buildings; to evaluate technical countermeasures to biological aerosols and agents; and to undertake a program of strategy, policy, and management studies and public education and public health education and training for biodefense, including conflict analysis and resolution in biowarfare and bioterrorism. Such a feasibility study should include a projection of the costs that would be associated with establishing such a national consortium.

Patriot Advanced Capability-3

The committee is aware that the Department of Defense has considered requesting authority for a multiyear procurement of Patriot Advanced Capability-3 (PAC–3) missiles. Consistent with its long support for the deployment of robust theater missile defenses, the committee encourages the Department to develop a PAC–3 acquisition plan that will maximize production efficiencies and reduce acquisition costs in the future.

Rotorcraft external airbag protection system

Each year, Navy rotorcraft experience an average of 11.4 noncombat related mishaps, with an average of almost 20 fatalities per year. The Navy accident reviews have classified a large majority of these mishaps as "survivable," yet 84 percent of all fatalities occur in these potentially survivable mishaps. Mishaps over water are particularly deadly since rotorcraft landing gear provides no cushioning effect on water impact and water quickly envelops the fuselage.

The committee understands that one possible alternative for alleviating this situation is a promising technology that would position airbags on the underside of the rotorcraft. Such a device would activate in proximity to the ground or water when the aircraft is subjected to an emergency descent.

The committee believes the Navy should investigate using this technology approach to saving lives. The Navy should investigate whether: (1) the technology has the potential for reducing fatalities in "survivable" accidents; and (2) the costs and potential weight penalties would make this an affordable system. Since all military services operate rotorcraft, the Navy should share the results of its efforts with the other services.

Sensor instrumentation

Many weapons systems are dependent upon gas turbine engines for power and propulsion. In order to adequately monitor high temperature components of these systems, new instrumentation must be developed. The committee encourages the military services to explore the development of photonic sensor systems for gas turbine engines in order to increase efficiency, reliability, and performance.

Space-based Laser

The committee is aware that the Missile Defense Agency is finalizing its Affordable Concept Study for the development of Space-based Laser technologies. This study was undertaken after the cancellation of the Space-based Laser Integrated Flight Experiment (IFX) in the Department of Defense Appropriations Act for Fiscal Year 2002 (P.L. 107–117). The committee agrees that a thorough evaluation is necessary. The committee believes that any plan must include the preservation of high energy laser risk reduction activities and facilities which, if lost, would be costly to regenerate.

Treatment of decompression sickness

The budget request included no research and development funds for the investigation of treatments for decompression sickness experienced by submariners or Navy diving personnel when they are moved suddenly from one atmospheric pressure to another. Decompression sickness would most likely occur as a result of an emergency situation that would not allow for the slow decompression of gases in the blood and tissues. Current treatment for decompression sickness requires recompression followed by slow decompression in a special chamber. Preliminary results indicate that blood substitutes have the potential to prevent the adverse effects of sudden recompression, which include neurological injury, muscle and joint pains, circulatory disaster, heart attack, pulmonary dysfunction, and death. Therefore, the committee strongly supports and encourages Navy development, with private and public partners, of initiatives which could lead to better treatment and prevention of decompression sickness.

TITLE III—OPERATION AND MAINTENANCE

Explanation of tables

The following tables provide the program-level detailed guidance for the funding authorized in title III of this Act. The tables also display the funding requested by the administration in the fiscal year 2003 budget request for operation and maintenance (O&M) programs and indicate those programs for which the committee either increased or decreased the requested amounts. As in the past, the administration may not exceed the authorized amounts (as set forth in the tables or, if unchanged from the administration request, as set forth in the Department of Defense's budget justification documents) without a reprogramming action in accordance with established procedures. Unless noted in the report, funding changes to the budget request are made without prejudice.

The President's budget request included $20.1 billion in the operation and maintenance title for the Defense Emergency Response Fund (DERF). Of this amount, $10.1 billion was requested for specific programs and $10.0 billion was requested as unspecified contingency funding for continuing the war on terrorism into fiscal year 2003. The authorization for this unspecified $10.0 billion, which would fund the costs of ongoing military operations as well as the additional pay and benefits of mobilized guard and reserve personnel, thus involving multiple appropriation accounts, has been transferred to title X of this Act. Funds transferred to the accounts in this title from the DERF are displayed on the tables that follow as increases to the amount requested for those programs in the O&M accounts. Programs for which funds were transferred from the DERF are annotated to indicate that funds were originally requested in the DERF.

Of the specified $10.1 billion, approximately $4.3 billion was requested for programs that fall in the operation and maintenance title, including O&M and revolving fund accounts. The committee's recommended authorizations for those programs are included in this title. Authorizations reflecting the committee's actions on the balance of the $10.1 billion can be found in their respective titles of this Act.

The budget request also proposed to change the accounting structure for various health and retirement benefits of federal civilian employees to an accrual basis. As discussed elsewhere in this report, the committee did not agree with this proposed change. The operation and maintenance accounts in this title have been reduced by $2.3 billion to reflect the appropriate funding levels for defense programs under current accounting procedures. The authorizations for revolving and management funds in this title have been reduced by $839.1 million for this same reason. These reductions would not entail any change to the benefits of federal civilian em-

ployees funded by either direct appropriations or through the working capital funds.

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		Operation and Maintenance, Army			
	DIVI	**LAND FORCES**			
2020a	010		1,425,204		1,425,204
2020a	020	CORPS COMBAT FORCES	424,191		424,191
2020a	030	CORPS SUPPORT FORCES	361,001		361,001
2020a	040	ECHELON ABOVE CORPS SUPPORT FORCES	405,752		405,752
2020a	050	LAND FORCES OPERATIONS SUPPORT	1,115,776		1,115,776
		Combat training center improvements		1,200	1,200
		LAND FORCES READINESS			
2020a	060	FORCE READINESS OPERATIONS SUPPORT	1,529,998		1,529,998
		Battlefield mobility enhancers (M-Gators)		5,000	5,000
		Integrated training area management		15,700	15,700
		Live-fire range improvements		13,200	13,200
	60	Physical security equipment (Transfer from DERF)		76,900	76,900
	60	Alternate National Military Command Center (Transfer from DERF)		44,000	44,000
	60	CONUS support (Transfer from DERF)		2,000	2,000
	60	Information systems security program (Transfer from DERF)		5,000	5,000
2020a	070	LAND FORCES SYSTEMS READINESS	491,947		491,947
2020a	080	LAND FORCES DEPOT MAINTENANCE	808,666		808,666

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		LAND FORCES READINESS SUPPORT			
2020a	090	BASE OPERATIONS SUPPORT	3,207,409		3,207,409
2020a	100	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION (OPERAT	1,146,516		1,146,516
2020a	110	MANAGEMENT & OPERATIONAL HEADQUARTERS	297,834		297,834
2020a	120	UNIFIED COMMANDS	83,961		83,961
	120	Counter terrorism/force protection personnel (Transfer from DERF)		9,400	9,400
2020a	130	MISCELLANEOUS ACTIVITIES	1,607,610		1,607,610
		TOTAL, BA 01: OPERATING FORCES	**12,905,865**	**172,400**	**13,078,265**
		MOBILITY OPERATIONS			
2020a	140	STRATEGIC MOBILIZATION	365,257		365,257
2020a	150	ARMY PREPOSITIONED STOCKS	158,237		158,237
2020a	160	INDUSTRIAL PREPAREDNESS	9,497		9,497
2020a	170	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION (MOBILI	11,473		11,473
		TOTAL, BA 02: MOBILIZATION	**544,464**	**0**	**544,464**
		ACCESSION TRAINING			
2020a	180	OFFICER ACQUISITION	88,026		88,026
2020a	190	RECRUIT TRAINING	20,197		20,197
2020a	200	ONE STATION UNIT TRAINING	22,486		22,486
2020a	210	SENIOR RESERVE OFFICERS' TRAINING CORPS	209,550		209,550
2020a	220	BASE OPERATIONS SUPPORT (ACCESSION TRAINING)	89,214		89,214

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
2020a	230	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION (ACCESS	56,754		56,754
		BASIC SKILL/ ADVANCE TRAINING			
2020a	240	SPECIALIZED SKILL TRAINING	365,041		365,041
	240	Army language program, Army TIARA (Transfer from DERF)		19,500	19,500
	240	Contract linguists-force protection, Army TIARA (Transfer from DERF)		9,400	9,400
	240	Contract linguists- interrogation detainees, Army TIARA (Transfer from DERF)		5,000	5,000
	240	Classified (Transfer from DERF)		2,300	2,300
2020a	250	FLIGHT TRAINING	402,481	55,000	457,481
2020a	260	PROFESSIONAL DEVELOPMENT EDUCATION	133,572		133,572
2020a	270	TRAINING SUPPORT	431,508		431,508
2020a	280	BASE OPERATIONS SUPPORT (BASIC SKILL/ADVANCED TRAINING)	1,006,102		1,006,102
2020a	290	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION (BASIC S	351,864		351,864
		RECRUITING/OTHER TRAINING			
2020a	300	RECRUITING AND ADVERTISING	458,788		458,788
2020a	310	EXAMINING	87,568		87,568
2020a	320	OFF-DUTY AND VOLUNTARY EDUCATION	208,860		208,860
2020a	330	CIVILIAN EDUCATION AND TRAINING	99,193		99,193
2020a	340	JUNIOR RESERVE OFFICERS' TRAINING CORPS	97,512		97,512
2020a	350	BASE OPERATIONS SUPPORT (RECRUIT/OTHER TRAINING)	250,316		250,316
		TOTAL, BA 03: TRAINING AND RECRUITING	**4,379,032**	**91,200**	**4,470,232**

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		SECURITY PROGRAMS			
2020a	360	SECURITY PROGRAMS	572,013	47,500	619,513
	360	CONUS support (Transfer from DERF)		2,000	2,000
	360	Battle space characteristics (Transfer from DERF)		2,000	2,000
	360	Security and investigative activities (Transfer from DERF)		10,000	10,000
	360	Security and investigative activities (Transfer from DERF)		1,000	1,000
		LOGISTICS OPERATIONS			
2020a	370	SERVICEWIDE TRANSPORTATION	608,608		608,608
2020a	380	CENTRAL SUPPLY ACTIVITIES	547,994		547,994
2020a	390	LOGISTICS SUPPORT ACTIVITIES	356,424		356,424
		Anti-corrosion protective coatings		6,000	6,000
		Anti-corrosion product testing		1,000	1,000
2020a	400	AMMUNITION MANAGEMENT	311,789		311,789
		SERVICEWIDE SUPPORT			
2020a	410	ADMINISTRATION	638,845		638,845
	410	Critical infrastructure protection (Transfer from DERF)		600	600
2020a	420	SERVICEWIDE COMMUNICATIONS	655,796		655,796
	420	CONUS support (Transfer from DERF)		5,000	5,000
	420	Collaboration planning/enablers (Transfer from DERF)		2,500	2,500
	420	CONUS support (Transfer from DERF)		500	500
	420	Information systems security program (Transfer from DERF)		4,600	4,600

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
	420	Information systems security program (Transfer from DERF)		1,700	1,700
	420	Information systems security program (Transfer from DERF)		1,500	1,500
2020a	430	MANPOWER MANAGEMENT	245,901		245,901
2020a	440	OTHER PERSONNEL SUPPORT	204,749		204,749
2020a	450	OTHER SERVICE SUPPORT	623,408		623,408
2020a	460	ARMY CLAIMS	112,215		112,215
2020a	470	REAL ESTATE MANAGEMENT	54,282		54,282
2020a	480	BASE OPERATIONS SUPPORT (SERVICEWIDE SUPPORT)	1,298,623		1,298,623
		Utilities privatization		(8,936)	(8,936)
2020a	490	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION (SERVICI	257,333	86,005	343,338
		SUPPORT OF OTHER NATIONS			
2020a	500	INTERNATIONAL MILITARY HEADQUARTERS	205,623		205,623
2020a	510	MISC. SUPPORT OF OTHER NATIONS	58,091		58,091
2020a	520	EXPANSION OF NATO			
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**6,751,694**	**162,969**	**6,914,663**
		Legislative provisions not proposed	0	(7,500)	(7,500)
		Civilian personnel accrual accounting adjustment		(612,382)	(612,382)
		Contract services		(192,500)	(192,500)
		Total Operation and Maintenance, Army	**24,581,055**	**(385,813)**	**24,195,242**

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		Operation and Maintenance, Navy			
		AIR OPERATIONS			
1804n	010	MISSION AND OTHER FLIGHT OPERATIONS	3,247,197		3,247,197
1804n	020	FLEET AIR TRAINING	1,030,024		1,030,024
1804n	030	INTERMEDIATE MAINTENANCE	69,945		69,945
1804n	040	AIR OPERATIONS AND SAFETY SUPPORT	109,072		109,072
1804n	050	AIRCRAFT DEPOT MAINTENANCE	785,052		785,052
1804n	060	AIRCRAFT DEPOT OPERATIONS SUPPORT	55,930		55,930
		SHIP OPERATIONS			
1804n	070	MISSION AND OTHER SHIP OPERATIONS	2,442,911		2,442,911
1804n	080	SHIP OPERATIONAL SUPPORT AND TRAINING	589,655		589,655
		Fleet training resource strategy		15,000	15,000
	80	Various (Transfer from DERF)		5,000	5,000
	80	Cryptologic direct support (Transfer from DERF)		2,000	2,000
1804n	090	INTERMEDIATE MAINTENANCE	406,251		406,251
1804n	100	SHIP DEPOT MAINTENANCE	3,536,452	89,995	3,626,447
1804n	110	SHIP DEPOT OPERATIONS SUPPORT	1,324,577		1,324,577
		COMBAT OPERATIONS/SUPPORT			
1804n	120	COMBAT COMMUNICATIONS	424,042		424,042
		Improved shipboard combat information center		8,000	8,000

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		Submarine broadcast support		1,000	1,000
1804n	130	ELECTRONIC WARFARE	15,485		15,485
1804n	140	SPACE SYSTEMS & SURVEILLANCE	205,001		205,001
1804n	150	WARFARE TACTICS	166,186		166,186
		Fleet range operations support		8,000	8,000
1804n	160	OPERATIONAL METEOROLOGY & OCEANOGRAPHY	273,412		273,412
1804n	170	COMBAT SUPPORT FORCES	767,833		767,833
	170	Various (Transfer from DERF)		2,000	2,000
	170	Various (Transfer from DERF)		2,000	2,000
	170	Classified (Transfer from DERF)		1,000	1,000
	170	SCI GCCS I3 (Transfer from DERF)		3,800	3,800
	170	GENSER GCCS I3 (Transfer from DERF)		5,400	5,400
	170	JDIS / LOCE / CENTRIX (Transfer from DERF)		5,300	5,300
	170	CMMA (Transfer from DERF)		1,500	1,500
	170	CMMA (Transfer from DERF)		22,500	22,500
	170	JWICS connectivity (Transfer from DERF)		5,500	5,500
	170	Intelligence analysts (Transfer from DERF)		3,000	3,000
1804n	180	EQUIPMENT MAINTENANCE	169,941		169,941
1804n	190	DEPOT OPERATIONS SUPPORT	1,676		1,676
		WEAPONS SUPPORT			
1804n	200	CRUISE MISSILE	162,185		162,185

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1804n	210	FLEET BALLISTIC MISSILE	806,150		806,150
	210	Strategic security forces and technicians (Transfer from DERF)		7,000	7,000
1804n	220	IN-SERVICE WEAPONS SYSTEMS SUPPORT	43,314		43,314
1804n	230	WEAPONS MAINTENANCE	420,864		420,864
		Mark-45 overhauls		5,000	5,000
	230	Pioneer (Transfer from DERF)		6,000	6,000
		WORKING CAPITAL FUND SUPPORT			
1804n	240	NWCF SUPPORT			
		BASE SUPPORT			
1804n	250	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	1,153,732		1,153,732
	250	Site improvement (Transfer from DERF)		219,200	219,200
	250	Facilities sustainment, restoration and modernization (Transfer from DERF)		2,500	2,500
1804n	260	BASE SUPPORT	2,748,739		2,748,739
	260	Security forces and technicians (Transfer from DERF)		143,096	143,096
	260	Law enforcement (Transfer from DERF)		32,573	32,573
	260	Management and planning (Transfer from DERF)		1,712	1,712
	260	Shipyard security forces & technicians (Transfer from DERF)		28,000	28,000
	260	Base support services (Transfer from DERF)		38,500	38,500
		TOTAL, BA 01: OPERATING FORCES	**20,955,626**	**664,576**	**21,620,202**

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		READY RESERVE AND PREPOSITIONING FORCES			
1804n	270	SHIP PREPOSITIONING AND SURGE	528,795		528,795
		ACTIVATIONS/INACTIVATIONS			
1804n	280	AIRCRAFT ACTIVATIONS/INACTIVATIONS	3,432		3,432
1804n	290	SHIP ACTIVATIONS/INACTIVATIONS	156,037		156,037
		MOBILIZATION PREPAREDNESS			
1804n	300	FLEET HOSPITAL PROGRAM	25,561		25,561
	300	Medical operations (Transfer from DERF)		4,000	4,000
1804n	310	INDUSTRIAL READINESS	1,207		1,207
1804n	320	COAST GUARD SUPPORT	18,759		18,759
		TOTAL, BA 02: MOBILIZATION	**733,791**	**4,000**	**737,791**
		ACCESSION TRAINING			
1804n	330	OFFICER ACQUISITION	115,943		115,943
1804n	340	RECRUIT TRAINING	10,413		10,413
1804n	350	RESERVE OFFICERS TRAINING CORPS	83,461		83,461
		BASIC SKILLS AND ADVANCED TRAINING			
1804n	360	SPECIALIZED SKILL TRAINING	351,114		351,114
	360	Pre-deployment training (Transfer from DERF)		1,000	1,000
	360	Imagery training initiative (Transfer from DERF)		1,000	1,000

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1804n	370	FLIGHT TRAINING	371,096		371,096
1804n	380	PROFESSIONAL DEVELOPMENT EDUCATION	137,801		137,801
1804n	390	TRAINING SUPPORT	218,765		218,765
		RECRUITING, AND OTHER TRAINING AND EDUCATION			
1804n	400	RECRUITING AND ADVERTISING	257,292		257,292
1804n	410	OFF-DUTY AND VOLUNTARY EDUCATION	102,643		102,643
1804n	420	CIVILIAN EDUCATION AND TRAINING	75,178		75,178
1804n	430	JUNIOR ROTC	35,358		35,358
		BASE SUPPORT			
1804n	440	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	224,764		224,764
	440	Site improvement (Transfer from DERF)		42,000	42,000
1804n	450	BASE SUPPORT	375,698		375,698
		TOTAL, BA 03: TRAINING AND RECRUITING	**2,359,526**	**44,000**	**2,403,526**
		SERVICEWIDE SUPPORT			
1804n	460	ADMINISTRATION	669,509		669,509
	450	Security forces and technicians (Transfer from DERF)		1,500	1,500
1804n	470	EXTERNAL RELATIONS	4,639		4,639
	170	Various (Transfer from DERF)		7,000	7,000
1804n	480	CIVILIAN MANPOWER & PERSONNEL MGT	119,785		119,785
1804n	490	MILITARY MANPOWER & PERSONNEL MGT	106,986		106,986

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1804n	500	OTHER PERSONNEL SUPPORT	199,531		199,531
1804n	510	SERVICEWIDE COMMUNICATIONS	732,372		732,372
	510	Critical infrastructure protection		6,000	6,000
	0	Carry on cryptologic systems (Transfer from DERF)		500	500
	510	HQ management and planning (Transfer from DERF)		3,920	3,920
	510	HQ management and planning (Transfer from DERF)		1,600	1,600
	510	Computer network defense (Transfer from DERF)		3,800	3,800
	510	Enclave boundary (Transfer from DERF)		1,200	1,200
	510	Intrusion detection (Transfer from DERF)		1,140	1,140
1804n	520	MEDICAL ACTIVITIES			
		LOGISTICS OPERATIONS AND TECHNICAL SUPPORT			
1804n	530	SERVICEWIDE TRANSPORTATION	186,872		186,872
1804n	540	ENVIRONMENTAL PROGRAMS			
1804n	550	PLANNING, ENGINEERING & DESIGN	393,563		393,563
1804n	560	ACQUISITION AND PROGRAM MANAGEMENT	857,646		857,646
	560	Acquisition program management (Transfer from DERF)		11,000	11,000
1804n	570	AIR SYSTEMS SUPPORT	464,959		464,959
		Configuration management systems		13,500	13,500
1804n	580	HULL, MECHANICAL & ELECTRICAL SUPPORT	51,399		51,399
		Ambient temperature cure coating tests		2,000	2,000
		Anti-corrosion product testing		1,000	1,000
1804n	590	COMBAT/WEAPONS SYSTEMS	43,907		43,907

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1804n	600	SPACE & ELECTRONIC WARFARE SYSTEMS	59,899		59,899
		SECURITY PROGRAMS			
1804n	610	SECURITY PROGRAMS	767,090	27,990	795,080
	610	Intel/security and investigative matters (Transfer from DERF)		3,500	3,500
	610	Various (Transfer from DERF)		2,000	2,000
	610	HUMINT (Transfer from DERF)		3,700	3,700
	610	Counter surveillance and law enforcement advance details (Transfer from DERF)		5,000	5,000
		SUPPORT OF OTHER NATIONS			
1804n	620	INTERNATIONAL HDQTRS & AGENCIES	9,349		9,349
		BASE SUPPORT			
1804n	630	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	99,406		99,406
	630	Site improvement (Transfer from DERF)		13,000	13,000
1804n	640	BASE SUPPORT	212,958		212,958
		CANCELLED ACCOUNTS			
1804n	650	CANCELLED ACCOUNT			
		PROBLEM DISBURSEMENTS			
1804n	660	PROBLEM DISBURSEMENTS			

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		JUDGMENT FUND			
1804n	670	JUDGMENT FUND			
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**4,979,870**	**109,350**	**5,089,220**
		Legislative provisions not proposed		(5,200)	(5,200)
		Civilian personnel accrual accounting adjustment		(324,278)	(324,278)
		Contract services		(152,300)	(152,300)
		Total Operation and Maintenance, Navy	**29,028,813**	**340,148**	**29,368,961**
		Operation and Maintenance, Marine Corps			
		EXPEDITIONARY FORCES			
1106n	010	OPERATIONAL FORCES	631,065		631,065
	10	Continuity of intelligence (Transfer from DERF)		1,000	1,000
	10	I-SURSS (Transfer from DERF)		700	700
	10	TRSS (Transfer from DERF)		1,000	1,000
	10	TCAC (Transfer from DERF)		500	500
	10	RREP (Transfer from DERF)		200	200
	10	TPC (Transfer from DERF)		700	700
	10	MCIA analytic support (Transfer from DERF)		2,400	2,400
	10	TEG (Transfer from DERF)		1,000	1,000
	10	TROJAN Lite (Transfer from DERF)		1,500	1,500

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
	10	ISR (Transfer from DERF)		2,900	2,900
	10	FLAMES/CESAS (Transfer from DERF)		2,000	2,000
	10	Computer network defense (Transfer from DERF)		2,000	2,000
	10	Secure wireless (Transfer from DERF)		800	800
	10	Deployed security interdiction devices (Transfer from DERF)		700	700
1106n	020	FIELD LOGISTICS	289,401		289,401
		Anti-corrosion product testing		1,000	1,000
1106n	030	DEPOT MAINTENANCE	138,576		138,576
1106n	040	BASE SUPPORT	907,624		907,624
	40	Physical security equipment (Transfer from DERF)		228,000	228,000
	40	CINC AT/FP staffs (Transfer from DERF)		3,200	3,200
	40	Physical security upgrades (Transfer from DERF)		10,000	10,000
		Training area management		1,590	1,590
		Exercise equipment maintenance		2,300	2,300
1106n	050	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	445,582		445,582
		USMC PREPOSITIONING			
1106n	060	MARITIME PREPOSITIONING	80,743		80,743
1106n	070	NORWAY PREPOSITIONING	3,813		3,813
		TOTAL, BA 01: OPERATING FORCES	**2,496,804**	**263,490**	**2,760,294**
		ACCESSION TRAINING			
1106n	080	RECRUIT TRAINING	10,516		10,516

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1106n	090	OFFICER ACQUISITION	355		355
1106n	100	BASE SUPPORT	65,906		65,906
1106n	110	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	29,122		29,122
		BASIC SKILLS AND ADVANCED TRAINING			
1106n	120	SPECIALIZED SKILLS TRAINING	40,524		40,524
1106n	130	FLIGHT TRAINING	175		175
1106n	140	PROFESSIONAL DEVELOPMENT EDUCATION	8,912		8,912
1106n	150	TRAINING SUPPORT	112,202		112,202
1106n	160	BASE SUPPORT	80,141		80,141
1106n	170	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	30,144		30,144
		RECRUITING AND OTHER TRAINING EDUCATION			
1106n	180	RECRUITING AND ADVERTISING	121,345		121,345
1106n	190	OFF-DUTY AND VOLUNTARY EDUCATION	34,695		34,695
1106n	200	JUNIOR ROTC	13,312		13,312
1106n	210	BASE SUPPORT	15,137		15,137
	210	Site R (Transfer from DERF)		1,000	1,000
1106n	220	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	2,507		2,507
		TOTAL, BA 03: TRAINING AND RECRUITING	**564,993**	**1,000**	**565,993**
		SERVICEWIDE SUPPORT			
1106n	230	SPECIAL SUPPORT	198,890		198,890

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1106n	240	SERVICEWIDE TRANSPORTATION	34,627		34,627
1106n	250	ADMINISTRATION	39,262		39,262
1106n	260	BASE SUPPORT	20,438		20,438
1106n	270	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	2,938		2,938
		CANCELLED ACCOUNT			
1106n	280	CANCELLED ACCOUNT			
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**296,155**	**0**	**296,155**
		Legislative provisions not proposed	0	(200)	(200)
		Civilian personnel accrual accounting adjustment		(47,210)	(47,210)
		Contract services		(16,300)	(16,300)
		Total Operation and Maintenance, Marine Corps	**3,357,952**	**200,780**	**3,558,732**
		Operation and Maintenance, Air Force			
		AIR OPERATIONS			
3400f	010	PRIMARY COMBAT FORCES	3,244,026		3,244,026
	10	Combat air patrol (Transfer from DERF)		380,000	380,000
	10	Predator O&M (Transfer from DERF)		9,000	9,000
3400f	020	PRIMARY COMBAT WEAPONS	336,234		336,234

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
3400f	030	COMBAT ENHANCEMENT FORCES	248,367		248,367
		Airspace control and information ops range improvements		2,100	2,100
	30	Computer network defense combat enhancement (Transfer from DERF)		3,500	3,500
3400f	040	AIR OPERATIONS TRAINING	1,250,537		1,250,537
		Joint training and deployment preparation exercises		23,500	23,500
		Joint Advanced Weapon Scoring System		300	300
		Improved targets		4,000	4,000
		Range residue removal and range infrastructure improvements		3,400	3,400
		Security sensor upgrades and facility repairs		3,200	3,200
3400f	050	DEPOT MAINTENANCE	1,382,953	78,628	1,461,581
3400f	060	COMBAT COMMUNICATIONS	1,465,273		1,465,273
3400f	070	BASE SUPPORT	2,357,450		2,357,450
		Land planning outreach and restoration		1,200	1,200
		Primary training range infrastructure		2,800	2,800
	70	AEF/ force protection certification training (Transfer from DERF)		10,200	10,200
3400f	080	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	960,912	80,000	1,040,912
		COMBAT RELATED OPERATIONS			
3400f	090	GLOBAL C3I AND EARLY WARNING	816,000		816,000
	90	GeoReach/GeoBase (Transfer from DERF)		25,800	25,800
	90	Defense reconnaissance support (Transfer from DERF)		68,630	68,630
3400f	100	NAVIGATION/WEATHER SUPPORT	187,671		187,671

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
3400f	110	OTHER COMBAT OPS SUPPORT PROGRAMS	425,618		425,618
	110	Nat'l Airborne Command Center (NAOC) ground network (Transfer from DERF)		10,000	10,000
	110	Aircraft communication mods (Transfer from DERF)		3,600	3,600
	110	UH-1 support, capital region (Transfer from DERF)		700	700
	110	Communications systems operators training (Transfer from DERF)		500	500
	110	Commercial imagery - other combat (Transfer from DERF)		2,000	2,000
		Information warfare support (Transfer from DERF)		5,000	5,000
3400f	120	JCS EXERCISES	39,406		39,406
3400f	130	MANAGEMENT/OPERATIONAL HEADQUARTERS	221,692		221,692
	130	CENTCOM PSD & forward HQs (Transfer from DERF)		700	700
	130	CINC AT/FP staff (Transfer from DERF)		5,500	5,500
	130	Management headquarters STRATCOM (Transfer from DERF)		1,250	1,250
	130	Information warfare support (Transfer from DERF)		0	
	130	Tactical deception (Transfer from DERF)		0	
	130	Management HQs STRATCOM (Transfer from DERF)		0	
	130	Management critical infrastructure protection (Transfer from DERF)		400	400
3400f	140	TACTICAL INTEL AND OTHER SPECIAL ACTIVITIES	251,806		251,806
	140	Combat air intelligence systems (Transfer from DERF)		2,300	2,300
	140	Special purpose comms (Transfer from DERF)		2,000	2,000
	140	Tactical information program (Transfer from DERF)		5,000	5,000
	140	Special evaluation program (Transfer from DERF)		1,200	1,200
	140	DCGS architecture (Transfer from DERF)		3,000	3,000

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
	140	Integrated broadcast service smart pull technology (Transfer from DERF)		100	100
	140	Integrated broadcast service (Transfer from DERF)		100	100
		SPACE OPERATIONS			
3400f	150	LAUNCH FACILITIES	281,022		281,022
	150a	Range operations		11,100	11,100
3400f	160	LAUNCH VEHICLES	133,478		133,478
3400f	170	SPACE CONTROL SYSTEMS	244,626		244,626
3400f	180	SATELLITE SYSTEMS	60,989		60,989
3400f	190	OTHER SPACE OPERATIONS	251,191		251,191
		Defense reconnaissance support activities (SPACE) (Transfer from DERF)		10,000	10,000
3400f	200	BASE SUPPORT	493,528		493,528
	200	Weapons of Mass Destruction - 1st Responder (Transfer from DERF)		46,000	46,000
3400f	210	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	157,715		157,715
	210	AT/FP facility upgrades (Transfer from DERF)		99,585	99,585
		TOTAL, BA 01: OPERATING FORCES	**14,810,494**	**906,293**	**15,716,787**
		MOBILITY OPERATIONS			
3400f	220	AIRLIFT OPERATIONS	2,147,117		2,147,117
3400f	230	AIRLIFT OPERATIONS C3I	42,298		42,298
	230	Airlift operations critical infrastructure protection (Transfer from DERF)		1,800	1,800
3400f	240	MOBILIZATION PREPAREDNESS	175,023		175,023

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
3400f	250	DEPOT MAINTENANCE	312,552	60,000	372,552
3400f	260	PAYMENTS TO TRANSPORTATION BUSINESS AREA	470,700		470,700
3400f	270	BASE SUPPORT	527,755		527,755
	270	AEF/ force protection certification training (Transfer from DERF)		4,800	4,800
	270	Weapons of Mass Destruction - 1st Responder (Transfer from DERF)		21,850	21,850
3400f	280	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	159,896		159,896
	280	AT/FP facility upgrades (Transfer from DERF)		57,254	57,254
		TOTAL, BA 02: MOBILIZATION	**3,835,341**	**145,704**	**3,981,045**
		ACCESSION TRAINING			
3400f	290	OFFICER ACQUISITION	69,262		69,262
3400f	300	RECRUIT TRAINING	6,879		6,879
3400f	310	RESERVE OFFICER TRAINING CORPS (ROTC)	68,063		68,063
3400f	320	BASE SUPPORT (ACADEMIES ONLY)	73,180		73,180
3400f	330	FACILITIES SUSTAINMENT, RESTORATION & MOD. (ACADEMIES)	82,672		82,672
		BASIC SKILLS AND ADVANCED TRAINING			
3400f	340	SPECIALIZED SKILL TRAINING	307,625		307,625
3400f	350	FLIGHT TRAINING	663,762		663,762
3400f	360	PROFESSIONAL DEVELOPMENT EDUCATION	141,864		141,864
3400f	370	TRAINING SUPPORT	92,646		92,646
3400f	380	DEPOT MAINTENANCE	8,242		8,242

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
3400f	390	BASE SUPPORT (OTHER TRAINING)	573,464		573,464
	390	Weapons of Mass Destruction - 1st Responder (Transfer from DERF)		1,150	1,150
3400f	400	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION (OTHER	160,638		160,638
	400	AT/FP facility upgrades (Transfer from DERF)		16,341	16,341
		RECRUITING, AND OTHER TRAINING AND EDUCATION			
3400f	410	RECRUITING AND ADVERTISING	152,289		152,289
3400f	420	EXAMINING	3,222		3,222
3400f	430	OFF DUTY AND VOLUNTARY EDUCATION	96,516		96,516
3400f	440	CIVILIAN EDUCATION AND TRAINING	107,151		107,151
3400f	450	JUNIOR ROTC	43,448		43,448
		TOTAL, BA 03: TRAINING AND RECRUITING	**2,650,923**	**17,491**	**2,668,414**
		LOGISTICS OPERATIONS			
3400f	460	LOGISTICS OPERATIONS	922,106		922,106
		Anti-corrosion product testing		1,000	1,000
3400f	470	TECHNICAL SUPPORT ACTIVITIES	429,543		429,543
3400f	480	SERVICEWIDE TRANSPORTATION	237,503		237,503
3400f	490	DEPOT MAINTENANCE	78,062		78,062
3400f	500	BASE SUPPORT	1,154,363		1,154,363
3400f	510	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	245,436		245,436

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		SERVICEWIDE ACTIVITIES			
3400f	520	ADMINISTRATION	224,882		224,882
3400f	530	SERVICEWIDE COMMUNICATIONS	376,841		376,841
	530	Modernization, sustainment, and development (Transfer from DERF)		0	
	530	Servicewide comm modernization and sustainment (Transfer from DERF)		1,700	1,700
	530	Intrusion detection systems (Transfer from DERF)		1,500	1,500
3400f	540	PERSONNEL PROGRAMS	184,558		184,558
3400f	550	RESCUE AND RECOVERY SERVICES	110,418		110,418
3400f	560	ARMS CONTROL	33,092		33,092
3400f	570	OTHER SERVICEWIDE ACTIVITIES	572,320		572,320
		Maintenance data collection and analysis		20,000	20,000
3400f	580	OTHER PERSONNEL SUPPORT	44,716		44,716
3400f	590	CIVIL AIR PATROL CORPORATION	19,668		19,668
3400f	600	BASE SUPPORT	276,338		276,338
	600	AEF/ force protection certification training (Transfer from DERF)		2,900	2,900
	600	Weapons of Mass Destruction - 1st Responder (Transfer from DERF)		4,600	4,600
3400f	610	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	23,816		23,816
	610	AT/FP facility upgrades (Transfer from DERF)		3,976	3,976
		SECURITY PROGRAMS			
3400f	620	SECURITY PROGRAMS	1,054,171	117,860	1,172,031
	620	Security and Investigative Activities (Transfer from DERF)		2,000	2,000
	620	Defense Security Service (DSS) (Transfer from DERF)		5,000	5,000

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		SUPPORT TO OTHER NATIONS			
3400f	630	INTERNATIONAL SUPPORT	20,032		20,032
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**5,987,833**	**160,536**	**6,168,401**
		Unspecified flying hour costs		(287,628)	(287,628)
		Utilities	0	(55,000)	(55,000)
		Legislative provisions not proposed	0	(800)	(800)
		Civilian personnel accrual accounting adjustment		(531,055)	(531,055)
		Contract services		(211,400)	(211,400)
		Total Operation and Maintenance, Air Force	**27,304,623**	**144,141**	**27,448,764**
		Operation and Maintenance, Defense-Wide			
		OPERATING FORCES			
0100d	010	JOINT CHIEFS OF STAFF	398,341		398,341
	10	Combating terrorism readiness initiatives fund (Transfer from DERF)		12,000	12,000
0100d	020	SPECIAL OPERATIONS COMMAND	1,531,330		1,531,330
		TOTAL, BUDGET ACTIVITY 1:	**1,929,671**	**12,000**	**1,941,671**
		MOBILIZATION			
0100d	050	DEFENSE LOGISTICS AGENCY	41,420		41,420
		TOTAL, BUDGET ACTIVITY 2:	**41,420**	**0**	**41,420**

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		TRAINING AND RECRUITING			
0100d	060	AMERICAN FORCES INFORMATION SERVICE	11,232		11,232
0100d	070	CLASSIFIED PROGRAMS	6,869		6,869
0100d	080	DEFENSE ACQUISITION UNIVERSITY	103,514		103,514
0100d	090	DEFENSE CONTRACT AUDIT AGENCY	4,865		4,865
0100d	100	DEFENSE FINANCE AND ACCOUNTING SERVICE	9,160		9,160
0100d	110	DEFENSE HUMAN RESOURCES ACTIVITY	89,161		89,161
		Joint recruiting and advertising		(24,250)	(24,250)
0100d	120	DEFENSE SECURITY SERVICE	9,889		9,889
0100d	130	DEFENSE THREAT REDUCTION AGENCY	1,292		1,292
0100d	140	SPECIAL OPERATIONS COMMAND	62,982		62,982
		SOCOM training		16,700	16,700
		TOTAL, BUDGET ACTIVITY 3:	**298,964**	**(7,550)**	**291,414**
		ADMIN & SERVICEWIDE ACTIVITIES			
0100d	150	AMERICAN FORCES INFORMATION SERVICE	98,564		98,564
0100d	160	CIVIL MILITARY PROGRAMS	97,006		97,006
0100d	170	CLASSIFIED PROGRAMS	5,864,228	1,060	5,865,288
	170	Critical database backup (Transfer from DERF)		5,000	5,000
	170	Intelligence support to hard and deeply buried targets (Transfer from DERF)		12,600	12,600
	170	Hard and deeply buried targets (Transfer from DERF)		2,300	2,300
	170	Hard and deeply buried targets (Transfer from DERF)		2,600	2,600

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
	170	DIA (Transfer from DERF)		15,000	15,000
	170	Airborne integration - NIMA (Transfer from DERF)		2,000	2,000
	170	IEC workstations - NIMA (Transfer from DERF)		1,000	1,000
	170	Libraries communication - NIMA (Transfer from DERF)		10,100	10,100
	170	PGM targeting workstations - NIMA (Transfer from DERF)		2,000	2,000
	170	CENTCOM - NIMA (Transfer from DERF)		1,000	1,000
	170	Commercial imagery - NIMA (Transfer from DERF)		33,670	33,670
	170	Geospatial data generation (Transfer from DERF)		32,800	32,800
	170	Classified - NISA (Transfer from DERF)		11,000	11,000
	170	U-2 support (Transfer from DERF)		1,300	1,300
	170	Global and theater guarding solutions (Transfer from DERF)		5,400	5,400
	170	Coalition-intelligence information sharing (CENTRIX) (Transfer from DERF)		14,000	14,000
0100d	180	DEFENSE CONTRACT AUDIT AGENCY	377,495		377,495
0100d	190	DEFENSE CONTRACT MANAGEMENT AGENCY	1,070,567		1,070,567
0100d	200	DEFENSE FINANCE AND ACCOUNTING SERVICE	2,282		2,282
	200	Financial operations (Transfer from DERF)		5,900	5,900
	200	Financial operations (Transfer from DERF)		500	500
0100d	210	DEFENSE HUMAN RESOURCES ACTIVITY	256,042		256,042
	210	Critical infrastructure protection (Transfer from DERF)		500	500
0100d	220	DEFENSE INFORMATION SYSTEMS AGENCY	956,644		956,644
	220	Secure voice teleconferencing system (Transfer from DERF)		2,500	2,500
	220	Defense conferencing enhancement program (Transfer from DERF)		8,900	8,900

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
	220	DISA continuity of operations (Transfer from DERF)		2,500	2,500
	220	Bandwidth expansion (Transfer from DERF)		7,600	7,600
	220	Information assurance (Transfer from DERF)		500	500
	220	White House communications (Transfer from DERF)		3,000	3,000
	220	On-site administrators for primary sites (Transfer from DERF)		3,400	3,400
	220	Info assurance, intell/coalition encryption (CWAN) (Transfer from DERF)		5,000	5,000
	220	Info assurance, intell/coalition encryption (CFBL) (Transfer from DERF)		1,600	1,600
	220	Information assurance computer network defense (Transfer from DERF)		3,500	3,500
	220	On-site administrators for primary sites (Transfer from DERF)		3,000	3,000
0100d	230	DEFENSE LOGISTICS AGENCY	201,171		201,171
		Procurement Technical Assistance Program		5,000	5,000
		Business process (logistics) reengineering		(2,000)	(2,000)
	230	Critical infrastructure protection (CIP) (Transfer from DERF)		600	600
0100d	240	DEFENSE LEGAL SERVICES AGENCY	14,385		14,385
0100d	250	DEPARTMENT OF DEFENSE DEPENDENTS EDUCATION	1,616,135		1,616,135
	250	Enhanced force protection (Transfer from DERF)		18,000	18,000
	250	Enhanced force protection (Transfer from DERF)		6,000	6,000
	250	Enhanced force protection (Transfer from DERF)		200	200
0100d	260	DEFENSE POW /MISSING PERSONS OFFICE	15,974		15,974
0100d	270	DEFENSE SECURITY COOPERATION AGENCY	67,927		67,927
0100d	280	DEFENSE SECURITY SERVICE	170,447		170,447
	280	Critical infrastructure protection (Transfer from DERF)		500	500

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
0100d	290	DEFENSE THREAT REDUCTION AGENCY	273,510		273,510
0100d	300	OFFICE OF ECONOMIC ADJUSTMENT	14,740		14,740
0100d	310	OFFICE OF THE SECRETARY OF DEFENSE	499,943		499,943
		Range Enhancement Initiative Fund		20,000	20,000
		Legacy Resource Management Program		3,000	3,000
		Corrosion management		3,000	3,000
		Base information system		(10,000)	(10,000)
		Studies		(1,821)	(1,821)
		C3I Mission and Analysis Fund		(4,894)	(4,894)
	310	OSD continuity of operations (COOP) ops and sustainment (Transfer from DERF)		18,000	18,000
	310	National Capital Region continuity of operations (Transfer from DERF)		10,500	10,500
	310	National Infrastructure Protection Center (NIPC) Reserve support (Transfer from DERF)		4,000	4,000
	310	National Infrastructure Protection Center (NIPC) DoD detailees (Transfer from DERF)		4,000	4,000
	310	Hard and deeply buried targets (0902198D8Z) (Transfer from DERF)		3,050	3,050
	310	CIP – biological agent security (Transfer from DERF)		2,000	2,000
	310	CIP - nuclear security command and control (Transfer from DERF)		400	400
	310	CIP technology & consequence management (Transfer from DERF)		6,600	6,600
	310	Information operations (Transfer from DERF)		15,000	15,000
	310	Concept plan (Transfer from DERF)		0	0
	310	Information operations (Transfer from DERF)		22,000	22,000
	310	Information operations (Transfer from DERF)		1,500	1,500
	310	Information operations (Transfer from DERF)		6,000	6,000

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
	310	Horizontal fusion analysis (Transfer from DERF)		2,000	2,000
	310	Classified (Transfer from DERF)		9,500	9,500
0100d	320	SPECIAL OPERATIONS COMMAND	62,885		62,885
	320	Combat development activities (Transfer from DERF)		7,000	7,000
0100d	330	SPECIAL ACTIVITIES	68,000		68,000
0100d	340	JOINT CHIEFS OF STAFF	184,483		184,483
		Studies		(6,966)	(6,966)
	340	Other combating terrorism initiatives (Transfer from DERF)		1,459	1,459
	340	Vulnerability assessments, AT/FP requirements tracking & analysis (Transfer from DERF)		400	400
	340	CINC for Homeland Security (Transfer from DERF)		27,000	27,000
	340	Critical infrastructure protection (Transfer from DERF)		300	300
0100d	350	WASHINGTON HEADQUARTERS SERVICES	332,821		332,821
	350	Classified (Transfer from DERF)		28,000	28,000
		TOTAL, BUDGET ACTIVITY 4:	**12,245,249**	**400,558**	**12,645,807**
		Impact aid		30,000	30,000
		Impact aid for children with disabilities		5,000	5,000
		Commercial imagery		30,000	30,000
		Civilian personnel accrual accounting adjustment		(346,046)	(346,046)
		Contract services		(127,500)	(127,500)
		Financial management		(19,500)	(19,500)
		Total Operation and Maintenance, Defense-Wide	**14,515,304**	**(23,038)**	**14,492,266**

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		Operation and Maintenance, Army Reserve			
		LAND FORCES			
2080a	010	DIVISION FORCES	16,323		16,323
2080a	020	CORPS COMBAT FORCES	33,211		33,211
2080a	030	CORPS SUPPORT FORCES	281,583		281,583
2080a	040	ECHELON ABOVE CORPS FORCES	128,348		128,348
2080a	050	LAND FORCES OPERATIONS SUPPORT	461,173		461,173
		LAND FORCES READINESS			
2080a	060	FORCES READINESS OPERATIONS SUPPORT	115,962		115,962
		Information operations training and support		3,000	3,000
2080a	070	LAND FORCES SYSTEM READINESS	62,255		62,255
	70	Enhanced secure communications to Reserve Components (Transfer from DERF)		5,900	5,900
	70	Enhanced secure communications to Reserve Components (Transfer from DERF)		17,600	17,600
2080a	080	DEPOT MAINTENANCE	48,451		48,451
		LAND FORCES READINESS SUPPORT			
2080a	090	BASE SUPPORT	361,907		361,907
	90	Access control, vulnerability assessments (Transfer from DERF)		20,000	20,000
	90	Installation security (Transfer from DERF)		2,900	2,900
	90	Enhanced secure communications to Reserve Components (Transfer from DERF)		30,700	30,700
2080a	100	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	176,494		176,494

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
2080a	110	ADDITIONAL ACTIVITIES	2,712		2,712
		TOTAL, BA 01: OPERATING FORCES	**1,688,419**	**80,100**	**1,768,519**
		ADMINISTRATION AND SERVICEWIDE ACTIVITIES			
2080a	120	ADMINISTRATION	48,752		48,752
2080a	130	SERVICEWIDE COMMUNICATIONS	34,842		34,842
	130	Enhanced secure communications to Reserve Components (Transfer from DERF)		2,400	2,400
2080a	140	PERSONNEL/FINANCIAL ADMINISTRATION (MANPOWER MANAGEMENT	50,044		50,044
2080a	150	RECRUITING AND ADVERTISING	101,273		101,273
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**234,911**	**2,400**	**237,311**
		Civilian personnel accrual accounting adjustment		(43,220)	(43,220)
		Total Operation and Maintenance, Army Reserve	**1,923,330**	**39,280**	**1,962,610**
		Operation and Maintenance, Navy Reserve			
		RESERVE AIR OPERATIONS			
1806n	010	MISSION AND OTHER FLIGHT OPERATIONS	398,320		398,320
1806n	030	INTERMEDIATE MAINTENANCE	18,003		18,003
1806n	040	AIR OPERATION AND SAFETY SUPPORT	2,268		2,268
	40	Management and planning (Transfer from DERF)		61	61
	40	Management and planning (Transfer from DERF)		187	187

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1806n	050	AIRCRAFT DEPOT MAINTENANCE	129,532		129,532
	50	Physical security site improvement (Transfer from DERF)		68,777	68,777
1806n	060	AIRCRAFT DEPOT OPS SUPPORT	366		366
		RESERVE SHIP OPERATIONS			
1806n	070	MISSION AND OTHER SHIP OPERATIONS	68,219		68,219
1806n	080	SHIP OPERATIONAL SUPPORT AND TRAINING	558		558
1806n	090	INTERMEDIATE MAINTENANCE	11,712		11,712
1806n	100	SHIP DEPOT MAINTENANCE	80,272		80,272
1806n	110	SHIP DEPOT OPERATIONS SUPPORT	3,535		3,535
		RESERVE COMBAT OPERATIONS SUPPORT			
1806n	120	COMBAT SUPPORT FORCES	69,864		69,864
		RESERVE WEAPONS SUPPORT			
1806n	130	WEAPONS MAINTENANCE	5,668		5,668
		BASE SUPPORT			
1806n	140	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	66,599		66,599
1806n	150	BASE SUPPORT	146,119		146,119
		TOTAL, BA 01: OPERATING FORCES	**1,001,035**	**69,025**	**1,070,060**
		ADMINISTRATION AND SERVICEWIDE ACTIVITIES			
1806n	160	ADMINISTRATION	12,023		12,023

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1806n	170	CIVILIAN MANPOWER & PERSONNEL	2,161		2,161
1806n	180	MILITARY MANPOWER & PERSONNEL	32,479		32,479
1806n	190	SERVICEWIDE COMMUNICATIONS	111,766		111,766
	190	Reserve site C2, cryptologic COOP (Transfer from DERF)		5,000	5,000
1806n	200	COMBAT/WEAPONS SYSTEM	5,766		5,766
1806n	210	OTHER SERVICEWIDE SUPPORT	731		731
		CANCELLED ACCOUNTS			
1806n	220	CANCELLED ACCOUNTS			
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**164,926**	**5,000**	**169,926**
		Civilian personnel accrual accounting adjustment		(6,227)	(6,227)
		Total Operation and Maintenance, Navy Reserve	**1,165,961**	**67,798**	**1,233,759**
		Operation and Maintenance, Marine Corps Reserve			
		MISSION FORCES			
1107n	010	OPERATING FORCES	80,723		80,723
		Initial issue		5,000	5,000
1107n	020	DEPOT MAINTENANCE	12,571		12,571
1107n	030	BASE SUPPORT	29,473		29,473

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
1107n	040	TRAINING SUPPORT	20,641		20,641
1107n	050	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	10,785		10,785
		TOTAL, BA 01: OPERATING FORCES	**154,193**	**5,000**	**159,193**
		ADMINISTRATION AND SERVICEWIDE ACTIVITIES			
1107n	060	SPECIAL SUPPORT	8,461		8,461
1107n	070	SERVICEWIDE TRANSPORTATION	500		500
1107n	080	ADMINISTRATION	9,977		9,977
1107n	090	BASE SUPPORT	4,130		4,130
1107n	100	RECRUITING AND ADVERTISING	8,271		8,271
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**31,339**	**0**	**31,339**
		Total Operation and Maintenance, Marine Corps Reserve	**185,532**	**5,000**	**190,532**
		Operation and Maintenance, Air Force Reserve			
		AIR OPERATIONS			
3740f	010	PRIMARY COMBAT FORCES	1,346,055		1,346,055
		Range residue removal		400	400
3740f	020	MISSION SUPPORT OPERATIONS	69,818		69,818
3740f	030	DEPOT MAINTENANCE	337,113		337,113
3740f	040	BASE SUPPORT	282,280		282,280

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
	40	Weapons of Mass Destruction - 1st Responder (Transfer from DERF)		14,950	14,950
3740f	050	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	48,463		48,463
	50	AT/FP facility upgrades (Transfer from DERF)		6,202	6,202
		TOTAL, BA 01: OPERATING FORCES	**2,083,729**	**21,552**	**2,105,281**
		ADMINISTRATION AND SERVICEWIDE ACTIVITIES			
3740f	060	ADMINISTRATION	57,136		57,136
		Server consolidation		8,000	8,000
3740f	070	MILITARY MANPOWER AND PERSONNEL MANAGEMENT	24,088		24,088
3740f	080	RECRUITING AND ADVERTISING	18,683		18,683
3740f	090	OTHER PERSONNEL SUPPORT	6,593		6,593
3740f	100	AUDIOVISUAL	688		688
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**107,188**	**8,000**	**115,188**
		Legislative provisions not proposed		(100)	(100)
		Civilian personnel accrual accounting adjustment		(55,365)	(55,365)
		Total Operation and Maintenance, Air Force Reserve	**2,190,917**	**(25,913)**	**2,165,004**
		Operation and Maintenance, Army National Guard			
		LAND FORCES			
2065a	010	DIVISIONS	592,730		592,730
		Personal gear		12,000	12,000

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
2065a	020	CORPS COMBAT FORCES	652,895		652,895
2065a	030	CORPS SUPPORT FORCES	313,967		313,967
2065a	040	ECHELON ABOVE CORPS FORCES	516,742		516,742
2065a	050	LAND FORCES OPERATIONS SUPPORT	48,443		48,443
		LAND FORCES READINESS			
2065a	060	FORCE READINESS OPERATIONS SUPPORT	75,746		75,746
2065a	070	LAND FORCES SYSTEMS READINESS	107,925		107,925
2065a	080	LAND FORCES DEPOT MAINTENANCE	178,733		178,733
		LAND FORCES READINESS SUPPORT			
2065a	090	BASE OPERATIONS SUPPORT	561,967		561,967
	90	Security (Transfer from DERF)		350,000	350,000
2065a	100	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	363,571		363,571
2065a	110	MANAGEMENT & OPERATIONAL HEADQUARTERS	420,329		420,329
2065a	120	MISCELLANEOUS ACTIVITIES	46,673		46,673
	120	Classified network (Transfer from DERF)		86,200	86,200
	120	Classified network (Transfer from DERF)		8,500	8,500
		TOTAL, BA 01: OPERATING FORCES	**3,879,721**	**456,700**	**4,336,421**
		ADMINISTRATION AND SERVICEWIDE ACTIVITIES			
2065a	130	STAFF MANAGEMENT	104,409		104,409
2065a	140	INFORMATION MANAGEMENT	15,565		15,565

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Account	Line	Program	FY 2003	Senate Change	Senate Authorized
2065a	150	PERSONNEL ADMINISTRATION	52,259		52,259
2065a	160	RECRUITING AND ADVERTISING	84,868		84,868
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**257,101**	**0**	**257,101**
		Civilian personnel accrual accounting adjustment		(87,255)	(87,255)
		Total Operation and Maintenance, Army National Guard	**4,136,822**	**369,445**	**4,506,267**
		Operation and Maintenance, Air National Guard			
		AIR OPERATIONS			
3840f	010	AIRCRAFT OPERATIONS	2,637,374		2,637,374
		Range residue removal		6,600	6,600
		Range emitters		1,500	1,500
		Increased support for test and evaluation		2,000	2,000
3840f	020	MISSION SUPPORT OPERATIONS	341,385		341,385
		Medical equipment		350	350
		Personal gear		4,000	4,000
3840f	030	BASE SUPPORT	407,751		407,751
3840f	040	FACILITIES SUSTAINMENT, RESTORATION & MODERNIZATION	164,228		164,228
	40	AT/FP facility upgrades (Transfer from DERF)		38,015	38,015
3840f	050	DEPOT MAINTENANCE	565,224		565,224
		TOTAL, BA 01: OPERATING FORCES	**4,115,962**	**52,465**	**4,168,427**

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		SERVICEWIDE ACTIVITIES			
3840f	060	ADMINISTRATION	24,871		24,871
3840f	070	RECRUITING AND ADVERTISING	10,128		10,128
		TOTAL, BA 04: ADMINISTRATION & SERVICEWIDE ACTIVITIES	**34,999**	**0**	**34,999**
		Legislative provisions not proposed		(100)	(100)
		Civilian personnel accrual accounting adjustment		(88,416)	(88,416)
		Total Operation and Maintenance, Air National Guard	**4,150,961**	**(36,051)**	**4,114,910**
		TRANSFER ACCOUNTS			
0810a	010	ENVIRONMENTAL RESTORATION, ARMY	395,900		395,900
0810n	020	ENVIRONMENTAL RESTORATION, NAVY	256,948		256,948
0810f	030	ENVIRONMENTAL RESTORATION, AIR FORCE	389,773		389,773
0810d	040	ENVIRONMENTAL RESTORATION, DEFENSE-WIDE	23,498		23,498
0811d	050	ENVIRONMENTAL RESTORATION, FORMERLY USED DEFENSE SITES	212,102	40,000	252,102
0105d	060	DRUG INTERDICTION AND COUNTER-DRUG ACTIVITIES	848,907		848,907
		National Guard counterdrug state plans		25,000	25,000
0118d	070	OVERSEAS CONTINGENCIES	50,000		50,000
		TOTAL, O&M, TRANSFER ACCOUNTS	**2,177,128**	**65,000**	**2,242,128**
		MISCELLANEOUS			
0107d	080	OFFICE OF THE INSPECTOR GENERAL	163,440		163,440

Title III - Operation and Maintenance

Account	Line	Program	FY 2003	Senate Change	Senate Authorized
		Civilian personnel accrual accounting adjustment		(8,275)	(8,275)
0104d	090	U.S. COURT OF APPEALS FOR THE ARMED FORCES	9,925		9,925
		Civilian personnel accrual accounting adjustment		(311)	(311)
0838d	100	SUPPORT OF INTERNATIONAL SPORTING COMPETITIONS	19,000		19,000
0819d	110	OVERSEAS HUMANITARIAN, DISASTER, AND CIVIC AFFAIRS	58,400		58,400
1236n	120	PAYMENT TO KAHO'OLAWE ISLAND	25,000		25,000
0130d	140	DEFENSE HEALTH PROGRAM	14,360,271		14,202,441
		Civilian personnel accrual accounting adjustment		(126,230)	
		Financial management		(32,100)	
		Critical infrastructure protection - DHP (Transfer from DERF)		500	
0134d	150	FORMER SOVIET UNION THREAT REDUCTION	416,700		416,700
0839d	160	QUALITY OF LIFE ENHANCEMENTS			
0840d	170	OPPLAN 34A-35 P.O.W.			
0099d	180	COUNTER-TERRORISM/WMD DEFENSE			
		TOTAL, MISCELLANEOUS	**15,052,736**	**(166,416)**	**14,886,320**
		Travel	0	(159,790)	(159,790)
		Foreign currency fluctuation	0	(615,200)	(615,200)
		TOTAL OPERATION AND MAINTENANCE TITLE:	**129,771,134**	**(180,629)**	**129,590,505**
0833d	130	DEFENSE EMERGENCY RESPONSE FUND	20,055,000	(20,055,000)	
		Total O&M Including DERF	**149,826,134**	**(20,235,629)**	**129,590,505**

SUBTITLE A—AUTHORIZATION OF APPROPRIATIONS

Armed Forces Retirement Home (sec. 303)

The committee recommends a provision that would authorize the appropriation of $69.9 million from the Armed Forces Retirement Home Trust Fund for fiscal year 2003.

Range enhancement initiative fund (sec. 304)

The committee recommends a provision that would authorize $20.0 million for a Range Enhancement Initiative Fund that is described in more detail in the training range enhancement initiative section of this title. Amounts in this fund would be available to purchase restrictive easements, including easements entered into under agreements with private entities that would directly or indirectly enhance or protect military training operations. The committee has included a provision providing permanent authority to enter into such agreements in title XVIII of this act. Purchases of title to lands, as opposed to the purchase of easements, by the military departments for similar purposes would continue to be requested and authorized as military construction projects. The committee intends to evaluate the annual funding levels required for this fund in future years based on the experience with this fund in fiscal year 2003.

SUBTITLE B—ENVIRONMENTAL PROVISIONS

Enhancement of authority on cooperative agreements for environmental purposes (sec. 311)

The committee recommends a provision that would authorize the Secretary of Defense to enter into and fund cooperative agreements with Federal, State and local agencies, as well as Indian tribes, to obtain services to assist the Secretary in carrying out the Defense Environmental Restoration Program. This provision would extend to environmental cooperative agreements the authority granted in section 2410a of title 10, United States Code, to contract for severable services for a period that begins in one fiscal year and ends in the next fiscal year.

Modification of authority to carry out construction projects for environmental responses (sec. 312)

The committee recommends a provision that would require the Secretary of Defense to fund environmental restoration projects through the Environmental Restoration Accounts of the Department of Defense (DOD).

Since the beginning of the DOD environmental restoration program, restoration projects have been classified as repair and funded through the Department's Environmental Restoration Accounts. Earlier this year, the Department interpreted a provision of the National Defense Authorization Act for Fiscal Year 1998 to require that environmental restoration projects be classified as military construction. This new interpretation had the effect of imposing notification and funding requirements on environmental restoration projects that are likely to result in a backlog of projects and an in-

ability to meet legally enforceable deadlines applicable to such projects.

The committee directs DOD to fund environmental restoration projects through the Environmental Restoration Accounts, thereby reinstating the historic funding approach taken by the Department.

Increased procurement of environmentally preferable products and services (sec. 313)

The committee recommends a provision that would require the Secretary of Defense to establish a program for the acquisition of procurement items that are environmentally preferable or are made with recovered materials. At a minimum, the program would include three elements: (1) the establishment of goals for the increased purchase of procurement items that are environmentally preferable or are made with recovered materials; (2) a tracking system to enable the Department to monitor its progress in achieving these goals; and (3) training and education programs that the Secretary of Defense considers appropriate to ensure that Department of Defense (DOD) officials and contractors are aware of these goals.

Last year, the General Accounting Office (GAO) issued a report which criticized the performance of federal agencies, including the Department of Defense, in purchasing environmentally preferable products. The report concluded:

> Even today, many procuring officials and other federal purchasers either do not know about or implement the [requirements of the Resource Conservation and Recovery Act of 1976] for establishing affirmative procurement programs, particularly promotion and review and monitoring. * * *
>
> [Federal agencies] have not developed systems to track their purchases of such products, relying instead on inadequate estimates. Nor have they put programs in place to review and monitor progress. * * * [The Department of] Defense, the largest procuring agency, believes efforts to monitor and report on recycled-content product purchases conflict with the streamlining goals of procurement reform.

The committee recognizes that the review and monitoring of purchases of procurement items that are environmentally preferable or are made with recovered materials entails administrative costs but agrees with the GAO conclusion that an effective program requires such review and monitoring. For this reason, the goals and tracking system required by the provision recommended by the committee would apply only to direct DOD purchases of procurement items, not to products and services purchased by DOD contractors and subcontractors (even if they are incorporated into procurement items purchased by the Department). The committee understands that the administration has modified the Federal Procurement Data System to collect limited information on products and services purchased by contractors and subcontractors and encourages the administration to continue this effort.

The provision would also exclude credit card purchases and other local purchases that are made outside the Department's requisitioning system, because the committee understands that the De-

partment currently lacks the ability to track such purchases. The committee directs the Department to review its local purchasing practices and take appropriate steps to ensure compliance with the preference for procurement items that are environmentally preferable or are made with recovered materials.

In addition, the committee directs the Department to conduct a review of other DOD purchasing practices to determine the extent to which these practices are consistent with the objective of increasing the procurement of items that are environmentally preferable or are made with recovered materials. At a minimum, the Secretary should:

(1) review sample purchases of inventory items by the Defense Logistics Agency to determine the type of packaging being used for such items and the extent to which such packaging is made with recovered materials;

(2) review sample construction and renovation contracts to determine whether the contracts provide appropriate direction on the disposal and recycling of materials and/or any preference for the use of products that are made with recovered materials and other environmentally preferable products;

(3) review sample purchases of information technology products to determine the type of packaging being used for such items and the extent to which such packaging is made with recovered materials; and

(4) review sample fleet management contracts to determine the extent to which these contracts provide a preference for the use of re-refined motor oil.

The results of these reviews should be included in the Secretary's initial report required by subsection (d) of this provision.

Cleanup of unexploded ordnance on Kaho'olawe Island, Hawaii (sec. 314)

The committee recommends a provision that would require the Secretary of the Navy to continue cleanup activities on Kaho'olawe Island, Hawaii, until the Navy has inspected and assessed 100 percent of the island; cleared 75 percent of the island in accordance with Tier One standards; and cleared 25 percent of the island in accordance with Tier Two standards.

Title X of the Department of Defense Appropriations Act for Fiscal Year 1994 (Public Law 103–139) established the Kaho'olawe Island Conveyance, Remediation, and Environmental Restoration Trust Fund (the Kaho'olawe Trust Fund) to ensure the clearance and removal of unexploded ordnance from Kaho'olawe Island, Hawaii. Title X authorized the appropriation of $400.0 million to the Kaho'olawe Trust Fund to carry out the cleanup.

Finally, Title X provided for the Secretary of the Navy to retain control over the island "until either clearance and restoration are completed or within no more than ten years after the date of enactment of this Act, whichever comes first." The 10-year period established in Title X is scheduled to expire in fiscal year 2003.

Title X was implemented through a May 1994 Memorandum of Understanding between the United States Department of the Navy and the State of Hawaii (the MOU). Under the MOU, the Navy agreed to clear up to 25 percent of the surface of the island to a

Tier Two standard and 100 percent of the surface to a Tier One standard. Tier One and Tier Two standards are defined in the MOU.

Over the last nine years, Congress has appropriated $307.0 million to the Kaho'olawe Trust Fund. The Navy estimates that: (1) an additional appropriation of $75.0 million will be needed to achieve an optimum contractor cleanup effort before the agreement is closed out; and (2) such an appropriation would enable the Navy to inspect and assess 100 percent of the island, clear 75 percent of the island in accordance with Tier One standards, and clear 25 percent of the island in accordance with Tier Two standards before the scheduled deadline for completion of the cleanup.

The committee understands that when Title X was enacted in 1994, insufficient information was available to the Department of the Navy and the Congress to include a firm performance standard for completion of the cleanup effort. After nine years of investigation and remediation, however, the committee believes that a performance standard is now more appropriate than an arbitrary date as a standard for completion.

Accordingly, the provision recommended by the committee would override the deadline established in Title X and the MOU for completion of the cleanup. Instead, the committee recommends substituting a performance standard based on the Navy's estimate of what it should be able to accomplish over the next year, based on an optimum contractor cleanup effort.

The committee understands that the objectives established in this provision will be interpreted in the same manner as similar objectives in Title X and the MOU, to exclude areas determined to be inaccessible by the Navy and the Kaho'olawe Island Restoration Committee.

SUBTITLE C—DEFENSE DEPENDENTS' EDUCATION

Assistance to local educational agencies that benefit dependents of members of the Armed Forces and Department of Defense civilian employees (sec. 331)

The committee recommends a provision that would authorize $30.0 million for continuation of the Department of Defense assistance program to local educational agencies that benefit dependents of service members and Department of Defense civilian employees.

Impact aid for children with severe disabilities (sec. 332)

The committee recommends a provision that would authorize $5.0 million for continuation of the Department of Defense assistance program to local educational agencies that benefit dependents with severe disabilities.

Options for funding dependent summer school programs (sec. 333)

The committee recommends a provision that would require the Secretary of Defense to provide dependent summer school programs on the same financial basis as programs offered during the regular school year. The recommended provision authorizes the Secretary

to charge reasonable fees for all or portions of such summer school programs to the extent that the Secretary deems appropriate.

Comptroller General study of adequacy of compensation provided for teachers in the Department of Defense Overseas Dependents' Schools (sec. 334)

The committee recommends a provision that would extend from May 1, 2002 to December 12, 2002 the date for the Comptroller General to report on a study on whether compensation for teachers in the Department of Defense dependents' education program is adequate for recruiting and retaining high quality teachers, and whether changes in the methodology for computing teacher pay are necessary. The recommended provision would also require the Comptroller General, in carrying out the study, to consider whether the process for setting teacher compensation is efficient and cost-effective.

SUBTITLE D—OTHER MATTERS

Use of humanitarian and civic assistance funds for reserve component members of Special Operations Command engaged in activities related to clearance of landmines (sec. 341)

The committee recommends a provision that would amend section 401(c) of title 10, United States Code, to allow up to 10 percent of the funding for a fiscal year for humanitarian and civic assistance to be expended for the pay and allowances of reserve component personnel of the Special Operations Command (SOCOM) performing duty in connection with training and activities related to the clearing of landmines for humanitarian purposes.

Special Operations Forces (SOF) are uniquely qualified to conduct humanitarian demining training, one of their collateral missions. However, in recent years humanitarian demining missions had to be cancelled as active duty SOF have been unavailable for assignment to conduct humanitarian demining missions, and the cost of reserve SOF participation in these missions could not be funded with humanitarian and civic assistance funds. Allowing humanitarian and civic assistance funds to cover the pay and allowances of reserve component SOCOM personnel would further the U.S. Government's foreign and defense policies and would support the readiness of SOCOM reserve component personnel by providing critical mission training in language and cultural skills.

Calculation of five-year period of limitation for Navy-Marine Corps Intranet contract (sec. 342)

The committee recommends a provision that would authorize the Department of Defense to modify the start date of the Navy-Marine Corps Intranet (NMCI) contract for the purposes of the law which limits multiyear contracts to five years. Under the provision, the five-year period would begin on the date that the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) and the Chief Information Officer (CIO) of the Department of Defense jointly approve ordering the "second increment" beyond the initial test population of additional NMCI work stations. In accord-

ance with the National Defense Authorization Act for Fiscal Year 2002, this approval is contingent upon successful completion of testing that has been independently validated and approved by the Institute for Defense Analyses.

The committee recognizes that the Navy may renegotiate the NMCI contract to take advantage of the authority provided by this section. The Committee expects that the Secretary of the Navy would not agree to any such modification unless he determines that the terms and conditions would be in the best interests of the Department of Defense.

Reimbursement for Reserve intelligence support (sec. 343)

The committee recommends a provision that would add a new section to Chapter 1003 of title 10, United States Code, to authorize the use of operation and maintenance funds of the military departments, combatant commands, and defense agencies to reimburse pay, allowances and other expenses when members of the National Guard and Reserve provide intelligence or counterintelligence support to such departments, commands or agencies.

Clarification of required core logistics capabilities (sec. 344)

In an October 2001 report, the General Accounting Office (GAO) recommended that Congress clarify the law with respect to the Department of Defense's non-maintenance core logistics policies to ensure that the Department maintains the full range of logistics capabilities necessary to support military weapons systems and equipment in both peacetime and war. The committee believes that logistics support functions are an integral part of the process of maintaining military equipment. Therefore, the committee recommends a provision to clarify that core logistics capabilities include acquisition logistics, supply management, system engineering, maintenance, and modification management. The committee is also concerned that existing Department policies on core logistics capabilities do not provide sufficient direction about the maintenance of future weapons systems. This limitation inhibits the ability of the public depot system to plan for future work. Current law requires the Department of Defense to determine the core logistics requirements for new weapons systems within four years after initial operational capability (IOC). The committee's provision would shorten this time period to two years. The committee believes that this change would improve the Department's planning for future workloads in the public and private logistics sectors and allow for better workload and workforce planning within the public depots.

Rebate agreements under the special supplemental food program (sec. 345)

The committee recommends a provision that would authorize the Secretary of Defense to enter into contracts for rebates with producers of food products for the exclusive right to provide food in Navy Exchange Markets as supplemental food for the Women, Infants, and Children (WIC) Overseas Program. The Secretary already has this authority for products sold in commissary stores. The recommended provision would also increase the maximum pe-

riod of these exclusive rights contracts from one year to three years.

ADDITIONAL MATTERS OF INTEREST

Anti-corrosion initiative

The committee continues to be concerned that the Department of Defense (DOD) is overlooking efficiencies and improvements to readiness by its lack of focus on prevention and mitigation of corrosion. Corrosion negatively affects readiness and drains scarce resources, which in turn cause further readiness shortfalls. Readiness impacts are obvious: the most recent Quarterly Readiness Report to the Congress (December 2001) stated that "corrosion is a primary degrader to the maintenance of Marine Corps vehicles," and that corrosion "contributes to increased maintenance costs * * * and to structural damage." A study conducted for the Navy found that corrosion was a key contributor to "tired wires" in the F–14 aircraft and that improvements would likely improve safety, increase the efficiency of other maintenance efforts, and dramatically increase aircraft material condition.

The readiness impact of corrosion on facilities has also been documented. A March 1999 study conducted by the Air Force Inspector General found buildings that had corroded so badly that they could not be used for munitions operations, further depleting scarce munitions storage space. At one overseas munitions storage area, trash cans covered corroded ventilator shafts to prevent moisture from entering the shelter.

The committee notes that the costs of corrosion are also significant. A recent study conducted for the Federal Highway Administration in accordance with the Transportation Equity Act for the 21st Century (Public Law 105–178) estimated that the Defense Department's annual cost of corroded equipment and infrastructure was $20.0 billion. The study also stated that corrosion is "the number one cost driver in life cycle costs." Another study conducted in 1996 by the DOD Inspector General found that the Air Force spent approximately $1 billion annually to repair and prevent corrosion damage on its aircraft alone. Corrosion prevention can make serious progress toward avoiding some of these costs. For example, one unit alone, the 3rd Force Service Support Group (3D FSSG) of the III Marine Expeditionary Force, saved $28.4 million over two years with the Corrosion Rehabilitation Facility it operates at Camp Kinser, Okinawa. The committee believes corrosion policies can be better coordinated within DOD. Therefore, the committee recommends a provision, discussed more fully in title IX, to establish a senior official responsible for anti-corrosion activities. The committee recommends an increase of $3.0 million for the Office of the Secretary of Defense to support these additional policy development and coordination responsibilities.

In addition, the committee recommends an increase of $12.0 million for current anti-corrosion programs, including $2.0 million for Operation and Maintenance, Navy to complete testing of ambient temperature cure glass coatings; $6.0 million for Operation and Maintenance, Army to continue applications of corrosion prevention and control coatings for vehicles; and $1.0 million in Operation and

Maintenance for each of the four military services to continue testing of promising anti-corrosion technologies.

The committee believes that the services should capitalize on the opportunities to coordinate existing corrosion treatment programs with research efforts ongoing in academia to make the best use of these funds. The committee feels strongly that anti-corrosion efforts are appropriate throughout the life cycle of facilities and equipment and recommends further increases of $23.5 million for research and development programs to support corrosion prevention throughout the development of new materials, coatings, and manufacturing techniques. These increases are discussed in greater detail in title II.

Enhanced secure communications to reserve components

The budget request for the Defense Emergency Response Fund included $199.3 million for the reserve components under the overall heading of Commander in Chief Homeland Security. The committee supports information technologies programs for the reserve components, including particularly secure interstate voice, video, and data transmission for classified traffic. The committee, nevertheless, does not believe that the full program as contained in the budget request can be executed within the next fiscal year. Accordingly, the committee recommends a reduction in funding for National Guard operation and maintenance by $40.0 million and Army Reserve operation and maintenance by $8.0 million.

Additionally, to facilitate future budget decisions, the committee requests the future combatant commander for homeland security to conduct a review of the level to which such secure voice, video, and data transmission needs to be extended for the National Guard and Army Reserve. The commander shall report the results of such review to the congressional defense committees no later than April 30, 2003.

Foreign currency fluctuation

The General Accounting Office has estimated that the Department of Defense's fiscal year 2003 budget request overestimates the amounts needed to cover foreign currency fluctuation by $615.2 million. Therefore, the committee recommends a decrease of $615.2 million.

Personal gear for service members

The committee recommends an increase of $12.0 million for the Army National Guard and $4.0 million for the Air National Guard to purchase individual combat clothing and equipment, including the Extended Cold Weather Clothing System (ECWCS). The committee believes that additional outerwear to protect soldiers and airmen from cold and/or wet weather would improve their morale and safety in the field.

Training range enhancement initiative

The committee is strongly committed to ensuring that U.S. military services receive the best possible training. The committee is concerned that funding to maintain and improve training ranges is scarce, despite numerous requirements. Therefore, the committee

recommends an increase of $126.0 million for training range enhancements.

Of this amount, the committee recommends an increase of $20.0 million to establish a Range Enhancement Initiative Fund within the Office of the Secretary of Defense (OSD). OSD would provide these funds to the military services as needed to support the purchase of easements for land near military installations, thereby improving combat training. This model has already proven successful at Fort Bragg, where, under terms of a cooperative agreement, the Army transferred $8.5 million to outside partners, who provided an additional $7.0 million in private matching funds. These funds were used to purchase critical conservation lands near Fort Bragg which the private partners manage and own. In return, the Army retains a permanent conservation easement and the right to conduct special forces and airborne training on the land.

The committee understands that many bases still face challenges ensuring adequate land for training and operations. To address one such challenge, the committee recommends that the Department of Defense purchase a restrictive easement that would protect operations at Campbell Army Airfield at Fort Campbell, Kentucky. The committee understands that up to $7.3 million would be required if no private funds were available. The committee further understands that the potential for partnerships similar to the one at Fort Bragg exists at other installations. The committee expects OSD to allocate resources from the Range Enhancement Initiative Fund to those installations which could realize the highest military value from such partnerships. The committee has included a provision in title XXVIII of this act that would provide permanent authorization for such partnerships. Because the partnerships must be negotiated with other entities, the committee believes funds appropriated for these purposes should be available for obligation for more than one year.

The remaining $106.0 million in operation and maintenance funds would support improvements to Army, Navy, Air Force, and Marine Corps training ranges. This includes:

$15.7 million for the Army's integrated training area management efforts;

$13.2 million for improvements to Army live fire ranges and targeting systems;

$1.2 million for improvements to the Army's combat training centers, including civilian support for exercises;

$15.0 million for the Navy to continue to develop and implement the fleet Training Resource Strategy;

$8.0 million for the Navy to increase fleet range operations support;

$23.5 million for Air Force joint training and deployment preparation exercises such as Red and Maple Flag and Cope Thunder;

$300,000 for the Air Force's Joint Advanced Weapon Scoring System;

$4.0 million for improved targets, including urban training, time critical targets, designs, etc.;

$1.2 million for land planning outreach and restoration for the Air Force;

$1.5 million for Air National Guard range emitters;

$2.1 million for Air Force airspace control and information operations range infrastructure improvements;

$10.4 million to remove range residue and repair supporting infrastructure ($3.4 million for the active Air Force, $400,000 for the Air Force Reserve, and $6.6 million for the Air National Guard);

$3.2 million for Air Force security sensor upgrades and facility repairs;

$2.8 million for primary Air Force range training infrastructure;

$1.6 million for the Marine Corps to improve the management, maintenance, and certification of training areas; and

$2.3 million to adequately maintain equipment for combined arms exercises at 29 Palms, California.

Travel

The budget request included $3.2 billion for the travel of Department of Defense (DOD) employees. The committee recommends a reduction of $159.8 million to return the DOD travel budget to fiscal year 2002 levels (adjusted for inflation).

Army

Battlefield mobility enhancers

The committee recommends an increase of $5.0 million to Army operation and maintenance accounts for lightweight tactical utility vehicles (M-Gators). The committee supports efforts by the Army to improve casualty evacuation and resupply.

Information operations

The budget request for the Defense Emergency Response Fund (DERF) included $28.1 million for at least six separate Army programs to improve both offensive and defensive information operations. While the committee supports increased information security, the committee finds these requests duplicative. Therefore, the committee recommends a decrease of $10.0 million to the Operation and Maintenance, Army account.

Aviation training backlog

The committee commends the Army for developing a comprehensive plan to transform its aviation units, including pilot training. This transformation is complicated by a current significant backlog in pilot training. In transitioning newer aircraft to the Reserves and National Guard, pilots must be retrained in the new aircraft. At the same time, the Aviation School has revised its flight school curricula to ensure that pilots arrive in their field units at higher readiness levels, having spent more time in their primary combat aircraft. Finally, the committee understands that maintenance challenges have resulted in fewer aircraft available for training new pilots, creating a short-term training backlog.

The committee recommends an increase of $55.0 million to fund increased training for pilots from those Reserve and National Guard units scheduled to transition in fiscal year 2003 and to en-

hance field unit readiness by increasing active duty pilots' experience in their combat aircraft and reducing the backlog of pilots awaiting training.

Utilities privatization

The budget request included $15.3 million to accelerate the Army's plan to complete privatization of all utility systems by September 30, 2003, a 141 percent increase over fiscal year 2002 levels. The committee understands that the Army's utilities privatization efforts have been proceeding more slowly than has been anticipated and believes that significant funding increases would not be needed. Therefore, the committee recommends a reduction of $8.9 million to the requested amount.

Facilities sustainment

The budget request included $257.3 million for sustainment, restoration, and modernization (SRM) of Army infrastructure, $8.5 million less than fiscal year 2002 levels. This reduction means that the Army will face even greater challenges as it attempts to sustain and repair its facilities. The reduction is even more troubling when viewed in conjunction with the decreases in military construction, which fell by $328.3 million between fiscal year 2002 and fiscal year 2003. The committee is concerned that this decrease would harm the quality of life and work for Army service members and would have negative effects on readiness. Therefore, the committee recommends an increase of $86.0 million to sustain and maintain existing Army infrastructure.

Navy

Ship depot maintenance

The budget request included $3.5 billion for maintenance of Navy ships. The committee understands that the ongoing war on terrorism has created additional maintenance needs that were not anticipated at the time the budget was developed. Therefore, the committee recommends an increase of $90.0 million for ship depot maintenance.

The committee recognizes that the Navy has a difficult challenge managing scheduled maintenance when funding is limited and emergent repairs and new requirements arise. For example, in fiscal year 2002, war-related requirements caused the Navy to shift the maintenance availability of the USS Scranton into fiscal year 2003. This caused the scheduled maintenance for the USS Annapolis to move into fiscal year 2004 and also moved planned work among private and public sector shipyards. In planning for depot maintenance activities for fiscal year 2003, the committee believes that the Navy should review the impact of past disruptions and work to enhance the ability of the public and private shipyards to be able to meet future workloads effectively.

Improved shipboard combat information center

The budget request included $424.0 million for Navy combat communications. The committee recommends an increase of $8.0 million for improvements to the combat information center (CIC).

The CIC integrates tactical data from shipboard sensors to provide critical, time-sensitive information for use by Tactical Action Officers. Improvements will provide a more user-friendly interface for computers, speed the transfer of tactical data, and allow the use of three dimensional targeting information.

Submarine broadcast support

The committee understands that in the past, some Navy communications antennas have been painted with contaminated paints. In order to prevent environmental contamination and return these antennas to operational status as quickly as possible, the committee recommends an increase of $1.0 million to accelerate paint removal from naval communications towers.

Mark-45 overhauls

The budget request did not include any funding for overhauls of the Mark-45 gun system, the Navy's primary battery on destroyers and cruisers. The committee recommends an increase of $5.0 million for maintenance overhauls of Mark-45 gun weapons systems, to improve their operational availability, readiness, and safety.

Critical infrastructure protection for Navy and Marine Corps

Implementation of the Department of the Navy's Critical Infrastructure Protection (CIP) plan raises the protection level in Navy and Marine Corps facilities, information processes, and weapons acquisition activities against terrorist and other attacks. The committee is aware of the requirement to accelerate and complete vulnerability assessments and remediation in the Navy's mission-critical infrastructures and in the sustaining infrastructures in the private sector. Therefore, the committee recommends an increase of $6.0 million to implement the next phase of the Navy's CIP plan.

Configuration management for Navy weapons systems

The committee understands that continued modifications and upgrades to weapons systems present a challenge for supporting logistics and maintenance systems. Managing changes in weapons configuration is critical to ensuring that adequate supplies and technical skills are available for continuous operation of critical ships and aircraft. Therefore, the committee recommends an increase of $13.5 million for data tracking of platforms and parts, integrating existing data systems, and improving the Navy's tracking techniques to enhance the overall readiness of naval weapons systems.

Air Force

Air Force flying hour program

The budget request included $6.2 billion in operation and maintenance funds for flying hours to support Air Force training. This amount includes a $450.0 million "wedge" to support unspecified cost increases for spare parts that the Air Force has little data to support. The committee recommends a decrease of $287.6 million and has reallocated these funds to other known, high-priority readiness deficiencies.

Since the mid-1990s, the Air Staff's process for determining costs per flying hour has systemically underestimated actual flying hour costs. In its fiscal year 2003 budget request, the Air Force assumed that it would continue to underestimate true flying hour costs by the past margin of error (9.7 percent, or $450.0 million). One draft study conducted for the Air Force found that 3.5 percent of the 9.7 percent growth may be due to higher costs from aging equipment. To explain the remaining 6.2 percent, the Air Staff hypothesized that higher-than-budgeted inflation accounted for an additional 3.3 percent and that 2.9 percent was due to unanticipated cost drivers such as safety modifications, expirations of warranties, and other factors.

The committee believes that the Air Force's explanation of this cost increase is oversimplified and insufficient. In particular, the committee sees no reason why the other services would not also experience similar inflation rates or be equally susceptible to unanticipated cost increases. Neither the Army nor the Navy, however, included similar unspecified funding requests in their training budgets.

Therefore, the committee recommends a decrease of 6.2 percent ($287.6 million) to the Air Force flying hour program to be allocated proportionately across aircraft type models in various training accounts. This reduction supports the 3.5 percent increase in flying hour costs that was based on analysis of empirical data but denies funding for the Air Force's inflation and "other" percentage increases. As stated above, the committee believes these increases lack sufficient justification and that the Air Force should devote greater attention to determining the causes of cost growth.

The committee recommends a reallocation of the flying hour wedge to programs that would improve the Air Force's understanding of cost drivers and meet actual, validated readiness requirements. This reallocation includes the following increases:

(1) $20.0 million to improve maintenance data collection systems to allow for empirical analyses of causes of cost growth;

(2) $138.6 million for critical shortfalls in depot maintenance to improve the reliability and equipment condition of current aircraft. Of this amount, the committee recommends that $60.0 million be devoted to repairs for KC–135 aircraft, $11.5 million be available for engine overhauls for Air Force Special Operations Command MH–53 helicopters, and the remaining $67.1 million directed to other high priority depot-level repairs;

(3) $80.0 million for sustainment, restoration and modernization of infrastructure that directly supports flying readiness, to include runways, hangars, and flight line maintenance facilities; and

(4) $49.0 million for improvements to Air Force training ranges as part of the training range enhancement initiative discussed elsewhere in this report.

Combat air patrols

The budget request for the Defense Emergency Response Fund (DERF) included $1.2 billion for the flying hour costs associated with continued combat air patrols (CAPs) over major U.S. cities. The Air Force based its estimate for fiscal year 2003 CAP missions

on a heightened alert posture that has since been reduced. At the new estimated alert level, the Air Force estimates that flying hour costs for fiscal year 2003 will be $380.0 million. Therefore, the committee recommends a reduction of $820.0 million from the request.

Spacelift range system

The budget request included $281.0 million for Operation and Maintenance, Air Force for launch facilities. The committee supports the range modernization program and recommends an increase of $11.1 million for metric tracking, for activation of the Western Range operations control center, and for maintenance issues at both Eastern and Western Ranges. Delays in the range modernization programs have resulted in increased operating costs for legacy systems that have to be maintained for longer periods of time than originally planned, even while the operations tempo has increased. Sustainment and operating costs necessary to ensure adequate levels of range safety have increased.

Utilities costs

The Air Force's fiscal year 2003 budget request included $392.6 million for utilities purchases, an increase of $61.9 million over inflation. None of the other services projected similar increases in utilities costs; the Army's utilities request decreased by $6.6 million, the Navy's increased by $6.2 million, and the Marine Corps' increased by only $1,000 over fiscal year 2002 levels. The committee recommends a reduction of $55.0 million to the Air Force operation and maintenance account to bring the growth in Air Force utilities costs more in line with those of the other services.

Defense-Wide

Joint recruiting and advertising

The budget request included $41.6 million for the Joint Recruiting and Advertising Program (JRAP), an increase of almost $25.0 million over historic execution levels. The committee is concerned about the execution of such a large increase and recommends a reduction of $24.3 million, returning the JRAP to fiscal year 2001 levels (adjusted for inflation). The committee fully supports the intent and activities of the JRAP but understands that the program has experienced consistent underexecution, a problem that may persist given the large increase in funding requested for fiscal year 2003.

The committee directs the Comptroller General of the United States to conduct a study of the Department of Defense's recruiting and advertising programs. The study should include an evaluation of: (1) the justification for each service's advertising budget request; (2) metrics used to determine the cost effectiveness of each of the advertising programs; (3) whether the advertising mediums are appropriate; and (4) the relationship of advertising budgets to recruiting outcomes. The committee directs the Comptroller General to submit to the Committees on Armed Services of the Senate and the House of Representatives a report on the findings of this study and any recommendations no later than March 31, 2003.

Training and qualification shortfalls

The budget request did not include any funding to cover costs associated with increased training requirements and reorganization of training units to meet current Special Operations Forces (SOF) training needs. Current operational tempo and transformation programs have increased training requirements, which form the critical backbone of SOF readiness. The Special Operations Command has a requirement for increased funding for life cycle replacements for parachute, maritime, trauma resuscitation, and naval special warfare equipment, and improvements to Special Forces reconnaissance courses to increase the number of students obtaining training. The committee strongly supports increasing and improving training programs and equipment. Therefore, the committee recommends an increase of $16.7 million in Operation and Maintenance, Defense-Wide, Budget Activity 3 for SOF training and qualification shortfalls.

Procurement Technical Assistance Program

The budget request included $19.0 million for the Procurement Technical Assistance Program (PTAP). The committee has supported the PTAP program since its establishment in 1985. The program provides cost-effective technical assistance to small businesses in the industrial base supporting national defense. The committee recommends an increase of $5.0 million for the PTAP program.

Logistics reengineering

The budget request included $2.0 million for the Business Process Reengineering Center (BPRC), which supports the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) in proposing process, organizational, and cultural changes in the Department of Defense. The budget request also included $7.5 million for the Change Management Center, which also reports to USD(AT&L) and conducts commercial practices training and enterprise change modeling. The committee finds these requests duplicative and recommends a reduction of $2.0 million in the Defense Logistics Agency budget to consolidate all reengineering efforts in the Office of the Secretary of Defense.

Cultural and historic activities

The budget request included $287,000 for cultural and historic preservation activities funded through the Legacy Resource Management Program. The committee recommends an increase of $3.0 million to expand the Department of Defense's efforts to preserve cultural and historic assets.

Base information system

The budget request included $15.0 million in the Defense-wide operation and maintenance account over fiscal year 2002 levels to increase funding for a base information system to gather data on the real property inventory of the Department of Defense (DOD). The committee understands that the data system to collect this information has been an ongoing effort within the Department and does not believe that DOD has provided sufficient rationale for

such a sizeable increase. Therefore, the committee recommends a decrease of $10.0 million and authorizes a $5.0 million increase for the base information system.

C3 and Intelligence Mission and Analysis Fund

The budget request included $4.9 million for a new initiative to provide planning, coordination, and assessments for the National Command Authority's computer network. The program would also support analyses of spectrum policy, information assurance policies, and joint intelligence capabilities.

The committee recommends a reduction of $4.9 million in the Office of the Secretary of Defense, Operation and Maintenance, Defense-Wide account for this initiative. The fiscal year 2003 budget request already included substantial resources for the many components of this fund: an additional $99.3 million over fiscal year 2002 levels for increased support for White House and National Command communications, networks, and network security; an additional $17.1 million for various spectrum-related initiatives, including support for a Department of Defense Spectrum Defense Office; and $163.6 million for information assurance initiatives ($18.5 million more than in fiscal year 2002). The fiscal year 2003 request for the Defense Emergency Response Fund included another $2.6 billion for White House communications and security, communications, and information operations enhancements.

The committee believes that the types of functions proposed to be carried out with funding from the Command, Control, Communications and Intelligence Mission and Analysis Fund are important to our national security and worthy of support. However, the committee believes that the funds already provided for the programs covered by this initiative are sufficient to support planning and oversight for these activities.

Psychological operations

The budget request for the Defense Emergency Response Fund (DERF) included $67.0 million to support the Joint Staff's Information Operations Task Force and other information operations activities. The committee recognizes the value of psychological operations and information/perception management activities in influencing foreign audiences and in shaping the information environment in ways that are favorable to U.S. objectives. These operations and activities are particularly important when U.S. forces are engaged in hostilities, as in Afghanistan.

The committee is concerned, however, by some of the activities that are contemplated under this heading, particularly those activities that have traditionally been conducted by other agencies of the U.S. Government. The committee believes that the Department of Defense should not seek to duplicate capabilities that are resident elsewhere in the government, nor should the Department be acquiring equipment for other departments and agencies of the government. Accordingly, the committee recommends a decrease of $30.0 million for the Office of the Secretary of Defense.

Commander in Chief for Homeland Security

The budget request for the Defense Emergency Response Fund (DERF) included $41.0 million to stand up a headquarters for the new Commander in Chief for Homeland Security. The committee supports the establishment of this new combatant command but notes that the justification materials provided by the Department of Defense only explained how $37.0 million of the $41.0 million would be used, failing to account for the remaining $4.0 million. The request also included $10.0 million to provide salaries for civilian personnel who would be employed by the new headquarters. The committee understands that the headquarters would be supported within planned reductions in headquarters staffs and that civilian employees would be transferred from other existing billets. Similarly, the committee expects the funds for the employees' salaries to be transferred from their current parent organizations. Therefore, the committee recommends a reduction of $14.0 million to the DERF request and recommends that the remaining $27.0 million be transferred to Operation and Maintenance, Defense-Wide for the Joint Staff.

Studies

The budget request included $21.1 million for the Office of the Secretary of Defense (OSD) Study Program and $22.8 million for studies by the Joint Staff. This funding represents an $8.8 million increase over fiscal year 2002 levels, despite the fact that the Department of Defense's major analytic effort, the Quadrennial Defense Review, concluded last year. Further, none of the services requested study program increases in fiscal year 2003; the Army's requested study budget remained constant, the Navy's decreased by $2.3 million, and the Air Force's decreased by $16.8 million. Therefore, the committee recommends a reduction of $1.8 million for OSD studies and $7.0 million for Joint Staff studies to return the OSD and Joint Staff study budgets to fiscal year 2001 levels (adjusted for inflation), a level of funding that should adequately support necessary analyses.

Commercial imagery to support military requirements

The committee continues to support the use of commercial sources to help meet the imagery requirements of United States and coalition forces and the geospatial requirements of the National Imagery and Mapping Agency (NIMA). Three high level commissions, the Space Commission, the National Reconnaissance Office (NRO) Commission, and the National Imagery and Mapping Agency Commission, have all stated that the Department of Defense needs to better utilize commercial imagery. The Space Commission Report recommended that the U.S. Government pay for a substantial portion of its national security related imagery requirements by purchasing services from the U.S. commercial remote sensing industry. NIMA officials have acknowledged that significant portions of their geospatial information requirements can be met by current generation satellites operated by U.S. commercial remote sensing entities and that considerably more of these requirements could be met by proposed second generation satellites.

The committee believes that a world-class commercial remote sensing industry is in the national interests of the United States. Accordingly, the committee reaffirms its guidance to NIMA, the Director of Central Intelligence, and the Department of Defense that a comprehensive commercial imagery strategy must be developed and implemented. The committee further believes significant progress has been made in the past year with respect to understanding the desirability of integrating commercial remote sensing into a comprehensive national imagery and geospatial architecture. Unfortunately, little progress has been made in developing a long-term strategy or in aggressively integrating commercial capabilities into a comprehensive architecture. In fact, the strategy that NIMA seemed to have adopted last year that was designed to assure the commercial remote sensing industry of the long-term commitment and reliability of the U.S. Government as a customer appears to have been abandoned in favor of a return to a "day-to-day, as needed" approach to commercial imagery purchases. Such indecision is not in the best interests of the U.S. commercial remote sensing industry or in the national security interests of the U.S. Government.

To help the U.S. commercial remote sensing industry succeed, the U.S. Government should become a reliable, consistent customer of this industry's products. Additionally, the U.S. Government must facilitate a regulatory framework for the sale of remote sensing products, services, and technologies that better serves U.S. national security interests.

In view of the above, the committee directs the Director of NIMA to develop and implement a comprehensive commercial imagery strategy that includes a budgeted, multi year spending plan and a contractual regime for the purchase of commercial imagery, imagery products, and services from the U.S. commercial remote sensing industry. To assure the reputation of the U.S. Government as a consistent, reliable customer the Director of NIMA is encouraged to consider multi year procurement authority and the establishment of "anchor-tenant" business relationships with the commercial remote sensing industry as this commercial imagery strategy is established. The conference report accompanying the National Defense Authorization Act for Fiscal Year 2002 directed the Secretary of Defense and Director of Central Intelligence to plan and carry out a program to purchase a significant portion of their non-time critical, low and medium resolution satellite imagery requirements from the U.S. commercial remote sensing industry by 2005. The committee reaffirms that requirement and encourages the Director of NIMA to establish a concrete plan as soon as possible that incorporates the anticipated role and contribution of commercial remote sensing capabilities in the overall Future Imagery Architecture (FIA). As NIMA moves toward these future capabilities, the committee encourages NIMA to establish a related goal that 25 percent of NIMA's geospatial information requirements be provided by U.S. commercial remote sensing entities by the beginning of fiscal year 2005.

The budget request, including the Defense Emergency Response Fund (DERF), included increased funding for the purchase of commercial imagery products. In order to implement a comprehensive commercial imagery strategy and to ensure that commercial im-

agery plays a key role in fulfilling the Department's imagery needs, the committee recommends an increase of $30.0 million in Operation and Maintenance, Defense-Wide for the purchase of commercial imagery, imagery products and services from U.S. commercial remote sensing entities. Considering the overall importance of commercial imagery activities to integrated U.S. intelligence and geospatial requirements, the committee strongly urges the Secretary of Defense and Director of NIMA to establish a new, separate budget line for commercial imagery activities within the Department of Defense budget request, beginning with the fiscal year 2004 budget submission.

Guard and Reserve Components

Army information operations

The budget request included $116.0 million for land forces readiness operations support for the Army Reserve. The committee recommends an increase of $3.0 million to increase the Army Reserve's support to the Department of Defense through information operations training, future threat assessment, and improved information attack response capabilities.

Antiterrorism/force protection access control

The budget request for the Defense Emergency Response Fund (DERF) included $33.8 million for access control and vulnerability assessments for six Army Reserve installations. The Army subsequently determined that it does not have a requirement for $13.8 million of the funding requested for this purpose. Therefore, the committee recommends a reduction of $13.8 million from the Operation and Maintenance, Army Reserve account.

Initial issue

The committee is concerned that the budget request would not adequately fund personal items for new members of the Marine Corps Reserve. Many of these items are important for the safety and comfort of our marines in the field. Therefore, the committee recommends an increase of $5.0 million for the Marine Corps Reserve to purchase individual combat clothing and equipment items, including polar fleece pullovers.

Air Force Reserve Command server consolidation

The Air Force Reserve Command (AFRC) aims to achieve greater efficiency and reduce total ownership costs by consolidating its servers. The committee therefore recommends an increase of $8.0 million for the AFRC to increase storage of backup data, better protect its information technology infrastructure, and improve the speed and reliability of its computer networks through server consolidation.

National Guard support for test and evaluation

The budget request included $2.6 billion for National Guard flying operations. These funds support flying hours for the Air National Guard (ANG), including Defense Support Evaluation (DSE) functions. The DSE program provides target aircraft support for

surface-to-air missile testing. The committee recommends an increase of $2.0 million to Operation and Maintenance, Air National Guard to train the ANG pilots that fly in support of missile tests and evaluation.

Air National Guard medical equipment

The committee understands that the Air National Guard plans to transition its medical service units from their current configuration into more rapidly deployable Expeditionary Medical Support (EMEDS) units. EMEDS units would provide a more flexible, responsive and robust medical capability in support of the Expeditionary Air Force and other critical missions, and the committee fully supports this reorganization. To help prepare Air National Guard personnel for this transition, the committee recommends an increase of $350,000 for the Air National Guard to begin purchasing medical equipment for training for future EMEDS missions.

MISCELLANEOUS ADDITIONAL ITEMS OF INTEREST

Formerly Used Defense Sites

The budget request included $212.1 million for Environmental Restoration, Formerly Used Defense Sites (FUDS). The committee recommends an increase of $40.0 million to the FUDS program.

The committee notes that, until this year, the Department of Defense had been providing a level of funding for the cleanup of FUDS sites that was intended to result in remedies in place by 2014. This year, the Department delayed the cleanup goal by six years, to 2020, in order to reduce funding requirements. At the same time, the committee understands that the Department of Defense does not expect to have remedies in place for unexploded ordnance problems on FUDS sites until 2089 at the earliest.

The committee does not support the six-year delay in the FUDS cleanup objective, and it does not view 2089 as an acceptable goal for addressing unexploded ordnance problems. The committee expects the Department to work with the states to prioritize FUDS sites and to develop a reasonable time line for the cleanup of such sites.

Drug interdiction and counterdrug activities

The budget request included $998.7 million for drug interdiction and counterdrug activities of the Department of Defense (DOD): $848.9 million in the central transfer account and $149.8 million in the operating budgets of the military services for authorized counterdrug operations.

The committee recommends the following fiscal year 2003 budget for the Department's counterdrug activities:

Drug Interdiction and Counterdrug Activities, Central Transfer Account

[In thousands of dollars—May not add due to rounding]

Fiscal Year 2003 Counterdrug Request	$848.9
Goal 1 (Educate America's youth)	27.1
Goal 2 (Increase safety of citizens)	81.8
Goal 3 (Reduce health and safety costs)	82.5
Goal 4 (Shield America's frontiers)	335.7

Drug Interdiction and Counterdrug Activities, Central Transfer Account—Continued

Goal 5 (Break drug sources of supply)	321.9
Increases:	
National Guard Support	25.0
Total Fiscal Year 2003 Counterdrug Funding	$873.9

National Guard State Plans

The committee believes that the National Guard makes an important contribution to the national counterdrug effort. Accordingly, the committee recommends an increase of $25.0 million for the National Guard State Plans, including the National Interagency Civil-Military Institute. As a result of insufficient funding for fiscal year 2002, the State Plans had to be significantly adjusted. In order to avoid even greater disruption, DOD reprogrammed $12.2 million and, in an unprecedented action, the Director of the Office of National Drug Control Policy (ONDCP) used his authority to transfer $5.0 million from ONDCP's High Intensity Drug Trafficking Areas program account to DOD and limited its availability to the Governor's State Plans.

OTHER ITEMS OF INTEREST

Aerial refueling fee-for-service

In fiscal year 2002, the Department of Defense directed the Navy to conduct a pilot program for aerial refueling including tanker aircraft. The Navy has contracted aerial refueling services using commercial aircraft configured for aerial refueling in the conduct of this pilot program.

In testimony before the Seapower Subcommittee of the Committee on Armed Services, the Navy Director of Air Warfare in the Office of the Chief of Naval Operations stated that this pilot program has been successful and has provided a beneficial service for air wings during inter-deployment training. The committee encourages the Department to continue to explore the benefits of using this type of fee-for-service model in aerial refueling to achieve potential savings and relieve the strain on the aerial refueling fleet.

Air Force supersonic ranges

The committee understands that the Air Force currently operates thirteen supersonic ranges, with varying restrictions on altitude. The committee believes that additional supersonic training opportunities may be needed and that the Air Force should evaluate its requirements in this area. The committee directs the Secretary of the Air Force to conduct a study of the costs and benefits of extending the Melrose flight training range outside Cannon Air Force Base to include supersonic capabilities and to report back to Congress no later than March 1, 2003.

Army ammunition plants

The committee is aware of Army proposals to pursue a consolidated procurement contract for the operation of four government-owned/contractor-operated ammunition plants. The committee notes that such consolidation may cause disruption of ammunition

production or cause compression of the Load, Assemble, and Pack (LAP) sector of ammunition manufacturing. Therefore, the committee directs the Army to submit a report to the congressional defense committees providing the details of the proposed strategy, an analysis of alternatives (to include long-term leasing), and an assessment of the impact on existing items manufactured at the plants.

C–130 aircraft force structure

The Air Force has recently completed a comprehensive mobility force structure plan. One of the elements of this plan includes upgrading a portion of the C–130 aircraft tactical airlift fleet, in both the active force and reserve components, to a standard C–130X configuration. The rest of the force would receive new C–130J aircraft. The C–130 aircraft is a crucial component of intra-theater airlift.

The committee supports the general approach of modernizing the portion of the C–130 aircraft fleet for which this makes economic sense and replacing the remainder with new C–130J aircraft. Nevertheless, the committee has questions about the specific plan that would lead to a reduced inventory objective for tactical airlift forces.

The Air Force has stated that there is an excess inventory of C–130s. The committee is concerned about what appears to be contradictory analysis. The Department completed the Mobility Requirements Study for fiscal year 2005 (MRS 05) last year. MRS 05 was based on assessing the capability to fight two, nearly simultaneous major theater wars (2 MTW). The study analyzed the requirements for both inter-theater and intra-theater airlift and concluded there would be shortfalls in both categories. Although the 2 MTW-goal is no longer the basis for deciding on force structure size or content, commanders in chief have testified that strategic airlift is still stressed and that the lift requirements derived in MRS 05 remain valid.

The committee notes that the Air Force intends to implement the first C–130 force structure realignment beginning in fiscal year 2004. To better understand the impact of any reductions in tactical airlift, the committee directs the Secretary of Defense to submit a report to the congressional defense committees, no later than March 31, 2003, that would: (1) determine the required amount of tactical airlift to execute the national military strategy; and (2) reconcile any differences between MRS 05 and subsequent Air Force analysis underpinning the mobility force structure plan.

Commissary benefit

The commissary benefit is one of the most significant components of the military compensation package and is highly valued by military members, retirees, and their families. In addition to providing significant monetary savings, commissaries foster a sense of community for military families.

Although efficient operation of commissaries is essential, the committee is concerned that proposed personnel and funding reductions for the Defense Commissary Agency may adversely affect the quality of service to customers. Beneficiary groups have expressed concern that the reductions will result in additional store closings,

reduced hours, longer cashier lines, and reduced stock on store shelves. These impacts would not be acceptable.

The committee directs the Department of Defense to monitor closely the impact of proposed personnel and funding reductions to ensure that appropriate levels of service in commissaries are maintained.

Department of Defense support to the Interallied Confederation of Reserve Officers and the Interallied Confederation of Medical Reserve Officers

The committee is aware that the Interallied Confederation of Reserve Officers (CIOR) and the Interallied Confederation of Medical Reserve Officers (CIORMR) Summer Congress is scheduled to be held in Washington, DC in July 2004. CIOR is chartered by the North Atlantic Treaty Organization (NATO) Military Committee to advise NATO and support NATO's political and military objectives in each of the member nations in the alliance. The committee notes that historically the Department of Defense has supported the Summer Congress. In anticipation of the 2004 Summer Congress, the committee urges the Secretary of Defense to fully support participation by Reserve Component personnel in the representational, liaison, education, training, and organizational activities of CIOR and CIORMR. In addition to personnel, this support should include facilities and logistics to carry out the activities of the 2004 Summer Congress.

Formerly Used Defense Site at Waikoloa and Waimea, Hawaii Island

The Army Corps of Engineers recently determined that a Formerly Used Defense Site (FUDS) at Waikoloa and Waimea, Hawaii Island has "a medium to high potential for human health and safety risk from unexploded ordnance (UXO)." The Army Corps of Engineers estimated that the minimum cost of addressing this problem would be in excess of $250.0 million.

The committee directs the Secretary of the Army to develop a comprehensive plan for addressing risks to human health and safety at the Waikoloa FUDS site and to report to the congressional defense committees no later than 60 days after the date of enactment of this bill. The Secretary's report should include specific milestones for addressing the UXO problem at the Waikoloa FUDS site and the Department's plans for funding the clean-up effort.

Funding for efforts to address environmental impacts of unexploded ordnance, discarded military munitions, and munitions constituents

Section 312 of the National Defense Authorization Act for Fiscal Year 2002 established a new program element for remediation of unexploded ordnance (UXO), discarded military munitions, and munitions constituents in each of the environmental restoration accounts of the Department of Defense. The purpose of this provision was to establish a consolidated account for all UXO-related environmental expenditures of the Department of Defense.

The committee has since learned that a substantial amount of funding for efforts to address environmental impacts of UXO, dis-

carded military munitions, and munitions constituents is provided through accounts other than the Department's environmental restoration accounts, and therefore could not be included in the new program elements. For example, six separate accounts provide funding for UXO-related environmental expenditures in the Army alone: the environmental restoration account; the operation and maintenance accounts of the Army and the National Guard; the Base Realignment and Closure account; the Formerly Used Defense Sites account; and the Army research, development, test and evaluation accounts.

The committee directs the Department to provide a consolidated exhibit with its budget submission in each of the next four fiscal years. The exhibit would detail all proposed funding, in all accounts of the Department, for efforts to address environmental impacts of UXO, discarded military munitions, and munitions constituents (including UXO-related research and development).

Improved justification of service training budgets

The committee is concerned about the military services' training budget requests and believes that additional progress is possible in relating funds to training and training to readiness. The reliability of the services' methods for relating funding to training outputs varies, complicating the committee's evaluations of whether requested funding is sufficient for requisite training. Further, the relationship between training levels and readiness also remains ambiguous. The committee understands the complexity involved in clarifying these relationships and appreciates the Department of Defense's efforts to further define them. The committee looks forward to seeing the results of these efforts reflected in future budget requests.

"Starship" repair plan

The committee is aware that the Army's 1970 Basic Combat Training complexes, known as "starships", require extensive structural, roof, and utility repairs. The Army's 2000 Installation Status Report rates these facilities at C–3 or below, meaning that their condition impairs mission performance. These facilities are used primarily for initial entry training, and their poor condition has a negative impact not only on the quality of training that recruits receive, but also on the recruits' initial impressions of quality of life in the military. The committee understands that the goal at Fort Sill is to repair one of its five "starships" annually, with Sustainment, Restoration, and Modernization (SRM) funds of no more than $11.0 million. Fort Jackson, which has six starships, spends almost $3.2 million annually for the most urgent repairs to these facilities. Fort Benning, which has eight starship complexes, faces similar challenges.

Since SRM fluctuates annually and is habitually underfunded, these installations cannot develop a comprehensive plan for the repair and maintenance of starship facilities. The committee directs the Secretary of the Army to provide a briefing to the congressional defense committees no later than March 30, 2003, to include the status of all existing starship complexes, the impact of their condition on the Army's training mission, cost estimates to complete nec-

essary repairs, and a long-term plan to ensure adequate maintenance of the facilities.

Status of the Uniform National Discharge Standards

The Uniform National Discharge Standards (UNDS) Program was established by section 325 of the National Defense Authorization Act for Fiscal Year 1996 to provide a comprehensive set of standards for controlling incidental discharges from vessels of the Armed Forces. The program provided the Secretary of Defense and the Administrator of the Environmental Protection Agency (EPA) joint regulatory authority on incidental discharges within the navigable waters of the United States and waters of the contiguous zone.

Phase I of this program identified 25 discharges that will require control based upon the potential for adverse environmental impacts. The committee is aware that the development of performance standards for controlling discharges under Phase II of the program requires extensive research and that the Navy and EPA have attempted to expedite this process. Unfortunately, the completion of Phase II is not expected until calendar year 2011.

The committee is concerned about the lack of progress in the development of performance standards under the UNDS program. Accordingly, the committee directs the Secretary of the Navy and Administrator of the EPA to submit a joint report on the status of the UNDS program and efforts to expedite the development of performance standards under that program to the congressional defense committees by no later April 1, 2003.

Training of Navy and Marine Corps units for the global war on terrorism and to support the global naval forces presence policy

The committee directs the Secretary of the Navy to provide a report to the congressional defense committees on the plans for joint task force, combined-arms training of carrier battle groups and amphibious ready groups during fiscal year 2003. This report should include a description of the locations where that training will be conducted, the use of live munitions during that training, and a description of the naval and military capabilities to be exercised during training.

The report should also describe the Secretary's progress regarding the identification of an alternate location or locations for the training range at Vieques. The committee directs the Secretary to provide this report no later than March 1, 2003. The committee understands that, until such time as a decision is made by the Secretary of the Navy in accordance with section 1049 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107–107), Navy and Marine Corps training will continue at Vieques as it is currently.

TITLE IV—MILITARY PERSONNEL AUTHORIZATIONS

SUBTITLE A—ACTIVE FORCES

End strengths for active forces (sec. 401)

The committee recommends a provision that would authorize active duty end strengths for fiscal year 2003, as shown below:

	2002 authorization	Fiscal year—	
		2003 request	2003 recommendation
Army	480,000	480,000	480,000
Navy	376,000	375,700	375,700
Marine Corps	172,600	175,000	175,000
Air Force	358,800	359,000	359,000

The committee is concerned that the requested end strength may not be adequate to meet the number of missions the services are required to perform. If an increase in end strength is justified, the committee encourages the Secretary of Defense to use his authority to increase the authorized end strength by up to 2 percent to relieve personnel shortfalls, especially in high demand, low density military skills. In the longer term, the committee strongly encourages the Secretary of Defense to conduct a thorough review of force structure and to assign additional personnel to high demand, low density skill positions.

The committee is encouraged by the Department's recently developed human capital strategic plan to ensure that the right number of military personnel have the requisite skills, abilities, and motivation to effectively and efficiently execute assigned missions. The committee will closely monitor implementation of this plan.

Authority to increase strength and grade limitations to account for reserve component members on active duty in support of a contingency operation (sec. 402)

The committee recommends a provision that would authorize the Secretary of Defense to increase the limit on active duty end strength by the number of members of the reserve components serving on active duty, with their consent, in support of a contingency operation. The recommended provision would also authorize the Secretary of Defense to increase the limit on the number of members in pay grades E–8, E–9, 0–4, 0–5, 0–6 and general and flag officers by the number of reserve component members in those pay grades serving on active duty, with their consent, in support of a contingency operation.

Currently, reserve component members involuntarily ordered to active duty in support of a contingency operation are excluded from active duty end strength limitations. The recommended provision would remove the distinction between reserve component members

who consent to serve on active duty and those who are involuntarily ordered to active duty and would encourage the services to use volunteers to meet contingency operation requirements.

Increased allowance for number of Marine Corps general officers in grades above major general (sec. 403)

The committee recommends a provision that would authorize one additional Marine Corps general officer in a grade above major general. The recommended provision does not increase the total number of general officers in the Marine Corps.

Increase in authorized strengths for Marine Corps officers on active duty in the grade of colonel (sec. 404)

The committee recommends a provision that would increase by 40 the authorized strength for colonels on active duty in the Marine Corps.

SUBTITLE B—RESERVE FORCES

End strengths for Selected Reserve (sec. 411)

The committee recommends a provision that would authorize Selected Reserve end strengths for fiscal year 2003, as shown below:

	2002 authorization	Fiscal year—	
		2003 request	2003 recommendation
The Army National Guard of the United States	350,000	350,000	350,000
The Army Reserve	205,000	205,000	205,000
The Navy Reserve	87,000	87,800	87,800
The Marine Corps Reserve	39,558	39,558	39,558
The Air National Guard of the United States	108,400	106,600	106,600
The Air Force Reserve	74,700	75,600	75,600
The Coast Guard Reserve	8,000	9,000	9,000

End strengths for reserves on active duty in support of the Reserves (sec. 412)

The committee recommends a provision that would authorize the full-time support end strengths for fiscal year 2003, as shown below:

	2002 authorization	Fiscal year—	
		2003 request	2003 recommendation
The Army National Guard of the United States	23,698	23,768	24,492
The Army Reserve	13,406	13,588	13,888
The Navy Reserve	14,811	14,572	14,572
The Marine Corps Reserve	2,261	2,261	2,261
The Air National Guard of the United States	11,591	11,697	11,727
The Air Force Reserve	1,437	1,498	1,498

The committee recommends an increase of 300 in the Army Reserve, 724 in the Army National Guard, and 30 in the Air National Guard.

The committee is disappointed that the requested end strength for reserves on active duty in support of the Reserves does not in-

clude an increase of 300 in the Army Reserve and 724 in the Army National Guard for full-time support.

Full-time support has been identified as the top readiness issue of the reserve components. It directly impacts the ability to train, administer and prepare ready units and individuals for transition from a peacetime to a wartime posture. The Army has a plan to incrementally increase the Reserve Component Full-Time Support Program over 11 years to achieve a level of full-time support manning of 90 percent for units that deploy in less than 30 days; 80 percent for units that deploy between 30 and 75 days; 70 percent for units that deploy between 75 and 180 days; and 65 percent for units deploying after 180 days. This is the second year in a row that the requested end strength is less than required to execute the plan. Failure to budget for and request the planned-for increased end strength reflects less than full commitment to the needs of the reserve components. The recommended increase of 300 in the Army Reserve and 724 in the Army National Guard would bring the end strength up to the level in the Army's plan for fiscal year 2003.

The committee directs the Secretary of the Army to report, no later than February 1, 2003, to the Committees on Armed Services of the Senate and the House of Representatives, on whether the Army plan is still valid and on the Army's plans for the next five years to address full-time manning readiness requirements of the reserve components.

End strengths for military technicians (dual status) (sec. 413)

The committee recommends a provision that would authorize the minimum level of dual status technician end strengths for fiscal year 2003, as shown below:

	2002 authorization	Fiscal year—	
		2003 request	2003 recommendation
The Army Reserve	6,249	6,349	6,599
The Army National Guard of the United States	23,615	23,615	24,102
The Air Force Reserve	9,818	9,911	9,911
The Air National Guard of the United States	22,422	22,495	22,495

The committee is disappointed that the requested end strength for dual status military technicians does not include an increase of 487 dual status military technicians in the Army Reserve and 250 dual status military technicians in the Army National Guard for full-time support.

Full-time support has been identified as the top readiness issue of the reserve components. It directly impacts the ability to train, administer and prepare ready units and individuals for transition from a peacetime to a wartime posture. The Army has a plan to incrementally increase the Reserve Component Full-Time Support Program over 11 years to achieve a level of full-time support manning of 90 percent for units that deploy in less than 30 days; 80 percent for units that deploy between 30 and 75 days; 70 percent for units that deploy between 75 and 180 days; and 65 percent for units deploying after 180 days. This is the second year in a row that the requested end strength is less than required to execute the

plan. Failure to budget for and request the planned-for increased end strength reflects less than full commitment to the needs of the reserve components. The recommended increase of 250 dual status military technicians in the Army Reserve and 487 dual status military technicians in the Army National Guard would bring the end strength up to the level in the Army's plan for fiscal year 2003.

The committee directs the Secretary of the Army to report, no later than February 1, 2003, to the Committees on Armed Services of the Senate and the House of Representatives, on whether the Army plan is still valid and on the Army's plans for the next five years to address full-time manning readiness requirements of the reserve components.

Fiscal year 2003 limitation on non-dual status technicians (sec. 414)

The committee recommends a provision that would establish numerical limits on the number of non-dual status technicians who may be employed in the Department of Defense as of September 30, 2003, as follows: (1) Army National Guard of the United States, 1,600; (2) Air National Guard of the United States, 350; (3) Army Reserve, 995; and (4) Air Force Reserve, 0.

SUBTITLE C—AUTHORIZATION OF APPROPRIATIONS

Authorization of appropriations for military personnel (sec. 421)

The committee recommends a provision that would authorize a total of $94.4 billion for military personnel, an increase of $56.6 million over the budget request. This includes $32.9 million from the Defense Emergency Response Fund, $33.5 for increases to Army National Guard and Reserve full time support, $750 thousand for an increase to Air National Guard full time support, and a reduction of $10.6 million for programs included in the budget request but for which legislative authority is not recommended. An additional $13.9 million was also reduced from operation and maintenance accounts for the same reason.

TITLE V—MILITARY PERSONNEL POLICY

SUBTITLE A—OFFICER PERSONNEL POLICY

Extension of certain requirements and exclusions applicable to service of general and flag officers on active duty in certain joint duty assignments (sec. 501)

The committee recommends a provision that would extend to December 31, 2003: (1) the requirement that the service secretaries nominate officers for consideration for appointment to certain senior joint officer positions; (2) the exemption of officers serving in these positions in the grade of general or admiral from the limitation on officers serving on active duty in grades above major general or rear admiral; and (3) the authority of the Chairman of the Joint Chiefs of Staff to designate up to 12 general and flag officer positions that are joint duty assignments for exclusion from the limitation on the number of general and flag officers serving on active duty.

Extension of authority to waive requirement for significant joint duty experience for appointment as a chief of a reserve component or a National Guard director (sec. 502)

The committee recommends a provision that would extend from October 1, 2003 to December 31, 2003, the authority for the Secretary of Defense to waive the requirement that the Chairman of the Joint Chiefs of Staff determine that an officer recommended for appointment as a chief of a reserve component or a director of the Army National Guard or Air National Guard have significant joint duty experience.

The committee does not encourage routine waiver of the joint duty experience qualification for officers recommended for appointment as a chief of a reserve component or a National Guard director. Accordingly, the committee directs that the Secretary of Defense submit to the Committees on Armed Services of the Senate and the House of Representatives by May 1, 2003, a report indicating what steps have been taken to ensure that Reserve and Guard officers receive significant joint duty experience. The Secretary should also include in the report the date by which the waiver will no longer be required.

SUBTITLE B—RESERVE COMPONENT PERSONNEL POLICY

Time for commencement of initial period of active duty for training upon enlistment in reserve component (sec. 511)

The committee recommends a provision that would extend the time limit for commencement of an initial period of active duty for

training from 270 days to one year for non-prior service individuals who enlist in the Army National Guard or the Air National Guard, or as a reserve for service in the Army Reserve, Naval Reserve, Air Force Reserve, Marine Corps Reserve, or Coast Guard Reserve.

The recommended provision would enable individuals to enlist prior to commencing their last year of high school or a new year of college and delay their required training until after completion of these studies.

Authority for limited extension of medical deferment of mandatory retirement or separation of reserve component officer (sec. 512)

The committee recommends a provision that would authorize the service secretaries to defer the mandatory retirement or separation of a reserve component officer for 30 days after completion of an evaluation requiring hospitalization or medical observation to determine the officer's entitlement to retirement or separation for physical disability.

SUBTITLE C—EDUCATION AND TRAINING

Increase in authorized strengths for the service academies (sec. 521)

The committee recommends a provision that would increase the authorized strengths of the military academies to 4,400 cadets or midshipmen. The provision would also clarify that the service secretary can permit a variance above that limitation by not more than 1 percent.

SUBTITLE D—DECORATIONS, AWARDS, AND COMMENDATIONS

Waiver of time limitations for award of certain decorations to certain persons (sec. 531)

The committee recommends a provision that would waive the statutory time limits for award of military decorations to certain individuals who have been recommended by the service secretaries for these awards.

Korea Defense Service Medal (sec. 532)

The committee recommends a provision that would require the service secretaries to issue a campaign medal, to be known as the Korea Defense Service Medal, to all military personnel who served in the Republic of Korea, or the adjacent waters, between July 27, 1954, and a termination date determined by the Secretary of Defense.

SUBTITLE E—NATIONAL CALL TO SERVICE

National call to service (sec. 541 and 542)

The committee recommends a provision that would authorize unique incentives to encourage individuals to volunteer to serve the nation through enlisting in the Armed Forces. Individuals who volunteer under this program would be required to serve on active duty for 15 months after completion of initial entry training and

could complete the remainder of their military service obligation by choosing service on active duty, in the Selected Reserve, in the Individual Ready Reserve, or in another national service program designated by the Secretary of Defense. Participants would be required to meet all eligibility requirements for military service and would elect one of the following incentives: (1) a $5000 bonus payable after completion of 15 months of active duty, (2) repayment of a qualifying student loan not to exceed $18,000, (3) an educational allowance at the monthly rate payable under the Montgomery GI Bill for 12 months, or (4) an educational allowance of two-thirds of the monthly rate payable under the Montgomery GI Bill for 36 months. National Service Plan participants who are otherwise qualified and volunteer to continue serving on active duty may be considered for reenlistment or extension on active duty and any additional benefits for which they may be eligible.

The recommended provision would also encourage and facilitate service by requiring institutions of higher education receiving assistance under the Higher Education Act of 1965 to provide military recruiters: (1) the same access to students and the institution as is provided to prospective employers, and (2) upon request, access to the names, addresses, and telephone listings of students, except for the information of students who have submitted a request that the information not be released without prior written consent.

SUBTITLE F—OTHER MATTERS

Biennial surveys on racial, ethnic, and gender issues (sec. 551)

The committee recommends a provision that would require the Secretary of Defense to conduct two separate biennial surveys, rather than a single annual survey, to identify and assess racial, ethnic, and gender issues and discrimination among members of the Armed Forces serving on active duty and the extent (if any) of "hate group" activity among such members. The recommended provision would require one survey every two years, a survey on racial and ethnic issues alternating with a survey on gender issues. The committee believes that these issues require the continued, focused attention of the military and civilian leadership of the Department of Defense and that these surveys play an important role in ensuring that such attention is provided.

Leave required to be taken pending review of a recommendation for removal by a board of inquiry (sec. 552)

The committee recommends a provision that would authorize the service secretaries to require an officer to take leave (including excess leave) while awaiting the secretary's action on a board of inquiry's recommendation that the officer not be retained on active duty. The officer would be afforded the opportunity to review and rebut the report of the board of inquiry prior to commencement of leave. The recommended provision also requires payment of accrued pay and allowances, reduced by other income received, if the board's recommendation is not approved by the secretary concerned.

Stipend for participation in funeral honors details (sec. 553)

The committee recommends a provision that would authorize service secretaries to provide transportation or a daily stipend to military retirees and members of veterans organizations or other approved organizations for service on funeral honors details.

OTHER ITEMS OF INTEREST

Career progression of military astronauts

Military officers who have been selected for astronaut duty with the National Aeronautics and Space Administration have, throughout the history of the space program, performed with distinction and made significant contributions to the national defense. Selection for both the Pilot Astronaut Program and Mission Specialist Program is extremely competitive, and only military officers with extraordinary personal qualifications and professional skills participate in these programs. The committee is concerned about career progression opportunities for officers who participate in the astronaut program and the obstacles they may encounter in advancing to higher rank due to the unique nature of the duty to which they are assigned.

The committee directs the Secretary of Defense, in consultation with the Administrator of the National Aeronautics and Space Administration, to submit a report to the Committees on Armed Services of the Senate and the House of Representatives no later than March 1, 2003, providing views on whether military astronauts should be awarded joint duty credit for astronaut duty or excepted from the requirement for joint duty assignment before consideration for promotion to general or flag officer and the rationale for these views. The report should also describe typical career patterns of officers selected for astronaut duties, including data about the promotion history of military astronauts from each of the Services, and provide recommendations regarding the management of this unique community of officers.

Human resources strategy and community support planning

The committee is pleased at the Department's progress in developing a human resources strategy and the concerted efforts it has made to plan for success in military and civilian personnel recruiting, retention, and career development. The human capital challenges confronting the Department demand a comprehensive plan aimed at ensuring that the personnel requirements of the armed services and the civilian employee workforce are met.

The committee supports the Department's commitment to a social compact aimed at strengthening the military community and, through this means, further improving the well being of military members and their families. In this regard, the committee urges the Department to continue to identify additional ways in which military personnel can nurture their strong familial relationships and better fulfill their irreplaceable roles as parents.

Integrated personnel readiness system

The committee is aware of initiatives in the Army to field an effective and efficient system for managing the readiness and deploy-

ment of individual soldiers and units. Some of these initiatives have already been developed and individually deployed at the operational level and have enhanced the readiness processing of personnel. The committee believes these initiatives could be brought together and managed as an integrated personnel readiness system.

The committee directs the Secretary of the Army to explore implementation of an integrated, secure, web-based system for mobilizing reserves and for deploying personnel. The following capabilities should be considered: (1) a computerized mobilization system for alerting and activating reservists and deploying personnel; (2) a readiness system to automate the process for determining the individual readiness of a soldier for deployment; (3) an in-transit visibility system to automate the tracking of personnel away from their home station, including a time audit of duty served; and (4) a personnel logistics system that facilitates common knowledge of mobilization actions and logistics support.

The committee directs the Secretary of the Army to submit a report on the potential implementation of such a system to the Committees on Armed Services of the Senate and the House of Representatives by June 30, 2003.

TITLE VI—COMPENSATION AND OTHER PERSONNEL BENEFITS

SUBTITLE A—PAY AND ALLOWANCES

Increase in basic pay for fiscal year 2003 (sec. 601)

The committee recommends a provision that would authorize an across the board military pay raise of 4.1 percent and an additional targeted pay raise for certain experienced mid-career personnel. The targeted raise would increase the pay for members in pay grades: (1) E–5 to E–8, 5.5 to 6.5 percent; (2) E–9, 6 to 6.5 percent; (3) W–1 to W–3, 5.5 to 6 percent; (4) O–3, 5 percent; and O–4, 5.5 percent.

Rate of basic allowance for subsistence for enlisted personnel occupying single Government quarters without adequate availability of meals (sec. 602)

The committee recommends a provision that would authorize payment of an increased amount of basic allowance for subsistence to enlisted members who are assigned to single Government quarters without adequate availability of meals from a Government messing facility.

Basic allowance for housing in cases of low-cost or no-cost moves (sec. 603)

The committee recommends a provision that would extend to locations outside the United States the authority to pay the basic allowance for housing based on the member's former duty assignment when the member's reassignment is a low-cost or no-cost permanent change of station or permanent change of assignment. This authority currently applies only to assignments within the United States.

SUBTITLE B—BONUSES AND SPECIAL AND INCENTIVE PAYS

One-year extension of certain bonus and special pay authorities for reserve forces (sec. 611)

The committee recommends a provision that would extend until December 31, 2003, the authority to pay the Selected Reserve re-enlistment bonus, the Selected Reserve enlistment bonus, the special pay for enlisted members assigned to certain high priority units in the Selected Reserve, the Selected Reserve affiliation bonus, the Ready Reserve enlistment and re-enlistment bonus, and the prior service enlistment bonus.

One-year extension of certain bonus and special pay authorities for certain health care professionals (sec. 612)

The committee recommends a provision that would extend until December 31, 2003, the authority for repayment of education loans for health profession officers with wartime-critical medical skills serving in the Selected Reserve. The provision would also extend, until this same date, payment of the accession bonus to nurse officer candidates, the accession bonus for registered nurses, the special pay for nurse anesthetists, the special pay for Selected Reserve health professionals in critically short wartime specialties, and the accession bonus for dental officers.

One-year extension of special pay and bonus authorities for nuclear officers (sec. 613)

The committee recommends a provision that would extend until December 31, 2003, the authority for: special pay for nuclear-qualified officers extending their period of active service, the nuclear career accession bonus, and the nuclear career annual incentive bonus.

One-year extension of other bonus and special pay authorities (sec. 614)

The committee recommends a provision that would extend until December 31, 2003, the authority to pay the aviation officer retention bonus, the reenlistment bonus for active members, the enlistment bonus for active members, the retention bonus for members with critical military skills, and the accession bonus for new officers in critical skills.

Increased maximum amount payable as multiyear retention bonus for medical officers of the Armed Forces (sec. 615)

The committee recommends a provision that would increase to $25,000 the maximum amount of the multiyear retention bonus for certain medical officers.

Increased maximum amount payable as incentive special pay for medical officers of the Armed Forces (sec. 616)

The committee recommends a provision that would increase to $50,000 the maximum amount payable as special incentive pay for certain medical officers of the Armed Forces for service during any 12–month period beginning after fiscal year 2002.

Assignment incentive pay (sec. 617)

The committee recommends a provision that would authorize the service secretaries, with the concurrence of the Secretary of Defense, to pay a monthly incentive pay of up to $1,500 to members serving in designated assignments. The recommended provision requires an annual report on the administration of this authority, including an assessment of its utility. Unless extended, this authority would terminate three years after enactment of the National Defense Authorization Act for Fiscal Year 2003.

The committee expects the Secretary of Defense to implement assignment incentive pay so that it is equitable across the services and in such a manner that members receiving this pay who are not

exposed to hostile fire and imminent danger do not receive better compensation than members engaged in combat operations, taking into account all pays, allowances, and tax advantages.

Challenging living and working conditions and personal sacrifice are hallmarks of military service. This type of pay has significant potential to provide an incentive to members to volunteer for the most challenging duty stations and enhance the ability of the services to fill key billets with the best qualified personnel.

The committee urges the Department to consider the use of assignment incentive pay for military personnel assigned to duty in Korea. The committee has received testimony on the need for improved living conditions and additional incentives for members ordered to duty in Korea. The committee believes this new discretionary pay authority would provide such an incentive.

Increased maximum amounts for prior service enlistment bonus (sec. 618)

The committee recommends a provision that would increase the maximum amount of the prior service enlistment bonus for certain former enlisted members who enlist in the Selected Reserve to $8,000 for persons who enlist for six years; $4,000 for persons who enlist for three years; and $3,500 for persons who have already received a prior service enlistment bonus for a previous three-year enlistment period, but who reenlist or extend the enlistment for an additional three years.

SUBTITLE C—TRAVEL AND TRANSPORTATION ALLOWANCES

Deferral of travel in connection with leave between consecutive overseas tours (sec. 631)

The committee recommends a provision that would eliminate the one-year limitation on use of travel and transportation allowances provided in connection with leave between consecutive overseas tours.

Transportation of motor vehicles for members reported missing (sec. 632)

The committee recommends a provision that would authorize shipment of two privately owned motor vehicles when transportation of household and personal effects is authorized at government expense because the member is in a missing status.

Destinations authorized for Government-paid transportation of enlisted personnel for rest and recuperation upon extending duty at designated overseas locations (sec. 633)

The committee recommends a provision that would authorize enlisted personnel who agree to extend an overseas tour for a period of not less than one year the options of round-trip transportation to: (1) the nearest port in the 48 contiguous states, or (2) an alternative destination at the same or lesser cost.

Vehicle storage in lieu of transportation to United States territory outside Continental United States (sec. 634)

The committee recommends a provision that would authorize a member to elect to store a motor vehicle at government expense in lieu of transportation of the motor vehicle when laws, regulations, or other restrictions preclude transportation of the motor vehicle to the member's new duty station in Alaska, Hawaii, Puerto Rico, the Northern Mariana Islands, Guam, or any territory or possession of the United States.

SUBTITLE D—RETIREMENT AND SURVIVOR BENEFITS MATTERS

Phased-in authority for concurrent receipt of military retired pay and veterans' disability compensation for certain service-connected disabled veterans (sec. 641)

The committee recommends a provision that would authorize concurrent receipt of military retired pay and veterans' disability compensation by certain military retirees. To qualify, members must be eligible for non-disability retirement and for veterans' disability compensation for a service-connected disability rated at 60 percent or higher. The amount of retired pay would be phased in over a five-year period, beginning with 30 percent of the otherwise authorized retired pay in 2003 and increasing to 45 percent in 2004, 60 percent in 2005, 80 percent in 2006, and 100 percent in 2007.

The committee is pleased that the Budget Resolution reported by the Senate Budget Committee would provide the mandatory funding allocation to address the needs of military retirees with service-connected disabilities rated at 60 percent or higher. The recommended provision would allow these veterans to receive the full retired pay they earned in a career of service to the Nation.

Increased retired pay for enlisted reserves credited with extraordinary heroism (sec. 642)

The committee recommends a provision that would authorize a 10 percent increase in the retired pay of an enlisted member of a Reserve component when the member has been credited with extraordinary heroism in the line of duty. The amount of retired pay, including the 10 percent increase, shall not exceed 75 percent of the member's retired pay base. This is similar to the authority to increase the retired pay of enlisted members retired with a regular retirement.

Expanded scope of authority to waive time limitations on claims for military personnel benefits (sec. 643)

The committee recommends a provision that would authorize the Secretary of Defense to waive the statute of limitations for claims involving uniformed service members' pay, allowances, travel, transportation, payments for accrued leave, retired pay, and survivor benefits.

SUBTITLE E—OTHER MATTERS

Additional authority to provide assistance for families of members of the Armed Forces (sec. 651)

The committee recommends a provision that would make permanent the temporary authority to provide assistance to families of members of the Armed Forces serving on active duty to ensure that the children of such families obtain needed child care, education, and other youth services. The assistance would be directed primarily toward providing family support for children of service members who are deployed, assigned to duty, or ordered to active duty in connection with contingency operations.

Time limitation for use of Montgomery GI Bill entitlement by members of the Selected Reserve (sec. 652)

The committee recommends a provision that would extend from 10 to 14 years the maximum period that a member of the Selected Reserve can use educational benefits provided under the Montgomery GI Bill for the Selected Reserve.

Status of obligation to refund educational assistance upon failure to participate satisfactorily in Selected Reserve (sec. 653)

The committee recommends a provision that would treat an obligation to pay a refund to the United States for certain educational assistance as a debt to the United States when the obligation to pay the refund was incurred because the member failed to participate satisfactorily in the Selected Reserve.

Prohibition on acceptance of honoraria by personnel at certain Department of Defense schools (sec. 654)

The committee recommends a provision that would repeal a limited exemption from the ban on receipt of honoraria by military and civilian faculty members and students at the three military academies and certain Department of Defense professional schools. The exemption limits acceptance of honoraria to $2,000. The Supreme Court has determined that the ban on receipt of honoraria violates the First Amendment rights of executive branch employees. Because the ban itself is no longer effective, the exemption places a limitation on military school faculty members and students that does not apply to other Department of Defense employees.

OTHER ITEMS OF INTEREST

Reserve personnel compensation program review

The committee recognizes that the contributions of the reserve components have greatly increased in the past decade. In particular, there are certain mission-critical skills and units among reserve forces that have been recalled for contingency operations, placing stress upon the members and their families. The role of reserves is so integral in the total force that military operations involving major, extended missions are required to include reserve participation.

The committee is concerned that the pay and benefits of reserve personnel must appropriately compensate them for their service. Today's total force concept, which relies heavily on National Guard and Reserve forces for both day-to-day and contingency operations, differs from that envisioned by the designers of the reserve compensation and retirement system more than a half-century ago. Accordingly, the committee directs the Secretary of Defense to conduct a reserve personnel compensation review aimed at determining the extent to which personnel and compensation policies and statutes, including the retirement system that defers eligibility for retired pay to age 60, appropriately address the demands placed on guard and reserve personnel. Other topics that should be reviewed include the number of years of reserve service needed to qualify for retirement and the comparability and sufficiency of the Reserve Montgomery GI Bill and Reserve Survivor Benefit Plan programs. The Secretary should report the results of this review to the Committees on Armed Services of the Senate and the House of Representatives no later than August 1, 2003.

TITLE VII—HEALTH CARE

Eligibility of surviving dependents for TRICARE dental program benefits after discontinuance of former enrollment (sec. 701)

The committee recommends a provision that would authorize certain surviving dependents to enroll in the TRICARE dental plan. Eligible dependents include dependents who were either enrolled in the dental plan on the date of the death of the military member or who had previously discontinued enrollment because the member had been transferred to a duty station where dental care was provided.

Advance authorization for inpatient mental health services (sec. 702)

The committee recommends a provision that would remove the requirement for pre-admission authorization for inpatient mental health services when such services are payable under Medicare. The recommended provision would require the Secretary of Defense to authorize, in advance, continued inpatient mental health services when the services are no longer payable under Medicare.

Continued TRICARE eligibility of dependents residing at remote locations after departure of sponsors for unaccompanied assignments (sec. 703)

The committee recommends a provision that would authorize continued eligibility of family members for TRICARE Prime Remote when the sponsoring service member is transferred from a duty that qualified the family members for TRICARE Prime Remote, and the family members remain at the current duty location because they are not authorized to accompany the member to the new duty assignment.

Approval of Medicare providers as TRICARE providers (sec. 704)

The committee recommends a provision that would require that Medicare-approved health care providers also be considered as approved TRICARE providers.

Claims information (sec. 705)

The committee recommends a provision that would require the Secretary of Defense, in new managed care support contracts entered into under the TRICARE program on or after October 1, 2002, to adopt new claims requirements that are substantially the same as Medicare claims requirements.

Department of Defense Medicare-Eligible Retiree Health Care Fund (sec. 706)

The committee recommends a provision that would require that contributions to the Department of Defense Medicare-Eligible Retiree Health Care Fund (the Fund) be paid from military personnel funds. The recommended provision would also require the participation of all the uniformed services in the Fund.

Technical corrections relating to transitional health care for members separated from active duty (sec. 707)

The committee recommends a provision that would correct section 736 of the National Defense Authorization Act for Fiscal Year 2002 to provide transitional health care to the dependents of members separated from active duty who are eligible for transitional health care.

OTHER ITEMS OF INTEREST

Research on war-related illnesses

In nearly every U.S. conflict since the Civil War, significant numbers of military personnel have emerged with similar, poorly understood illnesses that have lacked a specific medical diagnosis.

The most recent manifestation of this is the "Gulf War Illness" exhibited by veterans of the Persian Gulf War. Thousands of military personnel returned from serving their country in the Gulf and reported a variety of symptoms for which no cause has been determined. These symptoms are similar to those of patients in the general population suffering from chronic fatigue syndrome, fibromyalgia, and multiple chemical sensitivity. Although environmental exposure in the Gulf War cannot be ruled out as a cause, many believe that deployment stress is a likely factor in causing or intensifying at least some Gulf War illnesses.

The committee believes that it is important for the Department of Defense to continue extensive research into the phenomenon of undiagnosed illness, especially how physical and psychological stress can trigger negative health impacts in the body. This research takes on additional importance in light of the current high rate of deployment of military personnel in support of several ongoing contingency operations.

Reserve health care

The committee is concerned about the dissemination of information about TRICARE to reserve force service members and their families. Guard and reserve members who are called to active duty, and their families, face many challenges in accessing both information about the military health care benefit and health care itself. Families are geographically dispersed, often not within driving distance of a military treatment facility or TRICARE Service Center. Some families live in different states and/or TRICARE regions from where the member's unit is based or from where the member is mobilized. In locations away from concentrated military populations, many health care providers are not familiar with TRICARE.

The multitude of types and lengths of call-ups creates confusion about family member eligibility for each of the TRICARE options and the reserve family health care demonstration. Therefore, conveying accurate information about benefits and options is critical. The committee is aware that some reservists have not received sufficient, accurate information on TRICARE program options, transitional health care benefits, and associated program and cost information necessary to make informed health care decisions.

The committee urges the Department, especially Lead Agents of the TRICARE regions, to make a renewed effort to ensure that reserve force members and their families receive timely and appropriate information about their health care options.

TITLE VIII—ACQUISITION POLICY, ACQUISITION MANAGEMENT, AND RELATED MATTERS

SUBTITLE A—MAJOR DEFENSE ACQUISITION PROGRAMS

Buy-to-budget acquisition of end items (sec. 801)

The committee recommends a provision that would authorize the Department of Defense to make the best use of limited resources by conducting "buy-to-budget" acquisition. Under buy-to-budget acquisition, the Department would be permitted to acquire a higher quantity of an end item than the number specified in an authorization or appropriations law. The Department would be required to notify Congress of a decision to exercise this authority within 30 days of its exercise but would not be required to seek reprogramming authority. The purpose of the increased flexibility provided by this section is to enable the Department to take advantage of production efficiencies and other cost reductions.

Report to Congress on incremental acquisition of major systems (sec. 802)

The committee recommends a provision that would require the Secretary of Defense to submit to the congressional defense committees a report on how the Department of Defense plans to comply with applicable requirements of title 10, United States Code and Department of Defense regulations when it conducts programs for the incremental acquisition of major systems.

In testimony before the Readiness Subcommittee, Department of Defense witnesses stated that the Department is seeking to reduce weapons systems acquisition cycle time by using incremental acquisition and spiral development strategies.

The Assistant Secretary of the Air Force (Acquisition) testified that:

> All too often, our long cycle times and our program breakages have their roots in the way we conceive, plan and start our acquisitions. Our processes are too serial and allow each community involved to work too much in isolation. Too often, the warfighter decides a capability is needed and works for months or years to develop a 100 percent solution that is given to the acquisition community as a requirement. The acquirers then struggle to come up with an acquisition strategy that will meet the requirement within a limited budget. Because we are looking for a "big bang," all-at-once delivery of capability, the development time line—which drives both schedule and cost—is long and fraught with possibilities for things to go wrong * * *.

> There is a better way * * *. By delivering capability in increments, with a period for the warfighter to "use and learn" at each increment, we can incorporate what is learned in each new spiral. Because the spiral will be short, schedules and cost estimates will be more reliable and programs will be less subject to funding fluctuations. There will be many opportunities to rapidly inject new technology as a system develops as well as to look at requirements and re-prioritize as world events and threats change.

The Deputy Under Secretary of Defense for Acquisition, Technology and Logistics testified that:

> "Spiral development allows us to get capability to our warfighters [faster] and at less cost * * * by producing and deploying systems based on mature technologies. When deployed, the first increment of capability (or block) will meet many, but not all, of the systems' desired operational requirements. Subsequent blocks will incorporate new technologies that have matured as each block of capability is fielded. The series of blocks represent the "spirals" of increasing capability to the warfighter.

The committee supports the Department's effort to build more flexibility into the acquisition process and develop weapons systems in more manageable steps. At the same time, the committee believes that the Department must take a more disciplined approach to incremental acquisition and spiral development to avoid losing control over the acquisition process.

In the committee's view, the terms "incremental acquisition" and "spiral development" are not interchangeable. Incremental acquisition is an acquisition strategy of gradually improving a capability through a planned series of block upgrades, each of which is to be acquired and fielded. Spiral development is a strategy for achieving a new capability through the phased development of fieldable prototypes. The committee understands that it may take several development "spirals" before a system is ready for production and acquisition.

Section 802 would address incremental acquisition programs. The committee expects the Department to develop a disciplined approach to ensure that both the specific requirements and the key objectives of applicable laws and regulations will be met by all incremental acquisition programs. A separate section (sec. 803) would address spiral development programs.

Pilot program for spiral development of major systems (sec. 803)

The committee recommends a provision that would authorize the Secretary of Defense to conduct a pilot program for the spiral development of major systems. In testimony before the Readiness Subcommittee, witnesses for each of the three military services indicated that they were planning to adopt spiral development approaches in which new capabilities are achieved through the phased development of fieldable prototypes. The committee under-

stands that the Air Force alone is considering spiral development for thirteen different systems.

The committee believes that properly structured spiral development programs can play an important role in enabling the Department of Defense (DOD) to rapidly field new technologies. The General Accounting Office (GAO) has undertaken an extensive review of weapons systems acquisition issues at the request of the committee and has concluded that a "an evolutionary, or phased, approach to developing" weapons systems could lead to significantly improved outcomes.

At the same time, GAO has testified that, "Measures for success need to be defined for each stage of the development process so that decision-makers can be assured that sufficient knowledge exists about critical facets of the product before investment [of] more time and money." The committee believes that DOD must take a disciplined approach to spiral development to ensure that both Congress and the Department have the information they need to make acquisition and budget decisions.

To ensure that the Department develops a disciplined approach to spiral development, the provision recommended by the committee would authorize the Secretary of Defense to conduct spiral development programs on a pilot basis. Under this pilot approach, the Secretary would be required to issue guidance on how spiral development programs will be designed to meet key acquisition system objectives and to approve spiral development plans laying out the program strategy and the cost, schedule and performance goals for each spiral development program.

The committee expects that all spiral development programs for major systems will be conducted in accordance with the guidance issued by the Secretary pursuant to this section. The term "major system", as defined in section 2302(5) of title 10, includes any research and development program on which the total expenditures for research, development, test, and evaluation will exceed $115.0 million or on which the eventual total expenditure for procurement of the system will exceed $540.0 million (based on fiscal year 1990 constant dollars).

Improvement of software acquisition processes (sec. 804)

The committee recommends a provision that would require the secretary of each military department and the head of each defense agency that manages a major defense acquisition program with a substantial software component to establish a program to improve its software acquisition processes.

Many major defense acquisition programs are heavily reliant on the development of complex computer software. In a number of cases, mishandling of software acquisition has jeopardized an entire program. For example, the Navy Area missile defense program experienced such severe problems with software integration that the program was cancelled after years of development effort. Similarly, the V–22 and the Army's Maneuver Control system have experienced serious problems stemming from software development.

In a March 2001 report prepared for the committee, the General Accounting Office recommended that the Department of Defense address these problems by requiring components that are respon-

sible for systems/software development, acquisition, and engineering to implement software acquisition process improvement programs. The provision recommended by the committee would implement this recommendation.

Independent technology readiness assessments (sec. 805)

The committee recommends a provision that would require the Department of Defense (DOD) to justify any decision not to conduct an independent technology readiness assessment for a critical technology on a major defense acquisition program.

Section 804 of the National Defense Authorization Act for Fiscal Year 2002 (FY 2002 NDAA) required the Secretary of Defense to submit an annual report on the Department's compliance with the technology maturity requirements incorporated in DOD Instruction 5000.2. The committee report explained the need for this provision as follows:

> The DOD * * * frequently tries to move technologies to product development programs before they are mature. According to the [General Accounting Office (GAO)], the effort to field immature technologies almost always leads to schedule delays and cost increases:
>
> [Technology development problems need to be addressed] at a time when the product should be undergoing design and manufacturing development. As a result, the pace of technology advances outruns the time to develop a weapon system and some of the more mature components designed into a weapon system become obsolete before the weapon is manufactured. For example, the F–22 will have almost 600 obsolete components by fiscal year 2000 while the aircraft is still in development.

Paragraph 4.7.3.2.2.2 of DOD Instruction 5000.2 currently requires that the DOD science and technology components determine the technological maturity of each critical technology to be incorporated into a major defense acquisition program. If the Deputy Under Secretary of Defense for Science and Technology does not concur with the determination, an independent technology readiness assessment is required. These requirements are also stated in section C7.5 of DOD Regulation 5000.2–R.

Less than four months after the enactment of section 804, the Department's Business Initiative Council proposed to "streamline" these provisions to require such independent technology assessments only when "appropriate".

The committee believes that technological maturity requirements are the cornerstone of a sound acquisition process. For this reason, the committee recommends amending section 804 of the FY 2002 NDAA to require that the Department explain any decision not to conduct an independent technology readiness assessment for a critical technology on a major defense acquisition program.

Timing of certification in connection with waiver of survivability and lethality testing requirements (sec. 806)

The committee recommends a provision that would modify the authority of the Secretary of Defense to waive the requirement for survivability and lethality tests for major weapon programs.

Current law gives the Secretary the authority to waive such testing prior to the entry of a program into systems development and demonstration (known as Milestone B). However, under the Department's revised acquisition regulations, a program may now be initiated at Milestone B or even Milestone C (production and deployment), depending on the maturity of the program's technology. Under these circumstances, it may not be practical to make a waiver decision before the beginning of Milestone B.

In these special circumstances, the provision would give the Department the authority to make a waiver determination at the earliest possible point after the beginning of the first phase of the program (Milestone B or Milestone C). The amendment would not, however, change the basis for a waiver determination.

SUBTITLE B—PROCUREMENT POLICY IMPROVEMENTS

Performance goals for contracting for services (sec. 811)

The committee recommends a provision that would establish annual goals for the Department of Defense to increase the percentage of services contracts that are: (1) entered on the basis of competition; and (2) performance-based.

Section 802 of the National Defense Authorization Act for Fiscal Year 2002 established annual goals for Department of Defense savings to be achieved through improved management of the Department's $50.0 billion of services contracts. The statutory provisions establishing the management tools needed to achieve these savings were provided in Sections 801 and 803 of that Act and included the increased use of performance-based services contracting and increased competition for task orders under contracts for services.

The committee is concerned that some elements of the Department may have cut programs rather than utilizing contract management tools to achieve savings goals. Therefore, the provision recommended by the committee would establish specific targets for the use of these contract management tools, with the overall goal of ensuring that 80 percent of the Department's services contracts are both competitive and performance-based by 2011. This goal is comparable to what the Department achieved in implementing the Competition in Contracting Act of 1984 (enacted as Title VII of Division B of Public Law 98–369) in the 1980's and in adopting performance specifications for purchases of products in the 1990's.

Grants of exceptions to cost or pricing data certification requirements and waivers of cost accounting standards (sec. 812)

The committee recommends a provision that would require the Department of Defense (DOD) to issue guidance on grants of exceptions to cost or pricing data certification requirements and waivers of cost accounting standards. The provision would also require the Secretary of Defense to report to the congressional defense commit-

tees on certain exceptions to the Truth in Negotiations Act and waivers of the cost accounting standards.

Over the last ten years, the Truth in Negotiations Act and the Cost Accounting Standards have been substantially modified to provide DOD and other federal agencies additional flexibility to purchase commercial items without imposing burdensome requirements on contractors. The committee continues to believe that this flexibility plays an important role in ensuring that the Department has rapid access to high-technology products developed in the private sector.

At the same time, however, the committee is concerned that the Department has not always exercised this new flexibility in a responsible manner. Last year, the DOD Inspector General reviewed sample sole-source contracts valued at $652.0 million for which the Department did not obtain certified cost or pricing data. The Inspector General determined that contracting officials lacked valid exceptions from obtaining certified cost or pricing data in 32 percent of the contracting actions reviewed and failed to conduct adequate price analysis to support price reasonableness in 86 percent of the contracting actions reviewed.

Earlier this year, at the request of the committee, the General Accounting Office (GAO) reviewed waivers of certified cost or pricing data requirements for 20 contracts valued at $4.4 billion. The GAO determined that: (1) most of the waivers were based solely on a determination that sufficient information was available to determine the price to be fair and reasonable without the submission of cost or pricing data; and (2) in many of these cases, the Department was not obtaining sufficient data or conducting adequate price analysis to ensure price reasonableness. The GAO recommended that the Department develop guidance to better define when waivers should be used and how prices should be assessed in the event that they are used.

The committee has consistently taken the position that a determination that sufficient information is available to determine a price to be fair and reasonable without the submission of cost or pricing data is not alone sufficient to justify an "exceptional circumstances" waiver. The committee's view, as stated on page 775 of the conference report on the National Defense Authorization Act for Fiscal Year 2000 and page 690 of the conference report on the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999, is that such a waiver should be granted "only when a waiver is necessary to meet the needs of an agency, i.e. when the agency determines that it would not be able to obtain needed products or services from the vendor in the absence of a waiver."

The DOD Inspector General Report and the GAO report demonstrate that the Department's approach to "exceptional circumstance" waivers has led to higher prices and increased risks on DOD contracts. Accordingly, the provision recommended by the committee would require the Department to take additional steps to ensure that waivers to cost or pricing data requirements are granted only when properly justified and that DOD officials take appropriate steps to ensure price reasonableness when these requirements are waived.

Extension of requirement for annual report on defense commercial pricing management improvement (sec. 813)

The committee recommends a provision that would extend for three years the requirement in section 803(c)(4) of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 that the Secretary of Defense submit to the congressional defense committees an annual report on price trend analyses for commercial items purchased by the Defense Logistics Agency (DLA) and the military departments.

This provision was enacted in response to testimony from the Department of Defense Inspector General indicating that DLA had paid undiscounted or marginally discounted catalog prices for commercial items, resulting in price increases of as much as 1,430 to 13,163 percent.

The Inspector General reported last year that DLA has implemented a successful price analysis program that the Defense Supply Center, Richmond has used to address unreasonable prices. Earlier this year, the Inspector General reported that DLA had successfully built a strategic supplier alliance with one of its key suppliers that will result in price reductions of $59.0 million, demonstrating the beneficial effects of aggressive price management. Unfortunately, the Inspector General report indicated that the Army, Navy, and Air Force programs have lacked the quantitative depth and analysis of the DLA effort.

The committee continues to believe that an aggressive price trend analysis program can play an important role in ensuring that prices paid on Department of Defense contracts are fair and reasonable.

Internal controls on the use of purchase cards (sec. 814)

The committee recommends a provision that would require the Secretary of Defense to establish enhanced internal controls for the use of purchase cards by Department of Defense (DOD) employees.

In response to a report of the General Accounting Office (GAO) last year, the committee directed the Department to ensure that appropriate internal controls were in place for purchase card purchases. This was the third consecutive year in which the committee report raised concerns about the potential misuse of purchase cards by DOD employees.

Earlier this year, the GAO issued another report, in which it concluded that "serious weaknesses" remain in the Department's internal controls for purchase card purchases. According to the GAO, these continued weaknesses "contributed to additional purchases during fiscal year 2001 that we believe are fraudulent, improper, abusive or otherwise questionable." Among the questionable purchases were purchases of designer briefcases, Lego robot kits, and high-cost computer bags that were given away by DOD employees.

On April 18, 2002, the Director of the Office of Management and Budget responded to the GAO's findings by directing the heads of all federal departments and agencies to prepare remedial action plans for their purchase card programs. These plans are to include a reexamination of the number of purchase cards issued by the department or agency and detail the internal controls that the de-

partment or agency plans to use to manage risk. The Department of Defense has established a task force to address the issue.

While the committee continues to support the use of credit cards, the Department must take strong action to institute effective internal controls and address inappropriate credit card purchases. The provision recommended by the committee would require the Department to implement controls including: requirements for independent, documented receipt and acceptance of goods and services and independent, documented review and certification of monthly purchase card statements; specific policies limiting the number of purchase cards to be issued and establishing credit limits for cardholders; specific criteria for ensuring the integrity of cardholders; accounting system changes to ensure that purchase card transactions are properly recorded in Department of Defense accounting records; and regular internal review of purchase card statements.

Assessment regarding fees paid for acquisitions under other agencies' contracts (sec. 815)

The committee recommends a provision that would require the Secretary of Defense to carry out an assessment to determine the amount paid by the Department of Defense (DOD) as fees for the acquisition of property and services under contracts entered by other federal departments and agencies and whether these amounts could be put to better use.

The committee is concerned that the Department continues to order excessive quantities of products and services under contracts entered by other federal departments and agencies. In many cases, the personnel of other departments and agencies have considerably less expertise in procurement in general, and in the specific products and services to be acquired, than DOD personnel. The committee believes that the assessment required by this provision is a necessary step to ensure that the Department has appropriate management control over purchases conducted through other federal departments and agencies.

Pilot program for transition to follow-on contracts for certain prototype projects (sec. 816)

The committee recommends a provision that would enable the Department of Defense to capitalize on successful prototype projects by bringing the prototypes into production under standard procurement contracts. The provision would establish a three-year pilot program to ease the transition of nontraditional defense contractors from prototype transactions to standard procurement contracts. Under the pilot program, the Department would be authorized to enter contracts of $20.0 million or less that would treat items or processes developed by nontraditional defense contractors under prototype transactions: (1) as commercial items subject to the streamlined contracting procedures established in Part 12 of the Federal Acquisition Regulation; and (2) as items or processes that are developed with mixed funds for the purpose of negotiating rights in technical data under section 2320 of title 10, United States Code.

Waiver authority for domestic source or content requirements (sec. 817)

The committee recommends a provision that would provide the Secretary of Defense the authority to waive the application of statutory domestic source requirements and domestic content requirements, provided that: (1) application of the requirements would impede the reciprocal procurement of defense items under a Memorandum of Understanding between the United States and another country; and (2) the other country does not discriminate against items produced in the United States to a greater degree than the United States discriminates against items produced in that country. This proposed standard is consistent with the standard previously adopted by the committee for products covered by the domestic content restrictions in section 2534 of title 10, United States Code.

SUBTITLE C—OTHER MATTERS

Extension of the applicability of certain personnel demonstration project exceptions to an acquisition workforce demonstration project (sec. 821)

The committee recommends a provision that would extend certain authorities associated with the acquisition workforce pilot program established in section 4308 of the National Defense Authorization Act for Fiscal Year 1996. In particular, the provision recommended by the committee would extend until 2007 the exception authorized in section 4308 to otherwise applicable limitations on the size and duration of the pilot program.

Moratorium on reduction of the defense acquisition and support workforce (sec. 822)

The committee recommends a provision that would establish a moratorium on further cuts in the acquisition workforce for three years. The Secretary of Defense would be authorized to waive this prohibition upon certification to Congress that any reductions to the workforce would not negatively impact the ability of the workforce to efficiently and effectively carry out its legally required functions.

Twelve consecutive years of downsizing have left the Department of Defense (DOD) with a workforce that is smaller (by 51 percent), older (with an average age of 46.7 years), more senior (with an average of 20.2 years of service), higher grade, and rapidly approaching retirement. In August 2000, the then-Under Secretary of Defense for Acquisition, Technology, and Logistics wrote a memorandum in which he stated:

> I recommend that DOD not have any further mandated acquisition workforce reductions as a goal after FY 2001. By any terms, the DOD acquisition workforce has been drastically reduced while, at the same time the number of DOD procurement and contracting actions has increased * * *. We have gone as far as we can in mandating acquisition workforce reductions without causing significant adverse impacts on the DOD acquisition system.

The committee believes that no further cuts should be made until the Department is prepared to address shortcomings in the acquisition workforce on a comprehensive basis.

Extension of contract goal for small disadvantaged businesses and certain institutions of higher education (sec. 823)

The committee recommends a provision that would extend section 2323 of title 10, United States Code, for three years. Section 2323 establishes a five percent goal for Department of Defense contracting with small disadvantaged businesses and certain institutions of higher education.

Mentor-protege program eligibility for HUBZone small business concerns and small business concerns owned and controlled by service-disabled veterans (sec. 824)

The committee recommends a provision that would expand the list of entities eligible to participate as proteges in the Department of Defense mentor-protege program to include small business concerns owned and controlled by service-disabled veterans and qualified HUBZone small business concerns.

Repeal of requirements for certain reviews by the Comptroller General (sec. 825)

The committee recommends a provision that would repeal statutory requirements for certain reviews by the General Accounting Office (GAO) that are no longer needed.

The committee notes that the authority provided by sections 912, 5312, and 5401 of the National Defense Authorization Act for Fiscal Year 1996 has never been utilized. For this reason, the required reports on the manner in which this authority has been used are unnecessary.

The committee directs the Department of Defense to make a recommendation to the congressional defense committees as to whether the authority to conduct programs pursuant to these sections is likely to be needed in the future or should be repealed.

Multiyear procurement authority for purchase of dinitrogen tetroxide, hydrazine, and hydrazine-related products (sec. 826)

The committee recommends a provision that would authorize the Secretary of Defense to enter contracts for periods of up to 10 years for dinitrogen tetroxide, hydrazine, and hydrazine-related products if the contracts are in support of either United States national security programs or the United States space program. The Department of Defense has informed the committee that this authority is needed to ensure a reliable domestic industrial base for fuels that are a prerequisite of assured access to space.

Multiyear procurement authority for environmental services for military installations (sec. 827)

The committee recommends a provision that would amend section 2306c of title 10, United States Code, to cover environmental remediation services for an active military installation, an installa-

tion being closed or realigned under base realignment and closure procedures, or a formerly used defense site.

The Department of Defense proposed a legislative provision that would authorize a demonstration project using multiyear contracts for environmental remediation. The new authority would have been used to test the feasibility of using fixed-price multiyear contracts with incremental funding to obtain environmental remediation services.

Section 802 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 contained a new section 2306c of title 10, which creates permanent authority for multiyear contracts for the acquisition of services. Because permanent authority for multiyear service contracts is already available under section 2306c, the committee does not believe that a demonstration program is necessary.

The provision recommended by the committee would clarify that the authority provided in section 2306c extends to contracts for environmental remediation services. The committee encourages the Department to use this authority to issue competitive, performance-based task orders containing firm, fixed prices for specific tasks to be performed in accordance with the policy set forth in section 821 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001.

OTHER ITEMS OF INTEREST

Consolidation of Contract Requirements

Sections 411 through 413 of the Small Business Reauthorization Act of 1997 (Public Law 105–135) require federal agencies to conduct market research to assess the potential impact of "bundled contracts" and to proceed with such contracts only if the benefits of bundling substantially exceed the benefits of proceeding with separate contracts.

Unfortunately, it appears that these statutory provisions have not always had the intended effect of requiring the Department of Defense and other agencies to carefully weigh the impact of bundled contracts. For example, the Small Business Reauthorization Act defined bundling to include only those consolidated contracts that are "likely to be unsuitable for award to a small business concern." The General Accounting Office recently concluded that a contract cannot be considered unsuitable for award to a small business concern if a team of contractors, including small business concerns, could bid on the contract. Since a team of contractors could bid on virtually any requirement, this interpretation would appear to exclude virtually all contracts from the application of the bundling provisions.

The committee believes that there are circumstances in which the consolidation of contracts can enable the Department to leverage its market power or otherwise obtain better products or services at better prices. At the same time, however, individual small businesses that previously performed work for the Department may be adversely affected even in cases where a team of other small businesses is able to bid on the consolidated requirement. The Department should consolidate contracts only when the benefits of

consolidation significantly outweigh the benefits of proceeding with separate contracts.

For this reason, the committee directs the Department to conduct market research into a variety of alternative approaches and assess the costs and benefits of any consolidation of contract requirements in excess of $5.0 million, regardless of whether the consolidation constitutes "bundling" under the definitions provided in the Small Business Reauthorization Act. The Department should make appropriate changes to applicable regulations and guidance to ensure that the required analysis is carried out.

By requiring the Department to analyze the impact of a wider range of consolidated contracts, the committee does not intend to alter statutory reporting and review provisions that are applicable only to "bundled" contracts.

Management of electromagnetic spectrum in the acquisition process

The committee is concerned with the manner in which the Department of Defense (DOD) currently addresses electromagnetic radio frequency spectrum requirements during the development and acquisition of new weapons systems. Nearly all new military equipment requires access to the spectrum and operates in electromagnetic environments that may adversely affect its use. In addition, all electronic systems produce electromagnetic emanations that can adversely affect other systems.

The statement of managers accompanying the National Defense Authorization Act for Fiscal Year 2001 expresses the concern that DOD has pursued the development of weapons systems utilizing portions of the radio frequency spectrum not designated for military use, which can lead to unintended interference between those systems and commercial systems licensed to use the same spectrum. The conferees noted that the Department was developing new procedures to address interference problems and directed the General Accounting Office (GAO) to review those procedures and their implementation. In May 2001, GAO reported that it was too early to evaluate the effectiveness of the new procedures.

The committee continues to believe that spectrum issues will play a key role in the development of new DOD weapons systems. Accordingly, the committee directs the GAO to update its May 2001 report. The GAO review should also address the effectiveness of the Department's efforts to manage spectrum issues (including host nation supportability and the impact of electromagnetic environmental effects) in the acquisition process.

Polyacrylonitrile carbon fibers

Polyacrylonitrile (PAN) carbon fibers are used in a variety of defense and space applications such as aircraft, missiles, launch vehicles, and helicopters. The Department of Defense (DOD) currently restricts the procurement of PAN carbon fiber to domestic sources. Two years ago, DOD projected that the market for PAN carbon fiber would grow in the future with increased demand for defense and commercial applications. On this basis, the Department decided to phase out the domestic source restriction over a five-year period ending May 31, 2005. The phase-out period was designed to

give domestic suppliers time to adjust to market conditions and to give DOD the flexibility to adjust its policy if projected circumstances did not materialize.

Domestic suppliers of PAN carbon fibers believe that the market projections on which the DOD decision was based are no longer valid. The committee directs the Secretary of Defense to review the Department's previous report on PAN carbon fibers and report to the congressional defense committees by February 1, 2003 on: (1) whether the findings of that report remain valid; and (2) whether the PAN carbon fiber domestic source restriction should be maintained or discontinued.

TITLE IX—DEPARTMENT OF DEFENSE ORGANIZATION AND MANAGEMENT

Time for submittal of report on quadrennial defense review (sec. 901)

The committee recommends a provision that would amend section 118 of title 10, United States Code, to change the submission date of the report on each quadrennial defense review to the Committees on Armed Services of the Senate and the House of Representatives. Section 118 would no longer require submission of the report on September 30 of the year in which the review is conducted; the report shall instead be submitted no later than the date in the following year on which the President submits the budget for the next fiscal year to Congress.

Increased number of deputy commandants authorized for the Marine Corps (sec. 902)

The committee recommends a provision that would authorize an increase in the number of deputy commandants for the Marine Corps from five to six.

The committee supports this provision in order to establish the position of Deputy Commandant (Marine Corps Combat Development Command) as an additional duty for the Commanding General, Marine Corps Combat Development Command, to assist the Commandant in executing his responsibilities for developing Marine Corps warfighting concepts and determining associated required capabilities. The position would remain at Marine Corps Base Quantico, Virginia and will not require an increase in the number of lieutenant generals authorized for the Marine Corps.

Base operating support for Fisher Houses (sec. 903)

The committee recommends a provision that would require the service secretaries to provide base operating support for Fisher Houses associated with health care facilities. Currently, only the Navy is required to provide such support. The recommended provision includes all of the military services.

Prevention and mitigation of corrosion (sec. 904)

As discussed in title III, the committee believes that efforts to prevent and mitigate corrosion can be better coordinated within the Department of Defense (DOD). The Senate report on the fiscal year 2002 National Defense Authorization Act (S. Rept. 107–62) directed DOD to establish a single office to coordinate and direct anti-corrosion policies and standards; the House report (H. Rept. 107–194) contained similar direction. The General Accounting Office reports that no such office has been established.

Each of the military services makes ongoing efforts to reduce or mitigate corrosion. However, these efforts tend to be small, nar-

rowly focused, and uncoordinated within and among the services. Further, to the extent that anti-corrosion programs have been supported, they have focused on equipment when the problem also seriously impacts facilities.

The committee continues to see a need for a centralized direction within the Office of the Secretary of Defense to coordinate the Department's corrosion prevention and mitigation programs, policies, and strategies. Therefore, the committee recommends a provision directing the Secretary of Defense to designate a senior official responsible for developing policies, reviewing the services' budgets to ensure proper resources are being devoted to corrosion prevention efforts, and ensuring that anti-corrosion options are considered and inserted at the appropriate points throughout the life cycle of facilities and equipment, from initial design to retirement.

The provision further requires DOD to develop a long-term strategy to include: expanding the emphasis on corrosion prevention, establishment of common criteria for the military services when testing and evaluating new technologies, data collection on the effects and costs of corrosion on military assets, distribution of useful information about corrosion prevention, identification of specific corrosion-related programs worthy of pursuit in future budgets, and establishment of a coordinated research and development program to help transition new technologies into operational systems and current facilities.

TITLE X—GENERAL PROVISIONS

SUBTITLE A—FINANCIAL MATTERS

Transfer authority (sec. 1001)

The committee recommends a provision that would provide for the transfer of funds authorized in Division A of this Act to unforeseen higher priority needs in accordance with normal reprogramming procedures.

Reallocation of authorizations of appropriations from ballistic missile defense to shipbuilding (sec. 1002)

The committee recommends a provision that would transfer $690.0 million from ballistic missile defense items to shipbuilding programs. The committee believes that the proposed fiscal year 2003 budget does not provide adequate resources to maintain the Navy's surface fleet or attack submarine force levels. The committee has received ample testimony from Department of Defense (DOD) witnesses and numerous DOD and Navy reports indicating that the Navy should be building eight to 10 ships per year and investing $10.0 to $12.0 billion per year in shipbuilding to recapitalize the current fleet. A number of Navy witnesses, including the Chief of Naval Operations, have indicated that they believe the Navy should be building to a fleet with as many as 375 ships in order to meet the requirements the Navy faces today. The current shipbuilding plan would buy five ships and invest $8.6 billion in fiscal year 2003, including one ship and $0.4 billion from the National Defense Sealift Fund for a T–AKE dry cargo/ammunition ship. Two years ago, the Navy's shipbuilding plan called for 23 ships between 2003 and 2005; this year's plan calls for only 17.

Recognizing these deficiencies in the current plan, the committee believes that a much higher priority must be given to recapitalizing the Navy fleet. Therefore, the committee recommends adding $690.0 million to shipbuilding accounts as follows:

(1) an increase of $415.0 million for advance procurement for a *Virginia*-class attack submarine;

(2) an increase of $125.0 million for advance procurement for a DDG–51 destroyer; and

(3) an increase of $150.0 million for advance procurement for an LPD–17 amphibious transport dock.

Although these funds would not buy an additional ship in fiscal year 2003, they are logical steps that should be taken to support the Navy's acceleration of the procurement of ships that would otherwise be bought later in the Future Years Defense Program (FYDP) or to increase the current rate at which we are buying ships.

For example, the advance procurement for the *Virginia*-class attack submarine would buy an additional shipset of nuclear propul-

sion equipment in fiscal year 2003. This shipset of equipment would support procurement of an additional *Virginia*-class submarine in fiscal year 2005, increasing the rate in the FYDP from the current level of one per year. The Navy will need to accelerate the submarine construction rate to meet requirements identified in the 1999 "Attack Submarine Study" conducted by the Joint Chiefs of Staff. The study concluded that the Navy needs to have a minimum of 68 attack submarines in fiscal year 2015 to meet requirements defined by the regional commanders in chief and the national intelligence community. Increasing the current production rate in the fiscal year 2005 time frame is the only way the Navy will ever achieve that level.

The committee supports research and development of ballistic missile defense, but it believes that the proposed fiscal year 2003 ballistic missile defense budget contains a substantial amount of funding that is not required in fiscal year 2003 to further the development of effective missile defenses. Therefore, the committee recommends a reduction of $690.0 million in ballistic missile defense funding lines as distributed below. These reductions are in addition to the ballistic missile defense reductions recommended elsewhere in this report.

The budget request included $1.1 billion in the Ballistic Missile Defense (BMD) System program element, PE 63880C, an increase of $258.0 million over the current funding level. The major purpose of this program element is to develop an integrated architecture of BMD systems. While the committee believes this is an important goal, the committee notes that most of the systems that will comprise the BMD architecture are years away from being deployed, thus making development and definition of a detailed BMD architecture impossible at this point. After providing more than $800.0 million for this program element in fiscal year 2002, the Missile Defense Agency has yet to provide to Congress an indication of what the overall BMD architecture might be. A substantial increase was requested in Battle Management/Command and Control, BMD System Communications, Production Manufacturing and Technology, BMD System Program Operations and BMD Systems Engineering and Integration for this program element for fiscal year 2003, yet no compelling justification for such an increase was provided. Therefore, in addition to the $140.0 million reduction to BMD Systems Engineering and Integration recommended elsewhere in this report, the committee recommends a reduction of $222.0 million in PE 63880C, to be taken from among the following areas: Battle Management/Command and Control, BMD System Communications, Production Manufacturing and Technology, BMD System Program Operations, and BMD Systems Engineering and Integration.

The budget request included $3.2 billion in the Midcourse Defense program element, PE 63882C. The committee recommends a reduction of $166.0 million in this program element as follows:

(1) a reduction of $52.0 million to the budget request of $147.9 million for Sea-based Midcourse concept development, studies and risk reduction. More than $90.0 million would remain in this program element for such concept development work, which is a substantial level of funding given that no de-

velopment plan or path forward has yet been established for this system. Sea-based Midcourse test program funding would remain at the budget request level to continue the current set of Aegis Leap Intercept flight tests.

(2) A reduction of $50.0 million for Midcourse Systems Engineering and Integration (SE&I) not associated with a specific BMD system. This reduction is in addition to the reduction of $45.0 million discussed elsewhere in this report. These reductions would leave more than $170.0 million of SE&I funding elsewhere in this program element, which is a substantial amount of funding, especially considering the basic architecture for midcourse defense has yet to be defined.

(3) A reduction of $64.0 million for Midcourse Program Operations, which is the requested funding level. According to the fiscal year 2003 budget justification documentation, this funding "provides management and support for overhead/indirect fixed costs such as civilian payroll, travel, rents and utilities and supplies." More than $150.0 million of government program management and operations funding is requested in the individual BMD systems' budget lines in this program element, which is where such funding is ordinarily accounted for. The committee believes this is an adequate level of funding for such activities.

The budget request included $796.9 million in the Boost Defense program element, PE 63883C, an increase of $197.0 million over the current funding level. The committee recommends a reduction of $135.0 million in this program element, as follows:

(1) a reduction of $105.0 million for detailed design of the second Airborne Laser (ABL) aircraft to the budget request of $598.0 million for the ABL. Detailed design of a second ABL is premature; the first aircraft is experiencing technical difficulties and schedule slips and is not scheduled to be tested until 2005.

(2) A reduction of $10.0 million to the budget request of $34.8 million for Space-based Laser (SBL). More than $24.0 million would remain in this program element for SBL program definition and risk reduction, which the committee believes is adequate in the absence of a plan on how to proceed with this program.

(3) A reduction of $20.0 million for Boost Defense Program Operations, which is the requested funding level. According to the fiscal year 2003 budget justification documentation, this funding "provides management and support for overhead/indirect fixed costs such as civilian payroll, travel, rents and utilities and supplies." More than $60.0 million of government program management and operations funding is requested in the individual BMD systems' budget lines in this program element, which is where such funding is ordinarily accounted for. The committee believes this is an adequate level of funding for such activities.

The budget request included $117.7 million in PE 63869A for the Medium Extended Air Defense System (MEADS), a joint program involving the United States, Germany and Italy. The budget request represents an increase of $48.0 million over the current fund-

ing level. Since there is currently no internationally agreed-upon plan for MEADS, it would be premature to substantially increase program funding. Therefore, the committee recommends a reduction of $48.0 million in PE 63869A for MEADS, leaving $70.0 million in this program element to continue funding MEADS at the current level.

The budget request included $170.0 million in the Terminal Defense program element, PE 63881C. The committee recommends a reduction of $14.0 million for Terminal Program Operations, since no funding for this overhead function was requested last year and there was no justification provided for initiating such funding in fiscal year 2003.

The budget request included $934.7 million in the Theater High Altitude Air Defense (THAAD) program element, PE 64861C, including $40.0 million for 10 extra THAAD missiles. These missiles are not required for the THAAD test program, and if bought now they would be untested and unproven since THAAD flight testing is not scheduled to begin until fiscal year 2004. The committee believes it would be premature to fund extra THAAD missiles prior to the completion of successful flight testing, and recommends a reduction of $40.0 million in PE 64861C for these missiles.

The budget request included $373.4 million in the Sensors program element, PE 63884C, an increase of $39.0 million over the current funding level. The committee recommends a reduction of $65.0 million in this program element, as follows:

(1) A reduction of $55.0 million to the budget request of $294.0 million for Space-based Infrared System, Low component (SBIRS-Low). Subsequent to the budget submission, SBIRS-Low was restructured to maintain only one contractor instead of two in fiscal year 2003. The recommended reduction reflects the savings obtained in 2003 by only funding a single contractor.

(2) A reduction of $10.0 million for Sensors Program Operations, which is the requested funding level. According to the fiscal year 2003 budget justification documentation, this funding "provides management and support for overhead/indirect fixed costs such as civilian payroll, travel, rents and utilities and supplies." More than $20.0 million of government program management and operations funding is requested in the individual BMD systems' budget lines in this program element, which is where such funding is ordinarily accounted for.

Authorization of appropriations for continued operations for the war on terrorism (sec. 1003)

The committee recommends a provision that would authorize the appropriation of $10.0 billion for the conduct of operations in continuation of the war on terrorism in accordance with the Authorization for the Use of Military Force (P.L. 107–40), subject to certain conditions.

This money was expressly requested by the President to fund continued operations for the war on terrorism. As the Secretary of Defense explained in a March 14, 2002, letter to the committee:

> Consistent with our assumptions, the $10.0 billion is targeted at increased operating and transportation costs, spe-

cial pays, reserve/guard call-up, enhanced intelligence efforts, and other costs related to the war on terrorism.

The committee believes that there is no more important purpose to which this funding could be dedicated than the continuation of the war on terrorism. However, the Department is not yet in a position to state how long the war on terrorism will continue, or in what form, or to specify the specific programs for which the requested funds would be used.

For this reason, the provision recommended by the committee would authorize for appropriation the $10.0 billion requested by the President upon receipt of a budget request which: (1) designates the requested amount as being essential to the continued war on terrorism; and (2) specifies how the administration proposes to use the requested funds, consistent with the Authorization for the Use of Military Force.

Authorization of emergency supplemental appropriations for fiscal year 2002 (sec. 1004)

On March 21, 2002, the President submitted to Congress a request for $27.1 billion in supplemental appropriations for fiscal year 2002. Of that amount, $14.0 billion was for the Department of Defense and the intelligence community to continue to prosecute the global war on terrorism, including Operations Enduring Freedom and Noble Eagle. The committee recommends a provision that would authorize supplemental appropriations for the Department of Defense for fiscal year 2002.

The committee believes that supplemental appropriations for fiscal year 2002 are necessary for, and should be provided for, the purposes specified in the Authorization for Use of Military Force (Public Law 107–40). The committee also believes that these funds, and any future appropriations for such purposes, should be transferred to specific accounts within the Department of Defense for obligation, rather than being obligated directly from the Defense Emergency Response Fund. The committee believes that this would improve the efficiency and accountability of the expenditure of these funds and notes that the President has also recommended this change in his supplemental request.

United States contribution to NATO common-funded budgets in fiscal year 2003 (sec. 1005)

The resolution of ratification for the Protocols to the North Atlantic Treaty of 1949 on the Accession of Poland, Hungary and the Czech Republic contained a provision (section 3(2)(c)(ii)) that requires a specific authorization for U.S. payments to the common-funded budgets of the North Atlantic Treaty Organization (NATO) for each fiscal year, beginning in fiscal year 1999, in which U.S. payments exceed the fiscal year 1998 total. The committee recommends a provision to authorize the U.S. contribution to NATO common-funded budgets for fiscal year 2003, including the use of unexpended balances from prior years.

Development and implementation of financial management enterprise architecture (sec. 1006)

The committee recommends a provision that would require the Secretary of Defense to develop a comprehensive financial management enterprise architecture for all budgetary, accounting, finance and data systems of the Department of Defense (DOD). The provision would also prohibit significant expenditures on financial system improvements that would be inconsistent with the new architecture.

The committee understands that the Department has already initiated an effort to develop a comprehensive enterprise architecture by March 2003 as required by this provision. At a hearing of the Readiness Subcommittee, the Comptroller General of the United States testified that the Department should limit the additional business systems development that it undertakes before a new enterprise architecture has been approved. The DOD Comptroller agreed and stated that he has already taken some steps to limit spending on business systems development until the proposed architecture and transition plan have been completed.

The provision recommended by the committee would condition any obligation of more than $1.0 million for a defense financial system improvement upon a determination of compliance with the new architecture. Until the new architecture has been developed, expenditures would be limited to those that are necessary to address critical national security requirements or prevent significant adverse effects on ongoing projects.

Departmental accountable officials in the Department of Defense (sec. 1007)

The committee recommends a provision that would authorize the Secretary of Defense to designate certain Department of Defense employees and members of the Armed Forces as departmental accountable officials. A departmental accountable official could be held pecuniarily liable for illegal, improper, or incorrect payments when the official who certified payment relied on information provided through fault or negligence of the departmental accountable official.

Department-wide procedures for establishing and liquidating personal pecuniary liability (sec. 1008)

The committee recommends a provision that would authorize any officer of the Armed Forces or any civilian employee of the Department of Defense designated by regulation to act on reports of survey and vouchers pertaining to the loss, spoilage, unserviceability, unsuitability, destruction of, or damage to, property of the United States under the control of the Department of Defense. Currently, reports of survey procedures apply only to the Army and Air Force.

The recommended provision would also make members of all services liable for damage or cost of repairs caused by the members to any arms or equipment. Currently, only members of the Army and Air Force are so liable.

Travel card program integrity (sec. 1009)

The committee recommends a provision that would authorize direct payment to the issuer of a Defense travel card of official travel or transportation expenses charged on the Defense travel card by a Department of Defense employee or member. The recommended provision would also authorize withholding or deduction from the pay of a Department of Defense employee or member of the Armed Forces funds for payment of delinquent travel card charges when the employee or member is delinquent in the payment and does not dispute the amount of the delinquency.

SUBTITLE B—NAVAL VESSELS AND SHIPYARDS

Number of Navy surface combatants in active and reserve service (sec. 1021)

The committee recommends a provision which would require the Secretary of the Navy to report to Congress:

(1) within 90 days after enactment of this Act, if the number of surface combatants is below the 116 vessels described as the current force in the September 30, 2001 Quadrennial Defense Review Report (2001 QDR); or

(2) in the future, at least 90 days prior to reducing the number of active duty and reserve force surface combatants any further whenever the number of surface combatants is below 116 surface combatant vessels.

In either case, the report would have to include a risk assessment that uses the 2001 QDR assumptions.

In addition, the Secretary would be required to retain on the Naval Vessel Register a sufficient number of ships which could be reactivated within 120 days notice to provide a surge capability to regain the level of 116 surface combatants described in the 2001 QDR.

The Navy budget request recommends reducing the surface combatant force structure to 108, a number that would be eight fewer than the number in the current force described in the 2001 QDR. The 2001 QDR states that the current force of 116 surface combatants "were judged as presenting moderate operational risk, although certain combinations of warfighting and smaller scale contingency scenarios present high risk."

The committee received no information on the risk assessment associated with reducing the force structure below that noted in the 2001 QDR. Therefore, the committee concludes that the risk resulting from the Navy's proposed force structure would be higher than that noted in the 2001 QDR.

Previously, the Navy has sold, leased, and granted ships with remaining service life shortly after decommissioning those ships. Prior to the completion of an analysis of attack submarine force structure, the Navy decommissioned a number of attack submarines due to budget constraints, only to find out later that the analysis had indicated a requirement for having a higher number of attack submarines.

The committee concludes that it is not prudent to risk repeating the same mistake the Navy made with reducing attack submarines. Therefore, the provision would require the Secretary of the Navy

to: (1) provide a risk assessment prior to reducing the force structure; and (2) maintain the capability to reconstitute the force on short notice, if needed.

Plan for fielding the 155-millimeter gun on a surface combatant (sec. 1022)

The committee recommends a provision that would require the Secretary of the Navy to submit a plan for fielding the Navy's 155mm gun in a Navy ship on an expedited schedule, but no later than fiscal year 2006. That plan's attributes would have to include assurances of safe operation while providing the Marine Corps fire support.

The committee received testimony which indicated that the 155mm gun is the only weapons system in development that would be capable of providing the Marine Corps the required fire support from the sea. Unfortunately, the Navy budget request recommends another significant delay in providing the Marine Corps the 155mm gun capability.

The *Spruance*-class destroyers were designed to accommodate an eight-inch naval gun. Another factor in the committee's consideration is that the Navy intends to produce an engineering development model of the 155mm gun within the advanced gun system program. With the Navy's planned early retirement of some of the ships in the class, it would appear that there may be an opportunity to use a *Spruance*-class destroyer as the test ship for the advance gun system.

This approach would provide a rapid prototype gun that could be used in a contingency operation while testing the feasibility of backfitting *Spruance*-class destroyers with a version of the advanced gun system. Such an approach would also be in keeping with the Department's avowed interest in transformation and spiral development while making use of ships with useful service life remaining.

Most important, however, would be the fact that the application of the advanced gun system to the *Spruance*-class destroyer could provide, until DD(X) destroyers are fielded in numbers, the Marine Corps the fire support capability that has been missing since the decommissioning of the battleships in the early 1990s.

Report on initiatives to increase operational days of Navy ships (sec. 1023)

The committee recommends a provision that would require the Assistant Secretary of Defense for Acquisition, Technology and Logistics to report to the congressional defense committees, with submission of the President's budget request for fiscal year 2004, on the feasibility and projected impact of initiatives to maximize ship operational days.

The Chairman and Ranking Member of the Subcommittee on Seapower sent a letter to the Secretary of the Navy and the Chief of Naval Operations requesting the Navy to explore, at least, the following four focus areas to determine whether additional operational days could be made available to the regional commanders in chief without increasing the number of ships and without increasing the length of six-month deployments:

(1) Assign additional ships and submarines to homeports closer to their areas of operation. This is sometimes referred to as forward homeporting.

(2) Assign a ship to remain in a forward area of operations and rotate crews. Although not typically rotated in forward operating areas, the dual-crewing or "blue" and "gold" crews on ballistic missile submarines (SSBNs) are an example of such a concept.

(3) Retain ships to the end of their full service life by investing in the support funding needed to keep them. For example, keeping DD–963s in active service might make sense for the capabilities they provide (such as presence and antisubmarine warfare capability), rather than retiring them because they are not adequate to meet certain threats (because they do not have the very latest anti-air warfare systems).

(4) Preposition additional ships in forward operating areas that would be maintained by very small crews during normal circumstances. This concept would be analogous to the manner in which certain Ready Reserve Force (RRF) ships are kept ready to begin operations in just a few days.

The Seapower Subcommittee followed that letter with a hearing on the subject. The Navy witness in that hearing testified that some of the suggestions will be tested later this year because the Navy believes they will be productive. However, that testimony also led members to conclude that the Navy does not intend to investigate all of the focus areas suggested in the letter. This conclusion raised concerns that were amplified when it was revealed in written testimony that the Navy ship acquisition plan may be understated regarding requirements because the Navy is using an estimated ship service life of 35 years for planning but is executing a 20 to 22 years-of-age ship life decommissioning plan for destroyers and frigates.

According to the Congressional Research Service, the difference in estimated ship service life would cause the Navy to face an additional 15-ship backlog just between now and fiscal year 2007. That additional backlog would result in the requirement to build 15.5 new construction ships each year, starting in fiscal year 2008, merely to keep the force structure at about 300 battle force ships.

The Congressional Budget Office Study, "Increasing the Mission Capability of the Attack Submarine Force" validates the potential for one of the above focus areas.

Therefore, the committee concludes that: (1) there may be other means of increasing operational days for the regional commanders in chief; and, (2) all the possible alternatives should be thoroughly investigated and, when appropriate, tested.

SUBTITLE C—REPORTING REQUIREMENTS

Repeal and modification of various reporting requirements applicable with respect to the Department of Defense (sec. 1031)

The committee recommends a provision that would repeal or modify 28 obsolete or superceded reporting requirements presently

imposed by statute upon the Department of Defense (DOD). The reports recommended for repeal include:

(1) Prohibition on Certain Civilian Personnel Management Constraints (10 U.S.C. 129);

(2) Advisory Committees of the Department of Defense: Annual Report (10 U.S.C. 183);

(3) Amounts for Declassification of Records (10 U.S.C. 230);

(4) Authorized Strength: General and Flag Officers on Active Duty (10 U.S.C. 526(c));

(5) General and Flag Officers: Limitations on Appointments, Assignments, Details Outside an Officer's Own Service (10 U.S.C. 721(d));

(6) Health Care Services Recovered on Behalf of Covered Beneficiaries: Collection from Third-Party Payers (10 U.S.C. 1095(g));

(7) Child Care Services and Youth Program Services for Dependents: Financial Assistance for Survivors (10 U.S.C. 1798(d));

(8) Child Care Services and Youth Program Services for Dependents: Participation by Children and Youth Otherwise Ineligible (10 U.S.C. 1799(d));

(9) Performance Based Management: Acquisition Programs (10 U.S.C. 2220);

(10) Cooperative Research and Development Projects-subsection (g) (10 U.S.C. 2350a(g)(4));

(11) Procurement of Communications Support and Related Supplies and Services (10 U.S.C. 2350f(c));

(12) Armed Forces Relocation in Foreign Nation Report (10 U.S.C. 2350k(d));

(13) Federally Funded Research and Development Center Workload Effort (10 U.S.C. 2367(d));

(14) Military Base Reuse Studies and Community Planning Assistance (10 U.S.C. 2391(c));

(15) Department of Defense Technology and Industrial Base Policy (10 U.S.C. 2504);

(16) Asia-Pacific Center for Security Studies: Acceptance of Foreign Gifts and Donations (10 U.S.C. 2611);

(17) Leases: Non-excess Property of Military Departments (10 U.S.C. 2667(d)(3));

(18) Acquisition of Existing Facilities in Lieu of Authorized Construction-Notice (10 U.S.C. 2813(c));

(19) Relocation of Military Family Housing Units (10 U.S.C. 2827(b));

(20) Sale of Electricity from Alternate Energy and Cogeneration Production Facilities (10 U.S.C. 2867(c));

(21) Academy of Health Sciences: Admission of Civilians in Physician Assistant Training Program (10 U.S.C. 4416(f));

(22) Temporary Promotions in Certain Navy Lieutenants: Limitation on Number of Eligible Positions (10 U.S.C. 5721(f));

(23) Prohibition on Imposition of Additional Charges of Fees for Attendance at Certain Academies (P.L. 103–337; 108 Stat. 2772; 10 U.S.C. 6951 note);

(24) Weapons Development and Procurement Schedules (P.L. 104–106; 110 Stat. 229, 231; 10 U.S.C. 2431 note).

In addition to those reports to be repealed in full, the committee recommends repeal after 2004 of the report, Contracted Properties and Services: Prompt Payment of Vouchers (P.L. 106–398 Appendix; 114 Stat. 1654A–247; 10 U.S.C. 2226 note). The committee also recommends that section 483 of title 10, United States Code, be repealed two years after enactment of the present provision. The Secretary of Defense currently submits to the congressional defense committees reports on funding transfers from high-priority readiness items. The committee notes that the Department of Defense provides various other detailed reports to Congress, including the rebaseline report, reprogramming requests, and monthly execution status reports; these reports also provide information on funding transfers from high-priority readiness items. The committee is concerned, however, that DOD has not provided any reports that include funding transfers on high-priority readiness items to the committee in a consistent and timely manner. The committee makes this recommendation with the understanding that DOD will provide all reports which include funding transfers on high-priority readiness items to the committee in accordance with statutory requirements.

In addition to various repeals, the committee recommends that certain required reports be modified to reflect the most current and relevant reporting requirements. Sections 2486 (b) and 2492 (c) of title 10, United States Code, would be amended to no longer require annual submission of these various commissary reports. In section 2486 (b), the provision would require submission of the report only when changes are proposed or made to merchandise categories proposed to be made for sale in commissaries. Similarly, in section 2492(c), the provision would require submission of the report only when changes are proposed or made to host nation laws or conditions in host nations that affect restrictions on commissary purchasing in stores located outside of the U.S.

The committee carefully reviewed the Department's request to repeal these various reports. The criterion for the review was to relieve the Department of the burden of preparing a report whenever possible, consistent with the committee's oversight and legislative responsibilities. The committee notes, however, that there are a number of important reporting requirements for which either no report or only an interim report has been received. Foremost among such reports is the Secretary of Defense's annual report to the President and to Congress as required by section 113(c) of title 10, United States Code. The Secretary's annual report, which traditionally incorporates a number of other statutory reports, is a major source of important information for Congress. The committee also notes the continuing absence of a National Security Strategy, required to be submitted by the President in the annual national security strategy report under section 108 of the National Security Act of 1947 as added by the Goldwater-Nichols Department of Defense Reorganization Act of 1986. Without these important reports, Congress cannot gain a clear understanding of the Administration's national security strategy or its long-term plans for our Armed Forces. The Committee looks forward to receipt of the Secretary's annual report to the President and to Congress and the President's national security strategy.

Annual report on hardened and deeply buried targets (sec. 1032)

The committee recommends a provision that would require the Secretary of Defense, in conjunction with the Secretary of Energy and the Director of Central Intelligence, to submit a report on the research and development activities under their respective jurisdictions during the preceding fiscal year to develop a weapon to defeat hardened and deeply buried targets. The report would be submitted no later than April 1 of each year.

The committee is concerned that each of the three agencies is spending substantial amounts of money for a wide variety of hardened and deeply buried target-related activities within each agency. The committee is concerned that there is no central coordination or even any centralized knowledge of these many programs and their scope and cost. Dealing with the issue of hardened and deeply buried targets is a significant technical challenge, but it is not a new one. The issue has, however, come to the forefront as a result of the recent actions in Afghanistan. The committee is concerned that these programs do not appear to be well coordinated. The committee believes this report will be useful to ensure that this issue is addressed in a coordinated way to meet established requirements and that the funds are spent efficiently.

Revision of date of annual report on counterproliferation activities and programs (sec. 1033)

The committee recommends a provision that would revise the submission date for the annual report of the Counterproliferation Program Review Committee (CPRC) from February 1 of each year to May 1 of each year. This later date was the original date by which the CPRC annual report was required. In fiscal year 2000, Congress revised the submission date to February 1, but the Department of Defense has not submitted the CPRC annual reports until May of each year. The committee understands that the annual report is prepared after the budget request is submitted each year in order to make use of funding figures from the Future Years Defense Program (FYDP); the report therefore cannot be submitted along with the budget request. The committee believes that an achievable report deadline is preferable to an unachievable one. The committee recommends this change with the expectation that the Department of Defense will provide briefings to the congressional defense committees on the updated elements of the annual report, such as the Areas for Capability Enhancements (ACEs), when they have been decided by the CPRC. The committee directs the Department to notify the congressional defense committees each year when the CPRC has decided these elements prior to submission of the final report.

Quadrennial quality of life review (sec. 1034)

The committee recommends a provision that would require the Secretary of Defense to conduct a quadrennial quality of life review to examine the quality of life of members of the Armed Forces. The review would alternate with the quadrennial defense review so that one of these reviews would occur every two years. The recommended provision requires the Secretary of Defense to submit a

report on each quadrennial quality of life review to the Committees on Armed Services of the Senate and the House of Representatives no later than September 30 of the year in which the review is conducted.

SUBTITLE D—HOMELAND DEFENSE

Homeland security activities of the National Guard (sec. 1041)

The committee recommends a provision that would add a new section to title 32, United States Code, to authorize the Governor of a State, at the request of the head of a federal law enforcement agency and with the concurrence of the Secretary of Defense, to order personnel of the National Guard of a State to perform full-time National Guard duty for the purpose of carrying out homeland security activities. The intent would be to temporarily provide trained and disciplined personnel to a federal law enforcement agency until that agency is able to recruit and train sufficient personnel to perform the homeland security activities. The duration of the use of the National Guard of a State would be 179 days, but the Governor of a State could, with the consent of the Secretary of Defense, extend the period for an additional 90 days to meet extraordinary circumstances. The Secretary of Defense would provide funds to the State Governor to fund the costs of the use of the National Guard personnel and would require the head of the federal law enforcement agency receiving the support to reimburse the Department of Defense. Finally, the Secretary of Defense and the Governor of a State would enter into a memorandum of agreement, with each federal agency involved, covering specified matters including certifications by appropriate state officials as to the authorization under state law of the performance by the National Guard of the State of the homeland security activities involved.

The committee is aware that the Department of Defense has detailed approximately 1,600 personnel of the National Guard under their title 10, United States Code, federal status to several federal law enforcement agencies to perform homeland security activities along the borders of the United States. The National Guard personnel involved are under the overall supervision of, and perform duties under the direction and control of, the federal law enforcement agencies to which they are detailed. The Department of Defense and the federal agencies involved consider this arrangement to be consistent with the Posse Comitatus Act (18 U.S.C. 1385).

The committee believes that it is preferable to use National Guard personnel under their title 32, United States Code, status and under the authority of the State Governor, as has been the practice for more than a decade in connection with counterdrug activities authorized under the provisions of section 112 of title 32, United States Code.

Conditions for use of full-time reserves to perform duties relating to defense against weapons of mass destruction (sec. 1042)

The committee recommends a provision that would amend section 12310(c)(3) of title 10, United States Code, to strike a ref-

erence to the Department of Defense Consequence Management Program Integration Office (COMPIO). This amendment reflects the fact that the Deputy Secretary of Defense disestablished COMPIO on February 14, 2001, directing that its functions be integrated into existing Department of Defense organizations and processes to ensure greater effectiveness and oversight of programs.

The amended paragraph would authorize reserve personnel to perform duties described elsewhere in the section only while assigned to a reserve component Weapons of Mass Destruction-Civil Support Team in the United States, its territories, the District of Columbia and the Commonwealth of Puerto Rico.

Weapon of mass destruction defined for purposes of the authority for use of Reserves to perform duties relating to defense against weapons of mass destruction (sec. 1043)

The committee recommends a provision that would change the definition of the term "weapon of mass destruction" in sections 12304 and 12310 of title 10, United States Code, so as to include any large conventional explosive that is designed to produce catastrophic loss of life or property.

Report on Department of Defense homeland defense activities (sec. 1044)

Studies conducted by the Comptroller General over the last year and testimony from Department of Defense (DOD) officials have indicated that the Department still needs to clarify the structure, strategy, roles and responsibilities, and relationships among the various DOD entities that carry out the missions related to combating terrorism, homeland security, and homeland defense.

The committee believes that, in light of the proposed changes to the Unified Command Plan, expected changes to the structure of the Office of the Secretary of Defense, and the continued lack of clarity concerning the relationship between the Defense Department and other agencies or offices of the federal government responsible for homeland security or defense, a deeper examination of the Department's role in and capabilities for fulfilling its homeland defense mission is needed. Therefore, the committee recommends a provision that would direct the Secretary to submit a detailed report on how DOD should be and is fulfilling its homeland defense mission.

Strategy for improving preparedness of military installations for incidents involving weapons of mass destruction (sec. 1045)

A Department of Defense (DOD) study of the Installation Pilot Program, mandated by the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (PL 106–398), revealed a lack of preparedness of military installations to manage the consequences of a weapon of mass destruction (WMD) incident. The study demonstrated that standards, priorities and implementation schedules varied from service to service and from installation to installation. In a follow-up study, mandated by the National Defense Authorization Act for Fiscal Year 2002 (PL 107–333), the Comptroller General found that DOD does not have an overall manage-

ment framework to improve WMD preparedness at military installations and that overall funding of WMD preparedness at military installations lacks visibility. The study concluded that without a clear WMD preparedness strategy for military installations there is a potential for duplication, inappropriate allocation of resources, and reduction or loss of preparedness. In addition, without a performance plan that includes goals, objectives, and performance measures, Congress and DOD managers cannot measure the results of programs and identify funding levels and priorities. The Comptroller General recommended that DOD prepare a comprehensive strategy and plan for improving the preparedness of military installations in responding to attacks involving weapons of mass destruction.

Therefore, the committee recommends a provision that would direct the Secretary of Defense to develop a comprehensive plan to improve the preparedness of military installations for incidents involving weapons of mass destruction (WMD). The plan would: (1) include a strategy identifying long-term objectives and resource requirements; (2) describe how local, regional and national military response capabilities will be developed and used and how DOD will coordinate the use of military capabilities with local, regional, and national civilian capabilities, including private industry, where appropriate; (3) include a performance plan designed to achieve the objectives of the strategy, as well as a timetable for implementation; and (4) establish measurable goals, describe the process and resources required to attain those goals, identify performance measures required to attain those goals, and describe the process for evaluating results.

The plan would be submitted to the congressional defense committees no later than 180 days after this legislation comes into effect. No later than 60 days after the Secretary submits the plan to Congress, the Comptroller General would be required to review it and submit a report assessing the plan to the congressional defense committees.

The Secretary would be directed to inform Congress of progress under and updates to the plan for a total of three years in the materials the Secretary submits to Congress in support of the President's annual budget request.

SUBTITLE E—OTHER MATTERS

Continued applicability of expiring governmentwide information security requirements to the Department of Defense (sec. 1061)

The committee recommends a provision that would continue the applicability of expiring governmentwide information security requirements to the Department of Defense (DOD).

Subtitle G of Title X of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 enacted a new Government Information Security Reform Act (GISRA), addressing the responsibilities of the Office of Management and Budget and federal agencies (including DOD) in the area of information security. These provisions are scheduled to expire later this year.

The DOD Inspector General's annual report to Congress recommends that the expiring requirements of GISRA be extended. The report states:

> Although implementing GISRA has been difficult, the OIG, DOD, believes that its mandatory reporting requirements have refocused the Department's attention on this critical area. Until it was passed, we were very concerned that information security was a declining priority. * * *
>
> [W]e believe that the information assurance threat is greater than ever, and mandatory self assessments, with independent review, serve the Department's best interest. Therefore we recommend continuation of the core GISRA requirements.

The provision recommended by the committee would implement the Inspector General's recommendation.

Acceptance of voluntary services of proctors for administration of Armed Services Vocational Aptitude Battery (sec. 1062)

The committee recommends a provision that would authorize the service secretaries to accept voluntary services of secondary school faculty and other personnel to serve as proctors for the administration of the Armed Services Vocational Aptitude Battery.

Extension of authority to sell aircraft and aircraft parts for use in responding to oil spills (sec. 1063)

The committee recommends a provision that would extend until September 30, 2006, the authority in section 740 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (P.L. 106–181) to the Secretary of Defense to sell excess aircraft and aircraft parts to a person or entity that provides oil spill response services.

Amendments to impact aid program (sec. 1064)

The committee recommends a provision that would authorize continued eligibility of certain local education agencies for impact aid during temporary reductions in qualified students during the conversion of military housing units to private housing.

Additional Matters of Interest

Improved management of Department of Defense contracting for services

On June 22, 2001, the Secretary of Defense launched a Business Initiative Council to bring about better business practices and achieve savings within the Department of Defense (DOD). Testifying before this Committee on June 28, 2001, the Secretary stated:

> We have an obligation to taxpayers to spend their money wisely. Today we're not doing that. * * * Mr. Chairman, I have never seen an organization, in the private or public sector, that could not, by better management, operate at least five percent more efficiently if given the freedom to do so. Five percent of the DOD budget is over $15 billion!

The Secretary testified that $15.0 billion of savings from management efficiencies could be used to: increase ship procurement from six to nine ships a year; procure several hundred additional aircraft annually, rather than 189; meet the target of a 67-year facility replacement rate; and increase defense-related science and technology funding from 2.7 percent to 3 percent of the DOD budget.

The committee is disappointed that, to this date, the Business Initiative Council has identified only an estimated $121.0 to $132.0 million of the $15.0 billion annual savings projected by the Secretary. Despite the largest proposed increase in defense spending in 20 years, the budget request would fund just five ships and 166 aircraft, replace facilities at a 122-year rate, and leave the rate of defense-related science and technology funding unchanged at just 2.7 percent of the DOD budget. The committee concludes that, despite the proposed $48.0 billion increase in defense spending, management efficiencies are needed now more than ever to ensure that the taxpayers' money is wisely spent.

Section 802 of the National Defense Authorization Act for Fiscal Year 2002 (FY 2002 NDAA) established annual goals for Department of Defense savings to be achieved through improved management of the Department's $50.0 billion of services contracts. The Secretary of Defense was required to report to the congressional defense committees no later than March 1, 2002, on the Department's progress toward this goal. Unfortunately, this report, which was not submitted until May 1, 2002, states that the Department is unable to provide the required information.

Sections 801 and 803 of the FY 2002 NDAA established the management tools needed to achieve these savings, including the increased use of performance-based services contracting; required competition for task orders under contracts for services; enhanced data collection, program review, and spending analyses; and an improved management structure for services contracts. These tools would be enhanced by section 811 of this Act, which establishes specific goals for competitive contracting and performance-based contracting.

The statutory goal for fiscal year 2003 is a savings of 4 percent, or $1.7 billion. The budget request does not provide for any of these savings. While $1.7 billion is far less than the Secretary's goal of $15.0 billion in annual savings for management efficiencies, the committee believes that this level of savings should be achievable in fiscal year 2003. To ensure that the military services and defense agencies have an incentive to achieve these savings, the committee bill would permit them to retain half of the required savings.

Accordingly, Titles I, II and III of the bill include reductions totaling $850.0 million, to be achieved through improved management of the Department's services contracts. The specific reductions reflected in these titles are as follows:

Army Procurement Accounts—$31.0 million;
Navy Procurement Accounts—$24.4 million;
Air Force Procurement Accounts—$2.1 million;
Defense-Wide Procurement Accounts—$1.5 million;
Research and Development, Army—$13.7 million;

Research and Development, Navy—$6.9 million;
Research and Development, Air Force—$45.2 million;
Research and Development, Defense-wide—$25.2 million;
Operation and Maintenance, Army—$192.5 million;
Operation and Maintenance, Navy—$152.3 million;
Operation and Maintenance, Air Force—$211.4 million;
Operation and Maintenance, Marine Corps—$16.3 million;
Operation and Maintenance, Defense-Wide—$127.5 million.

The Committee expects the Department to distribute these reductions across budget activities and programs within the relevant appropriations accounts, based on the dollar value of contracts within those budget activities and programs to which improvements may be appropriately applied.

Information technology investments for functional area applications

Less than a year ago, the Department of Defense (DOD) initiated an ambitious effort to address shortcomings in the Department's financial management systems, operations, and controls. The Department's time line called for the development of a comprehensive enterprise architecture and a transition plan for implementing the proposed architecture by March 2003. The proposed architecture would then be implemented over a period of four years or more.

The committee strongly supports the Department's efforts to address shortcomings in its financial systems on a comprehensive basis. The committee shares the Department's view that problems with the reliability of financial and feeder systems data and interfaces between these systems must be addressed in order to ensure proper accountability and control over its physical assets, proper accounting for the costs of operations, and proper recording and reconciling of disbursements.

The committee also recognizes that the implementation of a new enterprise architecture for DOD financial management, accounting, and feeder systems will require substantially increased funding on such systems over the course of the Future Years Defense Plan. Until the proposed architecture has been developed, however, excessive spending on such systems is likely to be wasteful.

The Comptroller General of the United States testified before the Readiness Subcommittee that the Department should limit the additional business systems development that the Department undertakes before a new enterprise architecture has been approved. The DOD Comptroller testified that he agreed with this statement and that he had already taken some steps to limit spending on business systems development until the proposed architecture and transition plan have been completed.

Section 1006 would help enforce these limitations by requiring that any such expenditures be approved in advance by the Department's Financial Management Modernization Executive Committee. In accordance with the testimony of the Comptroller General and the DOD Comptroller, this provision would limit expenditures to those that are necessary to address critical national security requirements or prevent significant adverse effects on ongoing projects.

The budget request included more than $2.0 billion for information technology investments for functional area applications, an amount that is barely reduced from the $2.1 billion provided in fiscal year 2002. This amount includes funding for a large number of programs that may require fundamental restructuring depending on the outcome of the Department's current financial management review and the system architecture that the Department develops.

For example, the budget request included $196.5 million for the Defense Logistics Agency (DLA) business systems modernization program, which is expected to cost more than $1.0 billion by the time that it is completed. The General Accounting Office (GAO) reported last year that this program is being conducted "without having either a DLA enterprise architecture or a DOD-wide logistics management enterprise architecture." The GAO report concluded that

> By allowing the services and DLA * * * to proceed separately with new logistics management systems in the absence of a DOD-wide enterprise architecture, DOD will not be in a position to optimize logistics operations and system performance across the department, and thus is unlikely to successfully meet its strategic logistics management goals.

Similarly, the budget request included $128.4 million for Defense Finance and Accounting Service (DFAS) development modernization, $439.4 million for Army functional area application development modernization, $367.4 million for Navy functional area application development modernization, and $229.8 million for Air Force functional area application development modernization. These expenditures are the leading edge of a much larger investment, which, the DOD Inspector General concluded earlier this year, is unlikely to lead to properly integrated systems. The Inspector General's report concludes:

> DOD continues to develop [the DFAS Corporate Database (DCD)] and other financial management systems, which will not establish an integrated financial management system. Specifically,
>
> > The Defense Logistics Agency stated its $1 billion supply chain management system could not work with DCD and other standard systems;
> >
> > The Army and Navy did not determine whether their $975 million financial management systems could work with DCD and other standard systems.
> >
> > The Defense Finance and Accounting Service Denver personnel want to develop a $16 million Air Force-specific financial management system to replace DCD.
>
> As a result, DOD components are spending more than $2 billion to develop systems with no assurance that the financial portions of the systems will function as an integrated financial management system.

The committee shares the concern of the DOD Inspector General that DOD components are requesting more than $2.0 billion to develop new financial systems with no assurance that these systems will function as an integrated financial management system. For

this reason, the committee believes that the level of funding provided for functional area applications in advance of the development of a comprehensive system architecture is excessive.

Accordingly, the committee recommends reductions in Titles I, II and III of the bill totaling $400.0 million, in proportion to proposed spending on information technology development modernization for functional area applications in each accounts. The specific reductions reflected in these titles are as follows:

Other Procurement, Army—$53.2 million;
Other Procurement, Navy—$20.6 million;
Other Procurement, Air Force—$12.0 million;
Procurement, Marine Corps—$3.4 million;
Other Procurement, Defense-Wide—$3.5 million;
Research and Development, Army—$17.7 million;
Research and Development, Navy—$25.6 million;
Research and Development, Air Force—$27.2 million;
Research and Development, Defense-Wide—36.6 million;
Defense Health Programs—$32.1 million;
Defense Working Capital Fund Operations—$148.6 million;
Operation and Maintenance, Defense-Wide—$19.5 million.

The committee expects the Department to achieve these reductions by implementing the requirements of section 1006 and restricting the development of Department of Defense business systems until the Department has completed its proposed architecture and transition plan and is in a position to ensure that business system expenditures will be consistent with that architecture and plan.

Defense Emergency Response Fund

The President's budget request included $20.1 billion in the operation and maintenance title for the Defense Emergency Response Fund (DERF) for fiscal year 2003. Of this amount, $10.1 billion was requested for specific programs and $10.0 billion was requested as unspecified contingency funding for continuing the war on terrorism into fiscal year 2003.

The decision to appropriate funding to, and obligate funding directly from, the DERF in fiscal year 2002 was well intentioned and unavoidable under the unique circumstances that prevailed in the fall of 2001. However, the committee is concerned that obligation of funds directly from the DERF in fiscal year 2002 has reduced management oversight and accountability of those funds without any significant offsetting benefits, such as greater efficiency.

The $10.1 billion that was requested for specific programs in the DERF represented funding that normally appears throughout the defense authorization bill, including the procurement, research and development, operation and maintenance, military personnel, and military construction accounts. The committee believes that these programs should be funded and executed in their normal accounts. The committee found no compelling reason to authorize funding for programs through the DERF in fiscal year 2003 and recommends that all funding requested for specific programs in the DERF be transferred to the traditional appropriations accounts.

The committee's action with respect to the unspecified $10.0 billion contingency fund, which would be available to fund the costs

of ongoing military operations as well as the additional pay and benefits of mobilized guard and reserve personnel, is discussed separately in this section of the report. The committee believes that any subsequent appropriation of all or part of this $10.0 billion contingency should make such funds available for transfer to the traditional appropriation accounts before they are obligated.

The table that follows details the committee's action with respect to the DERF. The table lists each program for which funding was requested in the DERF, the amount the committee has authorized for that program, if any, and the account in which the funds have been authorized.

The report language following the table discusses those programs requested in the DERF for which no funds were authorized. Report language describing changes to other programs requested in the DERF can be found under the heading of the account to which the funds were transferred.

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Counter-Terrorism/ Force Protection	Base Pay	963		963	Military Personnel, Army
Counter-Terrorism/ Force Protection	RPA	264		264	Military Personnel, Army
Counter-Terrorism/ Force Protection	FICA	73		73	Military Personnel, Army
Counter-Terrorism/ Force Protection	Perimeter Security	100,000		100,000	Military Construction, Army
Counter-Terrorism/ Force Protection	Force Protection	31,000		31,000	Reserve Personnel, Army
Counter-Terrorism/ Force Protection	Counter Terrorism/Force Protection Personnel	9,400		9,400	Operation & Maintenance, Army
Counter-Terrorism/ Force Protection	Access Control, Vulnerability Assessments	33,800	(13,800)	20,000	Operation & Maintenance, Army Reserve
Counter-Terrorism/ Force Protection	Heavy Armored Sedan	10,700	(2,400)	8,300	Other Procurement, Army
Counter-Terrorism/ Force Protection	SINCGARS Family	22,100	(22,100)	0	Other Procurement, Army
Counter-Terrorism/ Force Protection	Physical Security System	4,500		4,500	Other Procurement, Army
Counter-Terrorism/ Force Protection	Language translation	7,300		7,300	RDT&E, Army
Counter-Terrorism/ Force Protection	Blue Force awareness suite	10,000		10,000	RDT&E, Army
Counter-Terrorism/ Force Protection	Remote observation & confirming sensors	600		600	RDT&E, Army
Counter-Terrorism/ Force Protection	Physical Security Equipment	76,900		76,900	Operation & Maintenance, Army
Counter-Terrorism/ Force Protection	Installation Security	2,900		2,900	Operation & Maintenance, Army Reserve
Counter-Terrorism/ Force Protection	Security	350,000		350,000	Operation & Maintenance, Army National Guard
Counter-Terrorism/ Force Protection	Multi-function remote unattended ground sensor	1,500		1,500	RDT&E, Army
Counter-Terrorism/ Force Protection	Laser induced breakdown spectroscopy	1,500		1,500	RDT&E, Army
Counter-Terrorism/ Force Protection	Universal soldier	8,000		8,000	RDT&E, Army
Counter-Terrorism/ Force Protection	CT echelon surveillance & reconnaissance	20,000	(5,000)	15,000	RDT&E, Army
Counter-Terrorism/ Force Protection	Security Forces and Technicians	143,096		143,096	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Law Enforcement	32,573		32,573	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Management and Planning	1,712		1,712	Operation & Maintenance, Navy

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Counter-Terrorism/ Force Protection	Security Forces and Technicians	1,500		1,500	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Strategic Security Forces and Technicians	7,000		7,000	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Site Improvement	219,200		219,200	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Site Improvement	42,000		42,000	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	HQ Management and Planning	3,920		3,920	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Site Improvement	13,000		13,000	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Intel/Security and Investigative Matters	3,500		3,500	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	HQ Management and Planning	1,600		1,600	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Management and Planning	61		61	Operation & Maintenance, Navy Reserve
Counter-Terrorism/ Force Protection	Management and Planning	187		187	Operation & Maintenance, Navy Reserve
Counter-Terrorism/ Force Protection	Shipyard Security Forces & Technicians	28,000		28,000	Operation & Maintenance, Navy
Counter-Terrorism/ Force Protection	Physical Security Site Improvement	68,777		68,777	Operation & Maintenance, Navy Reserve
Counter-Terrorism/ Force Protection	Physical Security Equipment	228,000		228,000	Operation & Maintenance, Marine Corps
Counter-Terrorism/ Force Protection	CINC AT/FP Staffs	3,200		3,200	Operation & Maintenance, Marine Corps
Counter-Terrorism/ Force Protection	Physical Security Upgrades	10,000		10,000	Operation & Maintenance, Marine Corps
Counter-Terrorism/ Force Protection	Security Forces Technicians	600		600	Military Personnel, Marine Corps
Counter-Terrorism/ Force Protection	Physical Security Site Improvement	183,100		183,100	Military Construction, Navy
Counter-Terrorism/ Force Protection	Design of Physical Security Site Improvement	17,630		17,630	Military Construction, Navy
Counter-Terrorism/ Force Protection	Physical Security Site Improvement	6,740		6,740	Military Construction, Navy Reserve
Counter-Terrorism/ Force Protection	Design of Physical Security Site Improvement	377		377	Military Construction, Navy Reserve
Counter-Terrorism/ Force Protection	Physical Security Equipment for the Mobile Security Force	14,000		14,000	Other Procurement, Navy
Counter-Terrorism/ Force Protection	Physical Security Equipment for Strategic Bases	4,000		4,000	Other Procurement, Navy
Counter-Terrorism/ Force Protection	Physical Security Equipment	76,483		76,483	Other Procurement, Navy

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Counter-Terrorism/ Force Protection	Coast Guard Support Night Vision Devices (NVDs)	4,000		4,000	Other Procurement, Navy
Counter-Terrorism/ Force Protection	Coast Guard Small Arms Procurement	3,000		3,000	Weapons Procurement, Navy
Counter-Terrorism/ Force Protection	Coast Guard Small Arms Ammunition	1,000		1,000	Procurement of Ammunition, Navy & Marine Corps
Counter-Terrorism/ Force Protection	Physical Security Upgrades	3,600		3,600	Procurement, Marine Corps
Counter-Terrorism/ Force Protection	Technology, Unmanned Surface Vehicle	36,000	(12,000)	24,000	RDT&E, Navy
Counter-Terrorism/ Force Protection	Security Equipment for Medical Labs	475		475	RDT&E, Navy
Counter-Terrorism/ Force Protection	Site Improvement for Medical Labs	450		450	RDT&E, Navy
Counter-Terrorism/ Force Protection	CENTCOM PSD & Forward HQs	700		700	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	CINC AT/FP Staff	5,500		5,500	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AT/FP Equipment Enhance/Modernize	7,200		7,200	Other Procurement, Air Force
Counter-Terrorism/ Force Protection	Base Physical Security Systems	39,600		39,600	Other Procurement, Air Force
Counter-Terrorism/ Force Protection	AEF/Force Protection Certification Training	10,200		10,200	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AEF/Force Protection Certification Training	4,800		4,800	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AEF/Force Protection Certification Training	2,900		2,900	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AT/FP Facility Upgrades	99,585		99,585	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AT/FP Facility Upgrades	57,254		57,254	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AT/FP Facility Upgrades	16,341		16,341	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AT/FP Facility Upgrades	3,976		3,976	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	AT/FP Facility Upgrades	29,631		29,631	Family Housing Operations & Debt, AF
Counter-Terrorism/ Force Protection	AT/FP Facility Upgrades	6,202		6,202	Operation & Maintenance, Air Force Reserve
Counter-Terrorism/ Force Protection	AT/FP Facility Upgrades	38,015		38,015	Operation & Maintenance, Air National Guard
Counter-Terrorism/ Force Protection	AT/FP Military Construction	185,597		185,597	Military Construction, Air Force
Counter-Terrorism/ Force Protection	AT/FP Military Construction	6,076		6,076	Military Construction, Air Force Reserve

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Counter-Terrorism/ Force Protection	AT/FP Military Construction	8,933		8,933	Military Construction, Air National Guard
Counter-Terrorism/ Force Protection	Weapons of Mass Destruction - 1st Responder	46,000		46,000	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	Weapons of Mass Destruction - 1st Responder	21,850		21,850	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	Weapons of Mass Destruction - 1st Responder	1,150		1,150	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	Weapons of Mass Destruction - 1st Responder	4,600		4,600	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	Weapons of Mass Destruction - 1st Responder	14,950		14,950	Operation & Maintenance, Air Force Reserve
Counter-Terrorism/ Force Protection	GeoReach/GeoBase	25,800		25,800	Operation & Maintenance, Air Force
Counter-Terrorism/ Force Protection	Financial Operations	5,900		5,900	Operation & Maintenance, Defense-Wide
Counter-Terrorism/ Force Protection	Security Guards	1,910		1,910	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Contract Security Guards	230		230	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Contract Security Guards	60		60	Defense Working Capital Fund, Defense/Stockpile
Counter-Terrorism/ Force Protection	Vulnerability Assessments	300		300	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Consequence Mgmt Training	300		300	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Access Control Systems	1,880		1,880	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Intrustion Detection Systems	545		545	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Barriers	50		50	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Fragment Retention Film	25		25	Defense Working Capital Fund, Defense
Counter-Terrorism/ Force Protection	Enhanced Force Protection	18,000		18,000	Operation & Maintenance, Defense-Wide
Counter-Terrorism/ Force Protection	Enhanced Force Protection	6,000		6,000	Operation & Maintenance, Defense-Wide
Counter-Terrorism/ Force Protection	Enhanced Force Protection	6,300		6,300	Military Construction, Defense-Wide
Counter-Terrorism/ Force Protection	Enhanced Force Protection	200		200	Operation & Maintenance, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Counter-Terrorism/ Force Protection	Advanced CBRNE Sensor & Info Fusion	3,000		3,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	CT Info Network	5,500		5,500	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Vulnerability Reduction Technology Measures	9,800		9,800	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Hazard Prediction and Decision Support Tools	5,000		5,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Hard Target Defeat Characterization Initiative	7,000		7,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Enhanced Blast Weapons Effects	7,000		7,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	SOF Support Defeat Terrorist	11,000		11,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Anti-Biological Weapon Defeat Device	5,000		5,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Combating Terrorism Readiness Initiatives Fund	12,000		12,000	Operation & Maintenance, Defense-Wide
Counter-Terrorism/ Force Protection	Other Combating Terrorism Initiatives	1,459		1,459	Operation & Maintenance, Defense-Wide
Counter-Terrorism/ Force Protection	Vulnerability Assessments, AT/FP requirements tracking & analysis	400		400	Operation & Maintenance, Defense-Wide
Counter-Terrorism/ Force Protection	Physical Security Equipment	10,000		10,000	Procurement, Defense-Wide
Counter-Terrorism/ Force Protection	Entry Point Screening & Perimeter Protection	11,000		11,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Reconnaissance Tool Kit	19,500		19,500	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Super Zoom Digital Camera	6,000		6,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Combating Terrorism BAA	19,500		19,500	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Attribution CT Tools and Deployable Communications	5,600		5,600	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Detection of Bio Agents in Food	3,000		3,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Alternate Power Sources for Battery Charging	5,000		5,000	RDT&E, Defense-Wide
Counter-Terrorism/ Force Protection	Stand Off Surveillance Camera	2,000	(2,000)	0	RDT&E, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Counter-Terrorism/ Force Protection	Miniature Chemical Analysis Sys for Detection of Chembio agents in the Chemlab	2,600		2,600	RDT&E, Defense-Wide
	Subtotal Counter-Terrorism/Force Protection	**2,680,200**	**(57,300)**	**2,622,900**	
Guantanamo Bay, Cuba Operations	Base Support Services	38,500		38,500	Operation & Maintenance, Navy
Guantanamo Bay, Cuba Operations	Facilities Sustainment, Restoration and Modernization	2,500		2,500	Operation & Maintenance, Navy
Guantanamo Bay, Cuba Operations	Medical Operations	4,000		4,000	Operation & Maintenance, Navy
	Subtotal Guantanamo Operations	**45,000**		**45,000**	
CINC Homeland Security	Enhanced Secure Communications to Reserve Components	5,900		5,900	Operation & Maintenance, Army Reserve
CINC Homeland Security	Classified Network	86,200		86,200	Operation & Maintenance, Army National Guard
CINC Homeland Security	Classified Network	48,500	(40,000)	8,500	Operation & Maintenance, Army National Guard
CINC Homeland Security	Enhanced Secure Communications to Reserve Components	25,600	(8,000)	17,600	Operation & Maintenance, Army Reserve
CINC Homeland Security	Enhanced Secure Communications to Reserve Components	30,700		30,700	Operation & Maintenance, Army Reserve
CINC Homeland Security	Enhanced Secure Communications to Reserve Components	2,400		2,400	Operation & Maintenance, Army Reserve
CINC Homeland Security	Information Systems Security Program - ISSP	15,700		15,700	Other Procurement, Army
CINC Homeland Security	CINC for Homeland Security	41,000	(14,000)	27,000	Operation & Maintenance, Defense-Wide
CINC Homeland Security	Facility Refurbishment	25,000		25,000	Military Construction, Defense-Wide
CINC Homeland Security	C4I Equipment and Connectivity	15,000		15,000	Procurement, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
	Subtotal CINC Homeland Security	**296,000**	**(62,000)**	**234,000**	
Combat Air Patrol	**Combat Air Patrol**	**1,200,000**	**(820,000)**	**380,000**	Operation & Maintenance, Air Force
Preferred Munitions	Tomahawk Remanufacture	598,000		598,000	Weapons Procurement, Navy
Preferred Munitions	Physical Security Equipment	4,000		4,000	Weapons Procurement, Navy
Preferred Munitions	JDAM Kits	54,000		54,000	Procurement of Ammunition, Navy & Marine Corps
Preferred Munitions	Laser Guided Bomb (LGB) Kits	25,000		25,000	Procurement of Ammunition, Navy & Marine Corps
Preferred Munitions	JDAM Tail Kits	106,000		106,000	Procurement of Ammunition, Air Force
Preferred Munitions	General Purpose Bombs	25,000		25,000	Procurement of Ammunition, Air Force
	Subtotal Preferred Munitions	**812,000**		**812,000**	
Training Munitions	CTG, 5.56MM, All Types	9,305		9,305	Procurement of Ammunition, Army
Training Munitions	CTG, 7.62MM, All Types	2,199		2,199	Procurement of Ammunition, Army
Training Munitions	CTG, .50 CAL, All Types	4,021		4,021	Procurement of Ammunition, Army
Training Munitions	CTG, 40MM, All Types	5,369		5,369	Procurement of Ammunition, Army
Training Munitions	CTG, ARTY 105MM HE M1 W/O Fuze	1,637		1,637	Procurement of Ammunition, Army
Training Munitions	Grenades, All Types	3,221		3,221	Procurement of Ammunition, Army
Training Munitions	Signals, All Types	946		946	Procurement of Ammunition, Army
Training Munitions	Items Less than $5 Million	302		302	Procurement of Ammunition, Army
Training Munitions	Laser Guided Bomb Kits	36,300		36,300	Procurement of Ammunition, Navy & Marine Corps
Training Munitions	Procure Training Munitions	23,300		23,300	Procurement of Ammunition, Navy & Marine Corps

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Training Munitions	Procure Training Munitions	4,500		4,500	Procurement of Ammunition, Navy & Marine Corps
Training Munitions	Procure Training Munitions	1,900		1,900	Procurement of Ammunition, Navy & Marine Corps
	Subtotal Training Munitions	**93,000**		**93,000**	
Continuity of Ops	Alternate National Military Command Center	44,000		44,000	Operation & Maintenance, Army
Continuity of Ops	CONUS Support	2,000		2,000	Operation & Maintenance, Army
Continuity of Ops	CONUS Support	5,000		5,000	Operation & Maintenance, Army
Continuity of Ops	CONUS Support	2,000		2,000	Operation & Maintenance, Army
Continuity of Ops	Information Systems	215,000		215,000	Other Procurement, Army
Continuity of Ops	Distributed Common Ground System (DCGS)	9,000		9,000	Other Procurement, Army
Continuity of Ops	Items Less than $5 Million (TIARA)	2,000		2,000	Other Procurement, Army
Continuity of Ops	Information Systems Security Program - ISSP	3,000		3,000	Other Procurement, Army
Continuity of Ops	Various	2,000		2,000	Operation & Maintenance, Navy
Continuity of Ops	Various	5,000		5,000	Operation & Maintenance, Navy
Continuity of Ops	Various	7,000		7,000	Operation & Maintenance, Navy
Continuity of Ops	Various	2,000		2,000	Operation & Maintenance, Navy
Continuity of Ops	Continuity of Intel	1,000		1,000	Operation & Maintenance, Marine Corps
Continuity of Ops	Site R	1,000		1,000	Operation & Maintenance, Marine Corps
Continuity of Ops	Reserve Site C2, Cryptologic COOP	5,000		5,000	Operation & Maintenance, Navy Reserve
Continuity of Ops	Radio Bn MILCON	20,000		20,000	Military Construction, Navy
Continuity of Ops	Continuity of Intelligence	2,000		2,000	Procurement, Marine Corps
Continuity of Ops	Secure Wireless Communications Equipment	3,000		3,000	Other Procurement, Navy

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Continuity of Ops	Intelligence Support Equipment	4,000		4,000	Other Procurement, Navy
Continuity of Ops	VH-3D/VH-60D Comm Upgrade	1,500		1,500	RDT&E, Navy
Continuity of Ops	VH-3D/VH-60D Comm Upgrade	6,000		6,000	Aircraft Procurement, Navy
Continuity of Ops	Combat Air Intelligence Systems	2,300		2,300	Operation & Maintenance, Air Force
Continuity of Ops	Wireless Communications	3,000		3,000	Other Procurement, Air Force
Continuity of Ops	National Airborne Command Center (NAOC) Ground Network and Senior Level	10,000		10,000	Operation & Maintenance, Air Force
Continuity of Ops	Aircraft Communication Mods	3,600		3,600	Operation & Maintenance, Air Force
Continuity of Ops	Special Purpose Comms	2,000		2,000	Operation & Maintenance, Air Force
Continuity of Ops	UH-1 support, capital region	700		700	Operation & Maintenance, Air Force
Continuity of Ops	Tactical Information Program	5,000		5,000	Operation & Maintenance, Air Force
Continuity of Ops	Tactical Information Program	10,000		10,000	Other Procurement, Air Force
Continuity of Ops	Defense Reconnaissance Support Activities (SPACE)	10,000		10,000	Operation & Maintenance, Air Force
Continuity of Ops	Communications Systems Operators Training	500		500	Operation & Maintenance, Air Force
Continuity of Ops	Critical Database Backup	5,000		5,000	Operation & Maintenance, Defense-Wide
Continuity of Ops	Critical Database Backup	10,000		10,000	Procurement, Defense-Wide
Continuity of Ops	Secure Bandwidth	30,000		30,000	RDT&E, Defense-Wide
Continuity of Ops	Mobile Secure Communications	20,400		20,400	RDT&E, Defense-Wide
Continuity of Ops	Mobile Secure Communications	500		500	Procurement, Defense-Wide
Continuity of Ops	Secure Voice Teleconferencing System	2,500		2,500	Operation & Maintenance, Defense-Wide
Continuity of Ops	Secure Voice Teleconferencing System and Secure Telephone Equipment	1,000		1,000	Procurement, Defense-Wide
Continuity of Ops	Defense Conferencing Enhancement Program	8,900		8,900	Operation & Maintenance, Defense-Wide
Continuity of Ops	DISA Continuity of Operations	2,500		2,500	Operation & Maintenance, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Continuity of Ops	Bandwidth Expansion	7,600		7,600	Operation & Maintenance, Defense-Wide
Continuity of Ops	Bandwidth Expansion	7,400		7,400	Procurement, Defense-Wide
Continuity of Ops	Information Assurance	500		500	Operation & Maintenance, Defense-Wide
White House Communications	White House Communications	3,000		3,000	Operation & Maintenance, Defense-Wide
Continuity of Ops	OSD Continuity of Operations (COOP) Operations and Sustainment of critical systems.	18,000		18,000	Operation & Maintenance, Defense-Wide
Continuity of Ops	OSD Continuity of Operations (COOP)-Network improvements	9,000		9,000	Procurement, Defense-Wide
Continuity of Ops	National Capital Region Continuity of Operations (NCR COOP)	10,500		10,500	Operation & Maintenance, Defense-Wide
Continuity of Ops	National Infrastructure Protection Center (NIPC) Reserve Support	4,000		4,000	Operation & Maintenance, Defense-Wide
Continuity of Ops	National Infrastructure Protection Center (NIPC) DoD Detailees	4,000		4,000	Operation & Maintenance, Defense-Wide
Continuity of Ops	National Infrastructure Protection Center (NIPC) Crucial Player	1,600		1,600	RDT&E, Defense-Wide
Continuity of Ops	DERIS	2,000		2,000	RDT&E, Defense-Wide
	Subtotal Continuity of Operations	**537,000**		**537,000**	
Pentagon Accel./Virtual Pentagon	Pentagon Acceleration	114,000		114,000	Pentagon Reservation Maintenance Revolving Fund
Pentagon Accel./Virtual Pentagon	Command Communications Survivability Project (Virtual Pentagon)	214,000		214,000	Pentagon Reservation Maintenance Revolving Fund
	Subtotal Pentagon Acceleration	**328,000**		**328,000**	

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Unmanned Aerial Vehicles	Predator A	68,000		68,000	Aircraft Procurement, Air Force
Unmanned Aerial Vehicles	Pred SatCom Equip & Ground Control Station Equip	14,000		14,000	Aircraft Procurement, Air Force
Unmanned Aerial Vehicles	3rd Squadron Initial Spares	8,000		8,000	Aircraft Procurement, Air Force
Unmanned Aerial Vehicles	Hellfire Missiles for Predator	10,000		10,000	Missile Procurement, Air Force
Unmanned Aerial Vehicles	Predator A & B	10,000		10,000	RDT&E, Air Force
Unmanned Aerial Vehicles	Predator A & B	5,000		5,000	Military Construction, Air Force
Unmanned Aerial Vehicles	Predator O&M	9,000		9,000	Operation & Maintenance, Air Force
Unmanned Aerial Vehicles	Global Hawk UAV	65,000		65,000	Aircraft Procurement, Air Force
	Subtotal Unmanned Aerial Vehicles	**189,000**		**189,000**	
VC-25	Passenger Data System	**68,000**		**68,000**	Aircraft Procurement, Air Force
B-2 Radar	B-2 Radar	**50,000**		**50,000**	RDT&E, Air Force
AC-130/C-130J Aircraft	**AC-130U Gunship Acquisition**	**60,000**		**60,000**	Procurement, Defense-Wide
KC-130/135 Aviation Support	Air Refueling	89,000		89,000	Aircraft Procurement, Air Force
KC-130/135 Aviation Support	KC-130J	334,000		334,000	Aircraft Procurement, Navy
	Subtotal KC-130/KC-135	**423,000**		**423,000**	
Nuclear Posture Review	Info Sys Security Program	15,000	(10,000)	5,000	Operation & Maintenance, Army

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Nuclear Posture Review	Brilliant Anti-Armor Submunition	55,000		55,000	RDT&E, Army
Nuclear Posture Review	Navy Cover and Deception Program	2,000		2,000	Other Procurement, Navy
Nuclear Posture Review	Power Projection Applied Research	7,300	(7,300)	0	RDT&E, Navy
Nuclear Posture Review	Chalk Coral	5,000		5,000	RDT&E, Navy
Nuclear Posture Review	GPS Enhancement for SLBM	30,000		30,000	RDT&E, Navy
Nuclear Posture Review	Retract Barley	20,000		20,000	RDT&E, Navy
Nuclear Posture Review	Information Warfare System	9,000		9,000	RDT&E, Navy
Nuclear Posture Review	Reentry Vehicle Sustainment Tech	7,500		7,500	RDT&E, Navy
Nuclear Posture Review	Reentry Vehicle Sustainment Tech	14,400		14,400	RDT&E, Navy
Nuclear Posture Review	Reentry Vehicle Sustainment Tech	18,000		18,000	RDT&E, Navy
Nuclear Posture Review	Management Headquarters STRATCOM	1,250		1,250	Operation & Maintenance, Air Force
Nuclear Posture Review	Information Warfare Support	5,000		5,000	Operation & Maintenance, Air Force
Nuclear Posture Review	Information Warfare Support	4,000	(4,000)	0	Operation & Maintenance, Air Force
Nuclear Posture Review	Tactical Deception	1,000	(1,000)	0	Operation & Maintenance, Air Force
Nuclear Posture Review	Management HQs STRATCOM	1,000	(1,000)	0	Operation & Maintenance, Air Force
Nuclear Posture Review	Security and Investigative Activities	2,000		2,000	Operation & Maintenance, Air Force
Nuclear Posture Review	Information Warfare Support	2,000		2,000	Other Procurement, Air Force
Nuclear Posture Review	Multi-disciplinary Space Technology	43,000	(43,000)	0	RDT&E, Air Force
Nuclear Posture Review	Space-Based Radar	0	43,000	43,000	RDT&E, Air Force
Nuclear Posture Review	Aerospace Propulsion	5,700	(5,700)	0	RDT&E, Air Force
Nuclear Posture Review	Ballistic Missile Technology	4,900		4,900	RDT&E, Air Force
Nuclear Posture Review	Aerospace Propulsion and Power Technology	4,400	(4,400)	0	RDT&E, Air Force
Nuclear Posture Review	Advanced EHF	19,000		19,000	RDT&E, Air Force

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Nuclear Posture Review	Intercontinental Ballistic Missile DEM/VAL	7,500		7,500	RDT&E, Air Force
Nuclear Posture Review	Advanced Program Technology	10,000		10,000	RDT&E, Air Force
Nuclear Posture Review	Technical Evaluation System	30,000		30,000	RDT&E, Air Force
Nuclear Posture Review	Information Systems Security Program	4,000		4,000	RDT&E, Air Force
Nuclear Posture Review	Advanced Program Evaluation	17,000		17,000	RDT&E, Air Force
Nuclear Posture Review	Defense Reconnaissance Support Activities (Space)	120,300	(23,300)	97,000	RDT&E, Air Force
Nuclear Posture Review	Defense Reconnaissance Support Activities (Space)	0	23,300	23,300	RDT&E, Air Force
Nuclear Posture Review	Support to Homeland Security	8,000		8,000	RDT&E, Defense-Wide
Nuclear Posture Review	Biological Warfare Defense	11,250		11,250	RDT&E, Defense-Wide
Nuclear Posture Review	Intelligence Support to Hard and Deeply Buried Targets	12,600		12,600	Operation & Maintenance, Defense-Wide
Nuclear Posture Review	Intelligence Support to Hard and Deeply Buried Targets	5,800		5,800	RDT&E, Defense-Wide
Nuclear Posture Review	Hard and Deeply Buried Targets	2,300		2,300	Operation & Maintenance, Defense-Wide
Nuclear Posture Review	Hard and Deeply Buried Targets	2,600		2,600	Operation & Maintenance, Defense-Wide
Nuclear Posture Review	Strategic Capability Modernization	125,000		125,000	RDT&E, Defense-Wide
Nuclear Posture Review	Hard and Deeply Buried Targets (0902198D8Z)	3,050		3,050	Operation & Maintenance, Defense-Wide
Nuclear Posture Review	Hard and Deeply Buried Targets (0901598D8Z)	3,750	(3,750)	0	Procurement, Defense-Wide
Nuclear Posture Review	Hard and Deeply Buried Targets	3,200		3,200	RDT&E, Defense-Wide
Nuclear Posture Review	Hard and Deeply Buried Targets	3,200		3,200	RDT&E, Defense-Wide
Nuclear Posture Review	NPR-IO-21	25,000		25,000	RDT&E, Defense-Wide
Nuclear Posture Review	NPR-IO-14	9,000	(9,000)	0	RDT&E, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Nuclear Posture Review	Special Reconnaissance Capabilities	5,000		5,000	RDT&E, Defense-Wide
	Subtotal Nuclear Posture Review	**685,000**	**(46,150)**	**638,850**	
Security, Comms & Info Operations	Army Language Program, Army TIARA	19,500		19,500	Operation & Maintenance, Army
Security, Comms & Info Operations	Contract Linguists-Force Protection, Army TIARA	9,400		9,400	Operation & Maintenance, Army
Security, Comms & Info Operations	Contract Linguists-Interrogation Detainees, Army TIARA	5,000		5,000	Operation & Maintenance, Army
Security, Comms & Info Operations	Classified	2,300		2,300	Operation & Maintenance, Army
Security, Comms & Info Operations	Battle Space Charactertics	2,000		2,000	Operation & Maintenance, Army
Security, Comms & Info Operations	Critical Infrastructure Protection	600		600	Operation & Maintenance, Army
Security, Comms & Info Operations	Security and Investigative Activities	10,000		10,000	Operation & Maintenance, Army
Security, Comms & Info Operations	Security and Investigative Activities	1,000		1,000	Operation & Maintenance, Army
Security, Comms & Info Operations	Collaboration Planning/Enablers	2,500		2,500	Operation & Maintenance, Army
Security, Comms & Info Operations	CONUS Support	500		500	Operation & Maintenance, Army
Security, Comms & Info Operations	Information Systems Security Program	4,600		4,600	Operation & Maintenance, Army
Security, Comms & Info Operations	Information Systems Security Program	1,700		1,700	Operation & Maintenance, Army
Security, Comms & Info Operations	Information Systems Security Program	1,500		1,500	Operation & Maintenance, Army
Security, Comms & Info Operations	Guardrail Mods (TIARA)	5,000		5,000	Aircraft Procurement, Army
Security, Comms & Info Operations	Information Systems Security Program - ISSP	1,700		1,700	Other Procurement, Army
Security, Comms & Info Operations	Information Systems Security Program - ISSP	1,900		1,900	Other Procurement, Army
Security, Comms & Info Operations	Information Systems Security Program - ISSP	4,400		4,400	Other Procurement, Army
Security, Comms & Info Operations	Prophet Ground (TIARA)	15,000		15,000	Other Procurement, Army
Security, Comms & Info Operations	Items Less than $5.0M (TIARA)	2,500		2,500	Other Procurement, Army

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	MA8975	39,100		39,100	Other Procurement, Army
Security, Comms & Info Operations	Tactical Unmanned Aerial Vehicles (TUAV)	9,500		9,500	Other Procurement, Army
Security, Comms & Info Operations	Tactical Unmanned Aerial Vehicles (TUAV)	1,500		1,500	Other Procurement, Army
Security, Comms & Info Operations	Classified	5,994		5,994	Other Procurement, Army
Security, Comms & Info Operations	Electronic Warfare	15,900		15,900	RDT&E, Army
Security, Comms & Info Operations	All Source System Analysis	8,000		8,000	RDT&E, Army
Security, Comms & Info Operations	Distributed Common Ground Systems (JMIP)	2,000		2,000	RDT&E, Army
Security, Comms & Info Operations	Distributed Common Ground Systems (JMIP)	2,000		2,000	RDT&E, Army
Security, Comms & Info Operations	Distributed Common Ground Systems (JMIP)	5,000		5,000	RDT&E, Army
Security, Comms & Info Operations	Airborne Reconnaissance Advanced Deveopment	3,000		3,000	RDT&E, Army
Security, Comms & Info Operations	Distributed Common Ground Systems (JMIP)	8,000		8,000	RDT&E, Army
Security, Comms & Info Operations	All Source System Analysis	4,300		4,300	RDT&E, Army
Security, Comms & Info Operations	Distributed Common Ground Systems (JMIP)	4,700		4,700	RDT&E, Army
Security, Comms & Info Operations	Hunter ground control station	12,100		12,100	RDT&E, Army
Security, Comms & Info Operations	APEX GOLD	4,000		4,000	Aircraft Procurement, Navy
Security, Comms & Info Operations	EP-3E COMINT/ ELINT Upgrades	22,500		22,500	Aircraft Procurement, Navy
Security, Comms & Info Operations	Various	2,000		2,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	Classified	1,000		1,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	Intelligence Analysts	3,000		3,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	SCI GCCS I3	3,800		3,800	Operation & Maintenance, Navy
Security, Comms & Info Operations	GENSER GCCS I3	5,400		5,400	Operation & Maintenance, Navy
Security, Comms & Info Operations	JDIS / LOCE / CENTRIX	5,300		5,300	Operation & Maintenance, Navy
Security, Comms & Info Operations	CMMA	1,500		1,500	Operation & Maintenance, Navy

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	Cryptologic Direct Support	2,000		2,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	CMMA	22,500		22,500	Operation & Maintenance, Navy
Security, Comms & Info Operations	JWICS connectivity	5,500		5,500	Operation & Maintenance, Navy
Security, Comms & Info Operations	Pioneer	6,000		6,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	Pre-Deployment Training	1,000		1,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	Imagery Training Initiative	1,000		1,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	HUMINT	3,700		3,700	Operation & Maintenance, Navy
Security, Comms & Info Operations	Carry on Cryptologic Systems	500		500	Operation & Maintenance, Navy
Security, Comms & Info Operations	Computer Network Defense	3,800		3,800	Operation & Maintenance, Navy
Security, Comms & Info Operations	Enclave Boundary	1,200		1,200	Operation & Maintenance, Navy
Security, Comms & Info Operations	Intrusion Detection	1,140		1,140	Operation & Maintenance, Navy
Security, Comms & Info Operations	Counter surveillance and law enforcement advance details	5,000		5,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	I-SURSS	700		700	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	TRSS	1,000		1,000	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	TCAC	500		500	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	RREP	200		200	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	TPC	700		700	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	MCIA Analytic Support	2,400		2,400	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	TEG	1,000		1,000	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	TROJAN Lite	1,500		1,500	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	ISR	2,900		2,900	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	FLAMES/CESAS	2,000		2,000	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	Computer Network Defense	2,000		2,000	Operation & Maintenance, Marine Corps

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	Secure Wireless	800		800	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	Deployed Security Interdiction Devices	700		700	Operation & Maintenance, Marine Corps
Security, Comms & Info Operations	Electronic Warfare (EW) Readiness Support	10,000		10,000	Other Procurement, Navy
Security, Comms & Info Operations	Cryptologic Direct Support	1,500		1,500	Other Procurement, Navy
Security, Comms & Info Operations	Information Systems Security Program	4,600		4,600	Other Procurement, Navy
Security, Comms & Info Operations	Information Systems Security Program	2,000		2,000	Other Procurement, Navy
Security, Comms & Info Operations	Information Systems Security Program	1,800		1,800	Other Procurement, Navy
Security, Comms & Info Operations	Tactical Interoperability and Information Support Systems	6,000		6,000	Other Procurement, Navy
Security, Comms & Info Operations	Special Purpose Supply Equip.	13,064		13,064	Other Procurement, Navy
Security, Comms & Info Operations	Computer Network Defense	1,900		1,900	Procurement, Marine Corps
Security, Comms & Info Operations	Deployed Security Interdiction Devices	700		700	Procurement, Marine Corps
Security, Comms & Info Operations	Secure Wireless	800		800	Procurement, Marine Corps
Security, Comms & Info Operations	I-SURSS	2,400		2,400	Procurement, Marine Corps
Security, Comms & Info Operations	TPCS	8,300		8,300	Procurement, Marine Corps
Security, Comms & Info Operations	TCAC	500		500	Procurement, Marine Corps
Security, Comms & Info Operations	TPC	3,300		3,300	Procurement, Marine Corps
Security, Comms & Info Operations	TEG	9,000		9,000	Procurement, Marine Corps
Security, Comms & Info Operations	TROJAN Lite	5,700		5,700	Procurement, Marine Corps
Security, Comms & Info Operations	ISR	1,700		1,700	Procurement, Marine Corps
Security, Comms & Info Operations	TACPHOTO	1,600		1,600	Procurement, Marine Corps
Security, Comms & Info Operations	FLAMES/CESAS	3,000		3,000	Procurement, Marine Corps
Security, Comms & Info Operations	Common Picture Advanced Technology	7,000		7,000	RDT&E, Navy
Security, Comms & Info Operations	Deployable Joint Command and Control	7,500		7,500	RDT&E, Navy

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	Distributed Common Ground Systems	3,000		3,000	RDT&E, Navy
Security, Comms & Info Operations	TCAC	2,500		2,500	RDT&E, Navy
Security, Comms & Info Operations	MANPACK SIDS	300		300	RDT&E, Navy
Security, Comms & Info Operations	TPCS	3,400		3,400	RDT&E, Navy
Security, Comms & Info Operations	I-SURSS	2,500		2,500	RDT&E, Navy
Security, Comms & Info Operations	RREP	300		300	RDT&E, Navy
Security, Comms & Info Operations	TENCAP	1,500		1,500	RDT&E, Navy
Security, Comms & Info Operations	TEG	1,000		1,000	RDT&E, Navy
Security, Comms & Info Operations	ISR	1,200		1,200	RDT&E, Navy
Security, Comms & Info Operations	TACPHOTO	100		100	RDT&E, Navy
Security, Comms & Info Operations	Develop USMC Shadow (Adv)	7,000		7,000	RDT&E, Navy
Security, Comms & Info Operations	ISR (BAMS UAV)/Classified	28,300		28,300	RDT&E, Navy
Security, Comms & Info Operations	Procure USMC Shadow Upgrades	15,000		15,000	Weapons Procurement, Navy
Security, Comms & Info Operations	Retract Maple	64,000		64,000	RDT&E, Navy
Security, Comms & Info Operations	Chalk Coral	11,400		11,400	RDT&E, Navy
Security, Comms & Info Operations	Acquisition Program Management	11,000		11,000	Operation & Maintenance, Navy
Security, Comms & Info Operations	Special Purpose Supply Equip.	900		900	Other Procurement, Navy
Security, Comms & Info Operations	767 RDT&E Testbed Aircraft	488,000	(250,000)	238,000	RDT&E, Air Force
Security, Comms & Info Operations	Rivet Joint QRC Sustainment	1,000		1,000	Aircraft Procurement, Air Force
Security, Comms & Info Operations	U-2 Defensive System	10,000		10,000	Aircraft Procurement, Air Force
Security, Comms & Info Operations	U-2 Airframe Repairs	5,000		5,000	Aircraft Procurement, Air Force
Security, Comms & Info Operations	U-2 SIGINT	2,700		2,700	RDT&E, Air Force
Security, Comms & Info Operations	Special Evaluation Program	1,200		1,200	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Special Evaluation Program	3,200		3,200	RDT&E, Air Force

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	DCGS Architecture	3,000		3,000	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Integrated Broadcast Service Smart Pull Technology IBS Smart Pul	6,600		6,600	RDT&E, Air Force
Security, Comms & Info Operations	Integrated Broadcast Service Smart Pull Technology	100		100	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Computer Network Defense	3,500		3,500	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Critical Infrastructure Protection	400		400	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Critical Infrastructure protection	1,800		1,800	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Computer Network Defense	4,600	(4,600)	0	Other Procurement, Air Force
Security, Comms & Info Operations	Moderization, Sustainment, and Development	4,900	(4,900)	0	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Enclove and Network Tools	2,000		2,000	Other Procurement, Air Force
Security, Comms & Info Operations	Moderization and Sustainment	1,700		1,700	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Intrusion Detection Systems	1,800		1,800	Other Procurement, Air Force
Security, Comms & Info Operations	Intrusion Detection Systems	1,500		1,500	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Defense Security Service (DSS)	5,000		5,000	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Integrated Broadcast Service	100		100	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Integrated Broadcast Service	10,800		10,800	Other Procurement, Air Force
Security, Comms & Info Operations	Defense Reconnaissance Support	68,630		68,630	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Activities (SPACE)	18,600		18,600	Other Procurement, Air Force
Security, Comms & Info Operations	Defense Space Reconnaissance Program	25,000		25,000	RDT&E, Air Force
Security, Comms & Info Operations	Commercial Imagery	2,000		2,000	Operation & Maintenance, Air Force
Security, Comms & Info Operations	Commercial Imagery	2,600		2,600	Other Procurement, Air Force
Security, Comms & Info Operations	Classified	176,584		176,584	Other Procurement, Air Force
Security, Comms & Info Operations	Commerical Imagery	2,400		2,400	RDT&E, Air Force
Security, Comms & Info Operations	Computer Network Defense	2,000		2,000	Other Procurement, Air Force

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	Integrated Broadcast Service	12,600		12,600	RDT&E, Air Force
Security, Comms & Info Operations	Tactical Terminal	3,300		3,300	Other Procurement, Air Force
Security, Comms & Info Operations	Global Hawk Defensive Sys	30,000		30,000	RDT&E, Air Force
Security, Comms & Info Operations	Global Hawk SIGINT	5,000		5,000	RDT&E, Air Force
Security, Comms & Info Operations	DCGS MASINT	5,000		5,000	RDT&E, Air Force
Security, Comms & Info Operations	ARGUS MASINT	9,000		9,000	RDT&E, Air Force
Security, Comms & Info Operations	U-2 SIGINT	10,800		10,800	RDT&E, Air Force
Security, Comms & Info Operations	AF DCGS Geospatial Services & Information	3,800		3,800	RDT&E, Air Force
Security, Comms & Info Operations	DCGS/U-2 SIGINT Network	15,000		15,000	RDT&E, Air Force
Security, Comms & Info Operations	Classified	72,000		72,000	RDT&E, Air Force
Security, Comms & Info Operations	Classified	12,000		12,000	Aircraft Procurement, Air Force
Security, Comms & Info Operations	Biological Warfare Defense	19,000		19,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	BLACK LIGHT	10,000		10,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	FINANCIAL OPERATIONS	500		500	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Crticial Infrastructure Protection	500		500	Defense Health Program
Security, Comms & Info Operations	Critical Infrastructure Protection	500		500	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	DIA	15,000		15,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	DIA	9,000		9,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	On-site administrators for primary sites (15 contractors @$200K each)	3,400		3,400	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Transportable Systems	5,900		5,900	Procurement, Defense-Wide
Security, Comms & Info Operations	Interoperability certification tests	4,500		4,500	RDT&E, Defense-Wide
Security, Comms & Info Operations	IA, Intell/Coalition Encrp (CWAN)	5,000		5,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	IA, Intell/Coalition Encrp (CFBL)	1,600		1,600	Operation & Maintenance, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	Information Assurance Computer Network Defense	3,500		3,500	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Suite of Enclave Security Tools	5,500		5,500	Procurement, Defense-Wide
Security, Comms & Info Operations	Test Suite - Wireless NIPRNET Gateway	500		500	Procurement, Defense-Wide
Security, Comms & Info Operations	On-site administrators for primary sites (15 contractors @$200K each)	3,000		3,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Intelligence Community Systems	5,000		5,000	Procurement, Defense-Wide
Security, Comms & Info Operations	Critical Infrastructure Protection (CIP)	600		600	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Critical Infrastructure Protection	500		500	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Airborne Integration	8,300		8,300	RDT&E, Defense-Wide
Security, Comms & Info Operations	Airborne Integration	1,000		1,000	Procurement, Defense-Wide
Security, Comms & Info Operations	Airborne Integration	2,000		2,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	IEC Workstations	1,000		1,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	IEC Workstations	2,000		2,000	Procurement, Defense-Wide
Security, Comms & Info Operations	IEC Workstations	1,000		1,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Libraries Communications	2,000		2,000	Procurement, Defense-Wide
Security, Comms & Info Operations	Libraries Communication	10,100		10,100	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Libraries Storage	1,000		1,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	Libraries Storage	7,600		7,600	Procurement, Defense-Wide
Security, Comms & Info Operations	PGM Targeting Workstations	1,700		1,700	RDT&E, Defense-Wide
Security, Comms & Info Operations	PGM Targeting Workstations	2,000		2,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	CENTCOM	1,000		1,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Commercial Imagery	33,670		33,670	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Geospatial Data Generation	32,800		32,800	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Classified	11,000		11,000	Operation & Maintenance, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	Classified	7,000		7,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	NC-2 COMSEC	10,000		10,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	Coalition Interoperability and Coalition Information Security	18,000		18,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	U-2 Support	1,300		1,300	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Global and Theater Guarding Solutions & Coalition Wide Area Networks	5,400		5,400	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Critical Infrastructure Protection	300		300	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Combat Development Activities	7,000		7,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	CIP – Biological Agent Security	2,000		2,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	CIP-Nuclear Security Command and Control	400		400	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	CIP Technology & Consequence Management	6,600		6,600	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	CIP-Technology & Consequence Management	2,900		2,900	RDT&E, Defense-Wide
Security, Comms & Info Operations	Measures and Signatures Information	4,000		4,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	Information Operations	25,000	(10,000)	15,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Concept Plan	10,000	(10,000)	0	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Information Operations	32,000	(10,000)	22,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Information Operations	1,500		1,500	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Information Operations	6,000		6,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Intel-IO-21	4,500		4,500	RDT&E, Defense-Wide
Security, Comms & Info Operations	Horizontal Fusion Analysis	2,000		2,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Horizontal Fusion Analysis	8,000		8,000	Procurement, Defense-Wide
Security, Comms & Info Operations	Horizontal Fusion Analysis	5,600		5,600	RDT&E, Defense-Wide
Security, Comms & Info Operations	Security-	10,000		10,000	RDT&E, Defense-Wide

DEFENSE EMERGENCY RESPONSE FUND
(Dollars in Thousands)

Category	Program	Amount Requested	Committee Change	Amount Transferred	Account to which transferred
Security, Comms & Info Operations	Collaborative Planning Tools	32,760		32,760	RDT&E, Defense-Wide
Security, Comms & Info Operations	Counter Intelligence	48,000		48,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	Coalition-Intelligence Information Sharing (CENTRIX)	14,000		14,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Coalition-Intelligence Information Sharing (CENTRIX)	12,000		12,000	Procurement, Defense-Wide
Security, Comms & Info Operations	Coalition-Intelligence Information Sharing (CENTRIX)	5,000		5,000	RDT&E, Defense-Wide
Security, Comms & Info Operations	Classified	9,500		9,500	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Classified	110,500		110,500	RDT&E, Defense-Wide
Security, Comms & Info Operations	Classified	32,100		32,100	RDT&E, Defense-Wide
Security, Comms & Info Operations	Classified	28,000		28,000	Operation & Maintenance, Defense-Wide
Security, Comms & Info Operations	Classified	304,358		304,358	Procurement, Defense-Wide
	Subotal Security/Comm, Information Operations	**2,588,800**	**(289,500)**	**2,299,300**	
	Subtotal DERF, Specific Programs	**10,055,000**	**(1,274,950)**	**8,780,050**	
Continuing the War on Terrorism	Continuing the War on Terrorism	10,000,000		10,000,000	Section 1003
	Total Defense Emergency Response Fund	**20,055,000**	**(1,274,950)**	**18,780,050**	

Modernization of strategic systems

The Defense Emergency Response Fund request included a $7.3 million increase to PE 62114N for accelerating technology to modernize strategic systems. The committee recommends a decrease of $7.3 million in this account to reflect the limited value that applied research in this area will have on currently approved Future Naval Capabilities thrust areas. The committee recommends that the Navy develop a coordinated plan for the role that basic and applied research programs will play in the overall modernization strategy for the Navy's strategic systems.

Stand off surveillance camera

The Defense Emergency Response Fund request included $2.0 million in PE 63750D8Z for stand off surveillance camera technology. The committee recommends a decrease of $2.0 million to this account to reflect a concern that this technology is commercially available, is not appropriate for a science and technology program, and does not fit well into an Advanced Concept Technology Demonstration.

Aerospace propulsion research

The Defense Emergency Response Fund (DERF) request included a $5.7 million increase to PE 62203F and a $4.4 million increase to PE 63216F for research support to the Department of Defense's Technology for the Sustainment of Strategic Systems effort, as part of the Nuclear Posture Review. The committee recommends a decrease of $5.7 million in PE 62203F and a decrease of $4.4 million in PE 63216F. The committee recommends that the Department develop a coordinated research plan for monitoring the aging of solid rocket propulsion materials and systems. The committee notes that technology development on strategic systems is already funded in the budget request and the DERF in the Ballistic Missile Technology account.

Air Force defensive information operations

The budget request included an increase of $26.8 million over fiscal year 2002 levels for Air Force defensive information operations: $6.8 million for engineering installation support for a program to detect and respond to network intrusions; $15.0 million for a program to sustain information assurance and allow for dynamic detection of network intrusions; and $5.0 million for a program to develop automated tools to detect network intrusions.

The fiscal year 2003 Defense Emergency Response Fund (DERF) request also included $9.5 million ($4.6 million for procurement and $4.9 million for operation and maintenance) to acquire the latest technology, equipment, and software for computer network defenses, including development of new tools for exploitation and denial of enemy intrusions while protecting critical information systems.

The committee finds these requests duplicative. Therefore, the committee recommends a reduction to the DERF request of $9.5 million.

SINCGARS family of radios

The budget request for the Defense Emergency Response Fund (DERF), Counter-Terrorism and Force Protection Activity, included $22.1 million to purchase the Single Channel Ground-to-Air Radio System (SINCGARS) family of radios for the Weapons of Mass Destruction-Civil Support Teams (WMD–CSTs). The budget request also included $30.1 million for SINCGARS, reflecting a total request of $52.2 million. The committee recommends a decrease of $22.1 million to this activity because the WMD–CSTs already have the capability that the SINCGARS would provide. Each of the teams has a Unified Command Suite (UCS) as their primary communications vehicle. The UCS contains several radio systems, including the PRC–117F, which have the SINCGARS capability. According to the Department of Defense, "There is not a shortfall of SINCGARS for the WMD–CST program."

Major equipment for hardened and deeply buried targets

The budget request for the Defense Emergency Response Fund (DERF) included $3.8 million in Procurement, Defense-Wide for Major Equipment in PE 91598D8Z. The committee recommends no funds for this line in the DERF because the justification for the request failed to identify what, if any, specific items will be procured. The justification for this procurement request included with the budget stated, "Specific procurement items cannot be identified at this time." While the committee generally supports work on hardened and deeply buried targets, the committee notes that the DERF includes over $400.0 million in funding for hardened and deeply buried targets. When there is a decision made as to what items would be required, the committee would consider a reprogramming request if necessary to buy needed equipment.

C3I Intelligence programs

The Defense Emergency Response Fund (DERF) included $9.0 million for Research, Development, Testing and Evaluation, Defense-wide for C3I Intelligence programs. This request, according to the Department of Defense justification documents for the DERF, "will provide analysis of the potential for wars, their deterrence, dissuasion, and termination courses of action to include: modeling of economic, political and social vulnerabilities to peace * * *". The committee believes these actions are already being performed by the Intelligence Community and recommends a reduction of $9.0 million, the amount of the request in this line, DERF PE 35190D8Z.

Management and organizational headquarters

The request included $1.0 million in the Defense Emergency Response Fund (DERF) for management and organizational headquarters Strategic Command. This line appears to be a duplicate request. The committee, therefore, recommends no funds for this activity in this line.

Air Force tactical deception personnel

The budget request for the Defense Emergency Response Fund (DERF) included $1.0 million to provide military deception per-

sonnel at selected Air Force units. These personnel would integrate military deception into Air Force operational planning. The committee understands that funds requested for the DERF are intended to support activities associated with the global war on terrorism. The committee does not understand, however, why military deception, an integral part of planning any military operation, is a new requirement. Therefore, the committee recommends a reduction of $1.0 million in the Operation and Maintenance, Air Force account.

OTHER ITEMS OF INTEREST

Comptroller General study of Special Operations Command forces language requirements, training and proficiencies

The committee directs the Comptroller General to study and provide a report to the Congress on Special Operations Forces (SOF) language requirements, training, and means of achieving and retaining proficiencies. The report shall include an evaluation of the process of developing and meeting language requirements and retaining the required language skills among SOF individuals and units. The report should also examine how the Special Operations Command could make better use of other national assets to anticipate future language needs and maintain a dynamic requirements and training strategy in order to meet these needs.

The committee also directs the Comptroller General to include within the report recommendations for improvements to SOF language training, if necessary, and an assessment of the resources required to make any such improvements. The report should be submitted to Congress no later than March 5, 2003.

Department of Defense STARBASE Program

The Department of Defense STARBASE Program is a very effective community outreach program for youths ages six through 18 that is aimed at improving math and science skills. It also addresses drug use prevention, health, self-esteem, and life skills and exposes youth, parents, and teachers to the value of military service. It currently operates at 39 locations associated with active, guard, and reserve commands throughout the United States. At least seven additional locations are seeking STARBASE programs.

The committee commends the Department's efforts to ensure that each STARBASE academy adheres to established program guidelines to meet the program's mission and objectives but is concerned about reports of failure to obligate STARBASE funds in a timely manner and of efforts to use STARBASE funding for other programs. The committee directs the Department to strengthen its oversight of the STARBASE program to improve training, standardization, and compliance with program guidelines.

TITLE XI—DEPARTMENT OF DEFENSE CIVILIAN PERSONNEL POLICY

Extension of authority to pay severance pay in a lump sum (sec. 1101)

The committee recommends a provision that would extend from October 1, 2003 to October 1, 2006 the authority of the Secretary of Defense and the service secretaries to pay severance pay in a lump sum.

Extension of voluntary separation incentive pay authority (sec. 1102)

The committee recommends a provision that would extend from September 30, 2003 to September 30, 2006, the authority of the Secretary of Defense to pay voluntary separation incentive pay to civilian employees.

Extension of cost sharing authority for continued FEHBP coverage of certain persons after separation from employment (sec. 1103)

The committee recommends a provision that would extend for three years the authority to permit certain Department of Defense civilian employees who are separated due to a reduction in force to elect continued health care coverage under the Federal Health Care Plan program. The recommended provision would require the separation to occur before October 1, 2006, or before February 1, 2007, if specific notice of the separation is given before October 1, 2006.

Eligibility of nonappropriated funds employees to participate in the Federal Employees Long-Term Care Insurance Program (sec. 1104)

The committee recommends a provision that would authorize nonappropriated funds employees to participate in the Federal Employees Long-Term Care Insurance Program.

Increased maximum period of appointment under the experimental personnel program for scientific and technical personnel (sec. 1105)

The committee recommends a provision that would authorize the Secretary to extend from four to five years the initial terms of appointments made under a previously authorized experimental hiring program. The committee notes that the Defense Advanced Research Projects Agency has made excellent use of these authorities to bring in senior technical talent in high level positions. The committee also notes that the authority has been granted to the military services' laboratories, although they have shown very limited progress in implementing the program.

The extension in the terms of appointment authorized by the program addresses a concern that the four-year appointments resulted in a discontinuity in retirement and health benefits for the employees involved. The ability to offer attractive retirement and health insurance benefits will enable defense agencies and laboratories to better compete for the highly trained technical personnel that are required to meet mission needs.

Qualification requirements for employment in Department of Defense professional accounting positions (sec. 1106)

The committee recommends a provision that would authorize the Secretary of Defense to require Department of Defense civilian employees in professional accounting positions to be certified public accountants. The recommended provision would exempt from this requirement employees currently employed in professional accounting positions.

Housing benefits for unaccompanied teachers required to live at Guantanamo Bay Naval Station, Cuba (sec. 1107)

The committee recommends a provision that would require the Navy to make excess military family housing at Guantanamo Bay Naval Station, Cuba, available for lease to Department of Defense Education Activity teachers assigned to teach at that station. The recommended provision would require payment of a housing allowance to teachers who lease such housing.

TITLE XII—MATTERS RELATING TO OTHER NATIONS

SUBTITLE A—COOPERATIVE THREAT REDUCTION WITH STATES OF THE FORMER SOVIET UNION

Specification of Cooperative Threat Reduction programs and funds (sec. 1201)

The committee recommends a provision that would define the Cooperative Threat Reduction (CTR) programs, define the funds as those authorized to be appropriated in section 301 of this act, and authorize the CTR funds to be available for obligation for three fiscal years.

Funding allocations (sec. 1202)

The committee recommends a provision that would authorize $416.7 million, the amount included in the budget request, for the Cooperative Threat Reduction (CTR) programs. The provision would also establish the funding levels for each of the program elements of the CTR program and provide limited authority to vary the amounts authorized for specific program elements.

The committee continues to support the CTR program and believes it is one of the most important national security efforts to reduce the threats posed by offensive nuclear weapons and delivery systems, weapons grade plutonium and uranium, and chemical and biological weapons and materials in states of the Former Soviet Union.

Authorization of use of Cooperative Threat Reduction funds for projects and activities outside the Former Soviet Union (sec. 1203)

The committee recommends a provision that would authorize the Secretary of Defense to conduct Cooperative Threat Reduction (CTR) programs outside of the countries of the Former Soviet Union (FSU) to address critical and emerging proliferation issues. The Secretary would be able to conduct these activities using fiscal year 2003 CTR funds or CTR funds for a fiscal year prior to 2003 that remain available to be obligated as of the date of enactment of the National Defense Authorization Act for Fiscal Year 2003. The amount that may be obligated may not exceed $50.0 million in any fiscal year. The provision would also direct the Secretary to use funds from a range of CTR program accounts if the new authority were exercised. The provision also directs the Secretary to seek, in the following year's CTR budget request, sufficient funds in the CTR program to pay back those funds used for countries outside of the FSU. The Secretary could obligate the CTR funds outside of the FSU 30 days after providing notice of his intended actions to the congressional defense committees. In the event the action is an emergency, the Secretary could obligate the funds immediately and

provide the congressional defense committees notice within 72 hours after obligating the funds.

In the event the Secretary uses the expanded CTR authority in any two fiscal years, the Secretary shall submit to Congress a report on the advisability of establishing one or more new CTR programs. The committee believes that there may be opportunities to expand the scope of the CTR program to include countries outside of the FSU. This authority would allow the Secretary to conduct a test program to determine if there are new cooperative opportunities to reduce the threats from proliferation of weapons of mass destruction knowledge, weapons, and materials.

Waiver of limitations on assistance under programs to facilitate Cooperative Threat Reduction and nonproliferation (sec. 1204)

The committee recommends a provision, that would provide the President with permanent authority to waive the annual certifications required for both the Cooperative Threat Reduction (CTR) programs and the Freedom Support Act nonproliferation programs, as requested by the administration. The provision would amend section 1203 of the Cooperative Threat Reduction Act of 1993 (22 U.S.C. 5952) and section 502 of the Freedom Support Act (22 U.S.C. 5852) and provide the President the authority to waive the restrictions in any given fiscal year for any given country if such a waiver is important to the national security interests of the United States.

If the President chooses to exercise the waiver for either the Cooperative Threat Reduction Act or Freedom Support Act preconditions, this waiver would be effective only when the President submits to Congress a report describing the activity or activities that prevent the President from making the certification or certifications required by the Act, and the strategy, plan, or policy of the President to promote the relevant State's future commitment to the preconditions.

ADDITIONAL MATTERS OF INTEREST

Cooperative Threat Reduction with the States of the Former Soviet Union

The budget request for the Cooperative Threat Reduction (CTR) program included $40.0 million to initiate a new effort, the Weapons of Mass Destruction Proliferation Prevention program. The committee supports this new effort aimed at providing equipment and training to improve border control capabilities to all Former Soviet Union (FSU) countries other than Russia. Nevertheless, the committee is concerned that there may be potential for duplication of efforts with other similar programs within the Department of Defense (DOD), as well as with the Department of Energy's National Nuclear Security Administration (NNSA) activities. The committee urges the Department of Defense to coordinate this new effort with all existing programs within the Department, the Department of Energy, the Department of State, the U.S. Customs Service, the Federal Bureau of Investigation, and the U.S. Coast Guard. The committee also expects DOD to coordinate with the NNSA in

the area of weapons of mass destruction detection technology. The committee directs DOD to report to the committee the results of this coordination and to present a strategic and budgetary plan describing how this new effort will complement, rather than duplicate, any similar ongoing efforts.

Pilot program for scientific exchange with the countries of the Former Soviet Union

The committee has been supportive of the work that the Department of Energy (DOE) and the Department of Defense (DOD) have done to engage the former biological and chemical weapons scientists in the countries of the Former Soviet Union (FSU) but believes that more can be done. Therefore, the committee directs the Secretary of Energy and Secretary of Defense to establish one or more pilot programs that would bring former biological and chemical weapons scientists from the FSU to the United States and bring U.S. scientists to the Former Soviet Union's chemical, biological, veterinary, and medical institutes. Each Department could establish a separate pilot program, or the two agencies could work together to establish a joint pilot program. The committee believes that there are significant, mutual, civil-scientific benefits that could be gained from long-term cooperative joint research projects and exchange programs. The committee believes that this exchange program is a logical next step to the current threat reduction programs in DOE and DOD. The committee urges the Secretaries to work closely with universities, industries, the national laboratories and other relevant federal and state agencies to establish the pilot program.

The committee directs the Secretaries to report to the congressional defense committees, no later than January 15, 2004, on the status of the pilot program or programs and the feasibility of establishing a permanent exchange program, including the funding requirement and any statutory or regulatory hurdles to implementing a permanent program.

SUBTITLE B—OTHER MATTERS

Administrative support and services for coalition liaison officers (sec. 1211)

In the future, the United States Armed Forces are likely to conduct operations as part of coalitions involving the military forces of allies and friends. Operation Enduring Freedom (OEF), the first major operation of the 21st century, illustrates this point. As General Tommy Franks, Commander in Chief, U.S. Central Command, who is leading this operation, noted during his testimony before the committee on February 12, 2002, the OEF "coalition has grown to more than 50 nations, with 27 nations having representatives at our headquarters." The nations involved in the coalition are assisting by providing military forces and capabilities; basing, staging and overflight rights; search and rescue; and planning, logistics, and intelligence support.

Accordingly, the committee recommends a provision that would authorize the Secretary of Defense to provide administrative services and support to coalition liaison officers while they are tempo-

rarily assigned to the headquarters of a combatant command, component command, or subordinate operational command in connection with the planning for, or conduct of, a coalition operation. Additionally, the Secretary would be authorized to pay the travel, subsistence, and similar personal expenses of a liaison officer of a developing country in connection with the assignment of that liaison officer to the headquarters of a combatant command if the assignment is requested by the commander of the combatant command. The Secretary would be authorized to provide the services and support with or without reimbursement.

Use of Warsaw Initiative funds for travel of officials from partner countries (sec. 1212)

The committee recommends a provision that would amend section 1051 of title 10, United States Code, to authorize the Secretary of Defense to pay for the travel-related expenses of personnel from a developing country participating in the North Atlantic Treaty Organization's (NATO) Partnership for Peace (PfP) program. This provision specifically addresses those travel-related expenses incurred when such personnel travel to the territory of any of the countries participating in the PfP program or any of the NATO member countries to attend a bilateral or regional conference, seminar, or similar meeting.

Support of United Nations-sponsored efforts to inspect and monitor Iraqi weapons activities (sec. 1213)

The committee recommends a provision that would extend, through fiscal year 2003, the authority of the Department of Defense to support United Nations-sponsored inspection and monitoring efforts to ensure Iraqi compliance with its international obligations to destroy its weapons of mass destruction programs and associated delivery systems. The provision would limit the assistance that could be provided by the Secretary of Defense to $15.0 million for fiscal year 2003.

Arctic and Western Pacific environmental cooperation program (sec. 1214)

The committee recommends a provision that would authorize the Secretary of Defense to conduct a cooperative program with countries in the Arctic and Western Pacific regions. The Secretary, with the concurrence of the Secretary of State, may provide cooperative assistance or provide assistance on environmental matters in the Arctic and Pacific regions, with certain exceptions. The primary focus of the program would be on technology projects and activities related to radiological threats and contamination. To reflect this focus the provision limits the availability of program funds to no more than 20 percent of such funds on non-radiological matters. The provision would also require the Secretary to submit an annual report on the program that would include a discussion of the activities, the funding, the life cycle costs of any projects, the participants, and any contributions from other agencies or countries. The committee urges the Secretary of Defense to work with the Secretary of State to obtain an agreement with cooperating partners as soon as possible to facilitate program implementation.

DIVISION B—MILITARY CONSTRUCTION AUTHORIZATIONS

Explanation of funding tables

Division B of this Act authorizes funding for military construction projects of the Department of Defense. It includes funding authorizations for the construction and operation of military family housing and military construction for the reserve components, the defense agencies, and the North Atlantic Treaty Organization (NATO) Security Investment program. It also provides authorization for the base closure account that funds environmental cleanup and other activities associated with the implementation of previous base closure rounds.

The following tables provide the project-level authorizations for the military construction funding authorized in Division B of this Act and summarize that funding by account. The tables also display the funding requested by the administration in the fiscal year 2003 budget for military construction and family housing projects.

Funds transferred to the accounts in this title from the DERF are displayed on the tables that follow as increases to the amount requested for those programs in the military construction accounts. Programs for which funds were transferred from the DERF are annotated to indicate that funds were originally requested in the DERF.

As noted earlier in this report, the amounts requested for national defense were decreased by $3.5 billion to reflect the accounting adjustment necessary to fund federal civilian retirement and health benefits under current law, rather than under the accrual basis requested in the administration's budget. The following tables include a reduction of $39.9 million to reflect that portion of this accounting change included in the military construction and family housing accounts.

Summary of FY03 Military Construction Authorizations
(Dollars in Thounsands)

	FY03 Auth Request	Senate Change	Senate Authorized
Military Construction			
Military Construction, Army	1,476,521	125,391	1,601,912
Military Construction, Navy	895,131	342,207	1,237,338
Military Construction, Air Force	644,090	411,220	1,055,310
Military Construction, Defense-Wide	687,535	34,424	721,959
Military Construction, Army National Guard	101,595	81,413	183,008
Military Construction, Air National Guard	53,473	150,586	204,059
Military Construction, Army Reserve	58,779	4,213	62,992
Military Construction, Naval Reserve	51,554	7,117	58,671
Military Construction, Air Force Reserve	31,900	27,983	59,883
Base Realignment & Closure, Defense	545,138	0	545,138
NATO Security Investment Program	168,200	0	168,200
Total Military Construction	4,713,916	1,184,554	5,898,470
Familiy Construction			
Family Housing Construction, Army	283,346	0	283,346
Family Housing Operations & Debt, Army	1,122,274	-8,187	1,114,087
Family Housing Construction, Navy & Marine Corps	375,700	0	375,700
Family Housing Operations & Debt, Navy & Marine Corps	867,788	-2,652	865,136
Family Housing Construction, Air Force	676,694	0	676,694
Family Housing Operations & Debt, Air Force	844,419	20,849	865,268
Family Housing Construction, Defense-Wide	5,480	0	5,480
Family Housing Operations & Debt, Defense-Wide	42,432	-37	42,395
DoD Family Housing Improvement Fund	2,000	0	2,000
Total Family Housing	4,220,133	9,973	4,230,106
Total FY03 Authorizations	8,934,049	1,194,527	10,128,576

FY2003 Authorization of Appropriations for Military Construction
(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Alabama	Army	Anniston Army Depot	Ammunition Containerization Doors	1,900		1,900
Alabama	Army	Ft. Rucker	UH-60 Parking Apron		3,050	3,050
Alabama	Army	Ft. Rucker	Physical Fitness Center		3,500	3,500
Alabama	Army National Guard	Gadsen	Add/Alter Readiness Center	1,781		1,781
Alaska	Army	Fort Richardson	Barracks Complex - D Street, Phase II	21,000		21,000
Alaska	Army	Fort Wainwright	Infantry Platoon Battle Course	24,000		24,000
Alaska	Army	Fort Wainwright	Automated Sniper Field Fire Range	1,600		1,600
Alaska	Army	Fort Wainwright	Mission Support Training Facility	50,000		50,000
Alaska	Army (Transfer from DERF)	Fort Wainwright	Mylar Window Glazing		910	910
Alaska	Army	Fort Wainwright	Battalion Headquarters	18,000		18,000
Alaska	Army	Fort Wainwright	Vehicle Maintenance Facility	16,500		16,500
Alaska	Army	Ft. Richardson	Community Center		15,000	15,000
Alaska	Air Force	Clear AFS	Upgrade Power Plant	14,400		14,400
Alaska	Air Force	Eielson AFB	Central Heat Plant Bag Houses	21,600		21,600
Alaska	Air Force	Eielson AFB	Blair Lakes Range Maintenance Complex		19,500	19,500
Alaska	TRICARE	Elmendorf AFB	Hospital Construction Claim Payment	10,400		10,400
Alaska	TRICARE	Fort Wainwright	Hospital Replacement, Phase IV	-		0
Arizona	Navy	MCAS Yuma	Combat Aircraft Loading Apron, Phase II	3,000		3,000
Arizona	Air Force	Davis-Monthan AFB	Dormitory (120 Rm)	9,110		9,110
Arizona	Air Force	Davis-Monthan AFB	HH-60 Apron/Taxiway D Shoulder	3,720		3,720
Arizona	Air Force	Davis-Monthan AFB	HH-60 Maintenance Hanger	6,440		6,440
Arkansas	Army	Pine Bluff Arsenal	Non-Stockpile Ammunition Demolition Shop	18,937		18,937
Arkansas	Air Force	Little Rock AFB	C-130J Maintenance Hanger	12,900		12,900
Arkansas	Air Force	Little Rock AFB	C-130J Engine/Propeller Storage Facility	2,100		2,100
Arkansas	Air Force	Little Rock AFB	Add/Alter C-130J Aircrew Fuselage Trainer	2,500		2,500
Arkansas	Air Force	Little Rock AFB	C-130J Maintenance Training Facility	8,100		8,100
Arkansas	Air National Guard	Little Rock AFB	Operations and Training Facility		5,100	5,100
Arkansas	Air National Guard	Ft. Smith MAP	Operations and Training Facility		7,900	7,900
California	Navy	Camp Pendleton	Aviation Armament Shop	6,610		6,610
California	Navy	Camp Pendleton	AAAV Training Complex	28,810		28,810
California	Navy	Camp Pendleton	Fire Protection Pipeline	5,320		5,320
California	Navy (Transfer from DERF)	Camp Pendleton	Force Intelligence Operations Center		20,000	20,000
California	Navy	Camp Pendleton	Bachelor Enlisted Quarters	23,230		23,230
California	Navy	Camp Pendleton	Water Treatment, Reservoir & Distribution	12,000		12,000
California	Navy	NAS Lemoore	Aircraft Parking Apron	8,450		8,450

FY2003 Authorization of Appropriations for Military Construction
(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
California	Navy	NAS Lemoore	Air Passenger Terminal	8,070		8,070
California	Navy (Transfer from DERF)	NAS Lemoore	Security Upgrades		19,335	19,335
California	Navy	MCAS Miramar	High Explosive Magazine	3,160		3,160
California	Navy	MCAS Miramar	Construction Equipment Shop	5,540		5,540
California	Navy	NAWC Point Mugu	Extend Aircraft Parking Apron	6,760		6,760
California	Navy	NAS San Diego	Replace Pier (San Clemente Island)	6,150		6,150
California	Navy (Transfer from DERF)	NPS Monterey	Replace Perimeter Security Fence		2,020	2,020
California	Navy (Transfer from DERF)	NS San Diego	Perimeter Security Lighting		1,580	1,580
California	Navy	NS San Diego	Pier 2 Electrical Upgrade	3,530		3,530
California	Navy (Transfer from DERF)	NS San Diego	Security Lights, Piers and Quaywalls		7,100	7,100
California	Navy	MAGTFC Twentynine Palms	Bachelor Enlisted Quarters	25,770		25,770
California	Navy	Port Hueneme NCTC	Seabee Training Facility		6,957	6,957
California	Navy	MCB Camp Pendleton	Child Development Center		8,230	8,230
California	Air Force	Beale AFB	Global Hawk Squadron Ops/Maint Facility	3,670		3,670
California	Air Force	Beale AFB	Global Hawk Upgrade Maintenance Dock	4,600		4,600
California	Air Force	Beale AFB	Global Hawk Dining Facility	3,470		3,470
California	Air Force	Travis AFB	Electrical System Replacement & Supporting Infrastructure		11,300	11,300
California	Air Force	Travis AFB	Aircraft Parts Store		8,000	8,000
California	Air Force	Travis AFB	Simulator Facility		4,600	4,600
California	Air Force	Vandenberg AFB	Upgrade Water Distribution System, Phase II	7,400		7,400
California	Air Force	Vandenberg AFB	Install Stormwater Drainage	3,100		3,100
California	DLA	Travis AFB	Replace Bulk Fuel Storage Tanks	16,000		16,000
California	Army National Guard	Moreno Valley	Readiness Center (ADRS)	12,044		12,044
California	Army National Guard	San Diego	OMS (ADRS)	6,774		6,774
California	Army Reserve	Vallejo	OMS/Marine/AMSA	6,501		6,501
California	Air National Guard	Sepulveda ANGS	Communications and Electronics Training Facility		7,000	7,000
California	Air Force Reserve	March AFB	Alter General Maintenance Shops		2,000	2,000
California	Air Force Reserve	March AFB	Add/Alter Squadron Operations		1,700	1,700
California	Air Force Reserve	March AFB	Alter Life Support		3,000	3,000
Colorado	Army	Fort Carson	Truck Loading/Unloading Docks	1,100		1,100
Colorado	Army	Fort Carson	Barracks Complex - Nelson Blvd, Phase II	42,000	0	42,000
Colorado	Army	Pueblo Depot	Ammunition Demilitarization Facility, Phase IV	38,000		38,000
Colorado	Air Force (Transfer from DERF)	USAF Academy	Perimeter Fence, Cadet Area, Phase I		4,200	4,200
Colorado	Air Force	Buckley AFB	Add/Alter SBIRS Mission Control Station	6,900		6,900

FY2003 Authorization of Appropriations for Military Construction
(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Colorado	Air Force	Buckley AFB	Wing Headquarters/Administrative Facility	10,800		10,800
Colorado	Air National Guard	Buckley AFB	Control Tower		5,900	5,900
Delaware	Air National Guard	New Castle County AP	Parking Apron/Taxiway		10,800	10,800
Colorado	Air Force (Transfer from DERF)	Peterson AFB	NORAD Battle Management Center		3,500	3,500
Colorado	Air Force (Transfer from DERF)	Peterson AFB	AT/FP Site Improvements		2,000	2,000
Colorado	Air Force (Transfer from DERF)	Schriever AFB	Visitors Center/Entry Control Gates		5,700	5,700
Connecticut	Navy (Transfer from DERF)	NSB New London	Gate 1 Security Improvements		4,080	4,080
Connecticut	Navy (Transfer from DERF)	NSB New London	Gate 7 Truck Access Security		3,800	3,800
District of Columbia	Army (Transfer from DERF)	Walter Reed AMC	Electric Switch Station		7,400	7,400
District of Columbia	Army (Transfer from DERF)	Walter Reed AMC	Physical Security, Forest Glenn		2,550	2,550
District of Columbia	Navy	MCB Washington, D.C.	Site Improvements	3,700		3,700
District of Columbia	Navy (Transfer from DERF)	ND Washington, D.C	O Street Visitor Processing Center		2,690	2,690
District of Columbia	Air Force (Transfer from DERF)	Bolling AFB	Security Forces Operations Facility		3,500	3,500
District of Columbia	Air Force (Transfer from DERF)	Bolling AFB	Perimeter Wall, North Gate		1,500	1,500
District of Columbia	DIA	Bolling AFB	Analysis Center	121,958		121,958
District of Columbia	Defense (WHS)	District Of Columbia	Parking Garage	2,500		2,500
Florida	Navy	Eglin AFB	Advanced Explosive Ordnance Disposal Tng Fac	6,350		6,350
Florida	Navy (Transfer from DERF)	NAS Jacksonville	Birmingham Gate Security Improvements		1,890	1,890
Florida	Navy (Transfer from DERF)	NAS Jacksonville	Commercial Gate Security Improvements		2,680	2,680
Florida	Navy (Transfer from DERF)	NAS Jacksonville	Yorktown Gate Security Improvements		2,200	2,200
Florida	Navy (Transfer from DERF)	NAS Mayport	Perimeter Security Upgrades		1,900	1,900
Florida	Navy	NAS Pensacola	Runway Approach Lights	990		990
Florida	Navy	Panama City	Naval Special Warfare Facility		10,700	10,700
Florida	Air Force (Transfer from DERF)	Eglin AFB	Barriers and Intrusion Detection System		1,050	1,050
Florida	Air Force (Transfer from DERF)	Eglin AFB	Security Fencing		3,200	3,200
Florida	Air Force	Hurlburt Field	Dormitory (144 Rm)	9,000		9,000
Florida	Air Force (Transfer from DERF)	Hurlburt Field	Force Protection, HQ AFSOC, Phase I		3,500	3,500
Florida	Air Force (Transfer from DERF)	Hurlburt Field	Force Protection, HQ 16 SOW, Phase II		2,500	2,500
Florida	Air Force (Transfer from DERF)	MacDill AFB	AT/FB Gates		7,000	7,000
Florida	SOCOM	Hurlburt Field	Add/Alter Command & Operations Facility	9,000		9,000
Florida	SOCOM	Hurlburt Field	Alter Facilities for CV-22	2,100		2,100
Florida	Air Force Reserve (Transfer from DERF)	Homestead ARS	Perimeter Fence		1,100	1,100
Georgia	Army (Transfer from DERF)	Fort Benning	Access Control Points		8,000	8,000
Georgia	Army	Fort Benning	Barracks Complex - Main Post, Phase I	45,000		45,000
Georgia	Army	Fort Benning	Urban Assault Course	3,250		3,250

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Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Georgia	Army	Fort Stewart	Saber Hall Complex	26,000		26,000
Georgia	Air Force	Warner-Robins AFB	Corrosion Control Depaint Facility		24,000	24,000
Georgia	Navy (Transfer from DERF)	NSB Kings Bay	Stimson Gate Security Improvements		1,580	1,580
Georgia	Air Force (Transfer from DERF)	Robins AFB	Base Entrance/Visitors Facility		5,400	5,400
Georgia	Naval Reserve	Atlanta	Bachelor Enlisted Quarters	6,730		6,730
Georgia	Naval Reserve	Savannah	Marine Corps Reserve Center	5,900		5,900
Georgia	Air National Guard (Transfer from DERF)	Savannah IAP	Relocate Base Entrance		1,450	1,450
Georgia	Air Force Reserve (Transfer from DERF)	Dobbins ARB	Visitor Center		2,000	2,000
Hawaii	Army	Schofield Barracks	Barracks Complex - Capron Ave, Phase I	49,000		49,000
Hawaii	Army	Schofield Barracks	Barracks Complex - Quad C	42,000		42,000
Hawaii	Army	Pohakuloa Training Area	Saddle Road Access, Phase II		13,000	13,000
Hawaii	Navy	MCB Hawaii	Religious Ministry Facility		9,500	9,500
Hawaii	Navy	Ford Island	Electrical System Upgrade		19,400	19,400
Hawaii	Navy	NS Pearl Harbor	Recapitalize Bravo Wharfs	10,490		10,490
Hawaii	Navy (Transfer from DERF)	NS Pearl Harbor	Security Lighting		4,200	4,200
Hawaii	Air Force (Transfer from DERF)	Hickam AFB	Flightline Security Fencing and Gates, Phase I		1,350	1,350
Hawaii	Msl Defense Agency	Kauai	THAAD Test Facility	23,400		23,400
Hawaii	TRICARE	Hickam AFB	Life Skills Clinic Replacement	2,700		2,700
Hawaii	Army National Guard	Barbers Point	Administrative Building, Add/Alter, Phase I	22,473		22,473
Idaho	Air National Guard	Gowen Field	Air Support Squadron Beddown		6,800	6,800
Illinois	Navy (Transfer from DERF)	NTC Great Lakes	Commercial Truck Inspection Station		1,620	1,620
Illinois	Navy (Transfer from DERF)	NTC Great Lakes	Intrusion Resistent Gates		6,470	6,470
Illinois	Navy	NTC Great Lakes	Recruit Barracks	43,360		43,360
Illinois	Navy	NTC Great Lakes	Recruit Barracks	41,740		41,740
Indiana	Army	Newport Army Ammunition Plant	Ammunition Demilitarization Facility, Phase V	61,494		61,494
Indiana	Air Force Reserve	Grissom ARB	Add/Alter Aircraft Maintenance Hangar		6,000	6,000
Iowa	Air National Guard	Sioux Gateway Airport	KC-135 Upgrade Aircraft Maint Hangar & Shops	6,900		6,900
Iowa	Air National Guard	Sioux Gateway Airport	KC-135 Upgrade Shops & Ops Facility	4,800		4,800
Iowa	Air National Guard	Des Moines	Upgrade Airfield Facilities		9,200	9,200
Kansas	Army (Transfer from DERF)	Fort Leavenworth	Access Control Points		3,150	3,150
Kansas	Army (Transfer from DERF)	Fort Riley	Access Control Gates		6,000	6,000
Kansas	Army	Fort Riley	Barracks Complex - Infantry Drive East	41,000		41,000
Kansas	Army	Fort Riley	Combined Arms Collective Training Facility, Phase I		13,800	13,800
Kansas	Army National Guard	Fort Riley	OMS Add/Alter (ADRS)	770		770
Kansas	Army National Guard	Kansas City	OMS Add/Alter (ADRS)	771		771

FY2003 Authorization of Appropriations for Military Construction
(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Kansas	Army National Guard	Topeka	Armed Forces Reserve Center	14,607		14,607
Kentucky	Army	Blue Grass Army Depot	Railyard Infrastructure	5,500		5,500
Kentucky	Army	Blue Grass Army Depot	Ammunition Demilitarization Facility, Phase III	10,300		10,300
Kentucky	Army	Blue Grass Army Depot	Ammunition Demilitarization Support, Phase III	8,300		8,300
Kentucky	Army	Fort Campbell	Barracks Complex - Range Road, Phase I	49,000		49,000
Kentucky	Army	Ft. Knox	Child Development Center		6,800	6,800
Louisiana	Army	Fort Polk	Digital Mulit-Purpose Training Range	31,000		31,000
Louisiana	Air Force	Barksdale AFB	Dormitory (168 Rm)	10,900		10,900
Louisiana	Air Force	Barksdale AFB	Replace Parking Ramp		12,000	12,000
Louisiana	DLA	NASJRB New Orleans	Replace Bulk Fuel Storage Tanks	9,500		9,500
Louisiana	Naval Reserve	NAS JRB New Orleans	Engine Maintenance Shop Addition	1,500		1,500
Louisiana	Naval Reserve	NAS JRB New Orleans	Hazardous Material Storage	2,690		2,690
Louisiana	Naval Reserve (Transfer from DERF)	NAS JRB New Orleans	Perimeter Road and Fencing		1,510	1,510
Louisiana	Naval Reserve	New Orleans	Runway And Taxiway Extension	14,600		14,600
Louisiana	Air National Guard	NASJRB New Orleans	Replace Vehicle Maint/Aircraft Spt Equip Complex		5,500	5,500
Maine	Navy	Portsmouth NSY	AT/FP Improvements	11,600		11,600
Maine	Navy	NAS Brunswick	Air Traffic Control Tower		9,830	9,830
Maine	Navy (Transfer from DERF)	Portsmouth NSY	Gate 1 Security Improvements		3,600	3,600
Maryland	Army	Aberdeen Proving Ground	Ammunition Demilitarization Facility, Phase V	30,600		30,600
Maryland	Army	Fort Detrick	Barracks Complex - Porter Street South	16,000		16,000
Maryland	Army	Fort Detrick	Community Support Center	3,700		3,700
Maryland	Navy	Andrews AFB	BEQ Replacement	9,680		9,680
Maryland	Navy	NSWC Carderock Division	National Maritime Tech Information Center		12,900	12,900
Maryland	Air Force (Transfer from DERF)	Andrews AFB	AT/FP Vehicle Gates		4,100	4,100
Maryland	Air Force (Transfer from DERF)	Andrews AFB	AT/FP improvements Harbor Gate		5,500	5,500
Maryland	NSA	Fort Meade	Operations Bldg 1 Stair Tower	2,588		2,588
Maryland	NSA	Fort Meade	Perimeter Security	1,896		1,896
Massachusetts	Air Force	Hanscom AFB	Add/Alter Fitness Center	7,700		7,700
Massachusetts	Air Force	Fourth Cliff, Scituate	Erosion Control and Retaining Wall		9,500	9,500
Michigan	Army National Guard	Lansing	Multi-Unit Readiness Center		16,928	16,928
Michigan	Air National Guard	Selfridge ANGB	Joint Dining Facility		8,500	8,500
Minnesota	Air National Guard	Duluth	Composite Maint Facility Modernization, Phase II		15,000	15,000
Michigan	Air National Guard (Transfer from DERF	Selfridge ANGB	Add Security Fence		1,000	1,000
Minnesota	Naval Reserve (Transfer from DERF)	NRC Cheyenne	Harden NRC Building		1,450	1,450
Mississippi	Navy	NCBC Gulfport	Communications/Instruction Facility	5,460		5,460

FY2003 Authorization of Appropriations for Military Construction
(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Mississippi	Navy	NS Pascagoula	Construct New Navy Channel	4,160		4,160
Mississippi	Navy	NS Pascagoula	BEQ Shipboard Ashore, Phase I		12,800	12,800
Mississippi	Navy	NAS Meridian	Replace Control and Beacon Tower		2,850	2,850
Mississippi	Air Force	Keesler AFB	Student Dormitory (200 Rm)	22,000		22,000
Mississippi	Air National Guard	Jackson IAP	C-17 Replace Fuel Cell Hangar/Shops	25,000		25,000
Mississippi	Air National Guard	Jackson IAP	C-17 Construct Maintenance Training Facility	4,100		4,100
Mississippi	SOCOM	Stennis Space Center	SOF Training Range		5,000	5,000
Missouri	Army	Fort Leonard Wood	Tactical Vehicle Simulator Building	15,500		15,500
Missouri	Army National Guard	Ft. Leonard Wood	Army Aviation Support Facility		14,767	14,767
Missouri	Air National Guard	Lambart-St. Louis IAP	Upgrade Facilities		5,000	5,000
Montana	Naval Reserve	Billings	Reserve Center/Land Acquisition	5,905		5,905
Montana	Air National Guard	Great Falls IAP	Munitions Load Crew Training Facility		3,500	3,500
Nebraska	Air Force	Offutt AFB	Fire/Crash Rescue Station		11,000	11,000
Nebraska	Army National Guard	Lincoln	Readiness Center Add/Alter (ADRS)	757		757
Nebraska	Army National Guard	Norfolk	Organizational Maintenance Shop (ADRS)	3,666		3,666
Nebraska	Army Reserve	Lincoln	AR Center/OMS/Unheated Storage	8,732		8,732
Nevada	Air Force	Nellis AFB	Land Acquisition	15,000		15,000
Nevada	Air Force	Nellis AFB	F-22 Munitions Maintenance Facility	3,170		3,170
Nevada	Air Force	Nellis AFB	Dormitory (144 Rm)	12,280		12,280
Nevada	Air Force	Nellis AFB	Land Acquisition		19,500	19,500
New Hampshire	Air National Guard	Pease ANGB	Fire Station		4,450	4,450
Nevada	Air Force (Transfer from DERF)	Nellis AFB	Explosive Ordance Disposal Facility		6,900	6,900
New Jersey	Air Force	McGuire AFB	C-17 Flightline Operations Facilities	24,631		24,631
New Jersey	Navy	Lakehurst NAWC	Fire Rescue Station		5,200	5,200
New Mexico	Air Force	Kirtland AFB	Visiting Airmen/Officers Quarters		8,400	8,400
New Mexico	Air Force	Holloman AFB	Survival Equipment Shop		4,650	4,650
New Jersey	Navy (Transfer from DERF)	NWS Earle	Water Front Main Gate Security Improvements		5,600	5,600
New Mexico	Air Force (Transfer from DERF)	Cannon AFB	Replace Security Forces Operations Facility		4,650	4,650
New Mexico	Air Force (Transfer from DERF)	Kirtland AFB	Upgrd Munitions Maint Storage Complex Security		11,000	11,000
New Mexico	Air Force (Transfer from DERF)	Kirtland AFB	Relocate Truman gate		2,500	2,500
New York	Army	Fort Drum	Shoot House	1,500		1,500
New York	DODEA	West Point	West Point ES Classroom Addition	3,898		3,898
New York	DODEA (DERF)	West Point	West Point ES Classroom Addition		449	449
New York	Army Reserve	Oswego	Reserve Center/OMS/Unheated Storage	5,492		5,492
New York	Naval Reserve	Syracuse	Vehicle Maintenance Facility	2,030		2,030

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Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
New York	Air Force Reserve	Niagara Falls ARS	Visiting Airmen Quarters, Phase 1		9,000	9,000
North Carolina	Army	Fort Bragg	Barracks Complex - Butner Road, Phase III	50,000		50,000
North Carolina	Army	Fort Bragg	Barracks Complex - Armistead Street	50,000		50,000
North Carolina	Army	Fort Bragg	Consolidated Fuel Facility	17,500		17,500
North Carolina	Army (Transfer from DERF)	Fort Bragg	Force Protection Plan, Phase II		18,000	18,000
North Carolina	Navy	Camp Lejeune	Fitness Center Addition	5,370		5,370
North Carolina	Navy	MCAS Cherry Point	T-56 Test Cell	6,040		6,040
North Carolina	Navy	MCAS New River	Property Control Facility	6,920		6,920
North Carolina	Air Force	Pope AFB	Dormitory (144 Rm)	9,700		9,700
North Carolina	Air Force	Seymour Johnson AFB	Fire/Crash Rescue Station		10,600	10,600
North Carolina	DODEA	Camp Lejeune	Berkeley Manor ES Replace School	10,884		10,884
North Carolina	DODEA (DERF)	Camp Lejeune	Berkeley Manor ES Replace School		1,254	1,254
North Carolina	DODEA	Fort Bragg	Butner ES Classroom Addition	900		900
North Carolina	DODEA (DERF)	Fort Bragg	Butner ES Classroom Addition		104	104
North Carolina	DODEA	Fort Bragg	McNair ES Classroom Addition	925		925
North Carolina	DODEA (DERF)	Fort Bragg	McNair ES Classroom Addition		107	107
North Carolina	SOCOM	Fort Bragg	SOF Weapons Training Facility	19,200		19,200
North Carolina	SOCOM	Fort Bragg	SOF Renovate Bryant Hall	11,600		11,600
North Carolina	Army National Guard	Elizabeth City	Motor Vehicle Storage Compound (ADRS)	208		208
North Carolina	Air National Guard (Transfer from DERF	Charlotte/Douglas Iap	Relocate Road and Gate House		2,500	2,500
North Carolina	Army Reserve	Fort Bragg	Add/Alter Reserve Center	1,624		1,624
North Dakota	Air Force	Minot AFB	CALCM Storage Facility		18,000	18,000
Ohio	Air Force	Wright-Patterson AFB	Dormitory (144 Rm)	10,400		10,400
Ohio	Air Force	Wright-Patterson AFB	AFIT Graduate Facility Upgrade		13,000	13,000
Ohio	Air Force (Transfer from DERF)	Wright-Patterson AFB	Small Arms Range Complex		12,000	12,000
Ohio	DLA	Columbus	Physical Fitness Facility	5,021		5,021
Ohio	Naval Reserve (Transfer from DERF)	NMCRC Columbus	Harden NRC Building		1,040	1,040
Ohio	Air Force Reserve (Transfer from DERF)	Youngstown Air Reserve Station	Visitors Center		2,500	2,500
Oklahoma	Army	Ft. Sill	Consolidated Maintenance Complex, Phase I		10,000	10,000
Oklahoma	Air Force	Altus AFB	Consolidated Base Engineer Complex, Phase I		7,700	7,700
Oklahoma	Air Force	Vance AFB	Elam Road Repair		4,800	4,800
Oregon	Air National Guard (Transfer from DERF	Klamath Falls Apt-Kingsley Field	Replace Cantonment Area Fence		1,000	1,000
Oregon	Air Force Reserve	Portland IAP	Consolidated Training, Phase I	1,609		1,609
Oregon	Air Force Reserve	Portland IAP	Alter Maintenance Shops	2,650		2,650
Oregon	Air Force Reserve	Portland IAP	Hydrant Refueling System, Phase I	6,400		6,400

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(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Oregon	Air Force Reserve	Portland IAP	Alter Maintenance Hangar	525		525
Pennsylvania	Army	Letterkenny Army Depot	Ammunition Road Infrastructure	1,550		1,550
Pennsylvania	Air National Guard	Pittsburgh IAP	Add/Alter Squadron Operations and Support Facilities		7,700	7,700
Rhode Island	Navy	NS Newport	Police/Security/Fire/Gate		9,030	9,030
Pennsylvania	Air National Guard (Transfer from DERF	Ft Indiantown Gap AGS	Base Entrance/Relocate Road/Fencing		2,300	2,300
South Carolina	Army	Fort Jackson	Basic Combat Training Complex, Phase III	39,000		39,000
South Carolina	Navy	MCAS Beaufort	Aircraft Acoustical Enclosure	13,700		13,700
South Carolina	Navy	MCRD Parris Island	All Weather Training Facility	7,410		7,410
South Carolina	Navy	MCRD Parris Island	Recruit Training Facility Addition	3,080		3,080
South Carolina	Air Force	Shaw AFB	Fighter Squadron Maintenance Facility		6,500	6,500
South Carolina	Air National Guard	McEntire ANGB	Replace Operations and Training Facility		10,200	10,200
South Carolina	Navy (Transfer from DERF)	NWS Charleston	Security Facilities Consolidation		5,740	5,740
South Carolina	DODEA	Fort Jackson	Hood St ES Classroom Addition	865		865
South Carolina	DODEA (DERF)	Fort Jackson	Hood St ES Classroom Addition		100	100
South Carolina	DODEA	Fort Jackson	Pierce Terrace ES Classroom Addition	1,382		1,382
South Dakota	Air Force	Ellsworth AFB	37th Bomb Squadron Operations Facility		13,200	13,200
South Dakota	Army National Guard	Camp Rapid	Barracks/Dining /Admin and Parking Complex Phase I		10,593	10,593
South Carolina	DODEA (DERF)	Fort Jackson	Pierce Terrace ES Classroom Addition		159	159
Texas	Army (Transfer from DERF)	Fort Hood	Access Control Buildings/Security Fencing		24,000	24,000
Texas	Army	Fort Hood	Barracks Complex - Clear Creek Road	45,000		45,000
Texas	Navy	NAS Kingsville	Upgrade Airfield Lighting And Controls	6,210		6,210
Texas	Navy	NS Ingleside	Mine Warfare Training Center Addition		5,480	5,480
Texas	Air Force	Lackland AFB	Student Dormitory (200 Rm)	18,500		18,500
Texas	Air Force (Transfer from DERF)	Lackland AFB	Mil Operations in Urban Terrain Site		13,000	13,000
Texas	Air Force (Transfer from DERF)	Lackland AFB	Mil Operations in Urban Terrain Site (Camp Bullis)		6,000	6,000
Texas	Air Force (Transfer from DERF)	Lackland AFB	Visiting Quarters (Camp Bullis)		4,000	4,000
Texas	Air Force	Sheppard AFB	Dormitory (144 Rm)	10,000		10,000
Texas	Air Force	Sheppard AFB	Euro-NATO Joint Pilot Training Flight Simulator	6,000		6,000
Texas	Air Force	Goodfellow AFB	Wing Support Complex		10,600	10,600
Texas	Air National Guard	Ft. Bliss	Base Defense Training Center		8,700	8,700
Texas	Army Reserve	Grand Prairie	Army Reserve Center/OMS/DSGS	9,113		9,113
Texas	Naval Reserve (Transfer from DERF)	NAS JRB Ft. Worth	Base Pass/ID/Visitor's Center		1,500	1,500
Texas	Naval Reserve	Waco	Vehicle Maintenance/Supply Storage Facility	4,140		4,140
Utah	Air Force	Hill AFB	Consolidated Software Support Facility		16,500	16,500
Vermont	Army National Guard	South Burlington	Readiness Center		11,241	11,241

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Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Virginia	Navy (Transfer from DERF)	NAB Little Creek	Fleet Information Warfare Center		5,370	5,370
Virginia	Navy (Transfer from DERF)	NAB Little Creek	New Truck Access Gate		4,400	4,400
Virginia	Navy	NSWC Dahlgren	Theater Warfare Integration Center	9,230		9,230
Virginia	Navy (Transfer from DERF)	NSWC Dahlgren	Chemical/Biological Det Facility Addition		6,600	6,600
Virginia	Navy	NS Norfolk	Upgrade Electrical Distribution, Phase III	25,160		25,160
Virginia	Navy	NS Norfolk	Aircraft Recap, Phase III	11,290		11,290
Virginia	Navy	NS Norfolk	Aircraft Maintenance Facilities	34,450		34,450
Virginia	Navy	NS Norfolk	BEQ, Shipboard Ashore, Phase I	37,310		37,310
Virginia	Navy	NS Norfolk	Shoreline Security Fencing	2,030		2,030
Virginia	Navy	NS Norfolk	Pier Replacement, Phase II	33,520		33,520
Virginia	Navy (Transfer from DERF)	NS Norfolk	Main Gate Improvements		2,200	2,200
Virginia	Navy (Transfer from DERF)	NS Norfolk	Gate 3A Security Improvements		4,005	4,005
Virginia	Navy (Transfer from DERF)	NS Norfolk	Gate 2 Security Improvements		4,400	4,400
Virginia	Navy (Transfer from DERF)	NSA Norfolk	Gate 5 Security Imrovements		2,260	2,260
Virginia	Navy	NAS Oceana	Airfield Approach Lighting	2,000		2,000
Virginia	Navy (Transfer from DERF)	NAS Oceana	Airfield Perimeter Security		10,500	10,500
Virginia	Navy (Transfer from DERF)	NAS Oceana	Post 1 Security Improvements		3,990	3,990
Virginia	Navy	NSY Portsmouth	AT/FP Improvements	19,660		19,660
Virginia	Navy	MCCDC Quantico	Armory/Fleet Weapons Support Facility	4,234		4,234
Virginia	Navy	MCCDC Quantico	BEQ (OCS)	10,280		10,280
Virginia	Navy	MCCDC Quantico	BEQ Addition, SNCO	5,040		5,040
Virginia	Navy	NWS Yorktown	BEQ Replacement	15,020		15,020
Virginia	Navy	Norfolk NSY	Ship Components Service Facility		16,810	16,810
Virginia	Air Force (Transfer from DERF)	Langley AFB	ACC Operations Support Center		24,000	24,000
Virginia	Air Force	Langley AFB	F-22 Squadron Ops/AMU	20,800		20,800
Virginia	Air Force	Langley AFB	F-22 Flight Simulator	8,120		8,120
Virginia	Air Force	Langley AFB	Dormitory (96 Rm)	8,320		8,320
Virginia	Air Force	Langley AFB	F-22 Infrastructure And Utilities	10,700		10,700
Virginia	Army National Guard	Ft. Pickett	Maneuver and Training Equipment Site, Phase II		8,957	8,957
Virginia	Defense (WHS)	Arlington	Land Acquisition	18,000		18,000
Virginia	DLA	Def Distribution Depot Richmond	Renovate Operations Center	5,500		5,500
Virginia	DTRA	Fort Belvoir	Headquarters Relocation	50,188		50,188
Virginia	DODEA	Quantico	Ashurst ES Classroom Addition	1,272		1,272
Virginia	DODEA (DERF)	Quantico	Ashurst ES Classroom Addition		146	146
Virginia	SOCOM	Little Creek	SOF Operations Trainer	4,400		4,400

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Virginia	SOCOM	Little Creek	SOF Seal Team Operations Facility	9,900		9,900
Virginia	Army Reserve	Fort Story	Readiness Center,OMS,AMSA,Storage	12,385		12,385
Virginia	Naval Reserve	Norfolk	Reserve Center Addition	4,770		4,770
Washington	Army	Fort Lewis	Combined Arms Collective Training Facility	29,800		29,800
Washington	Army	Fort Lewis	Battle Simulation Center	24,000		24,000
Washington	Army	Fort Lewis	Barracks Complex - 17th & B Street, Phase III	50,000		50,000
Washington	Navy	SWFP Bangor	Missiles Spares Storage Building	7,340		7,340
Washington	Navy (Transfer from DERF)	NSB Bangor	Small Arms Training Center		16,410	16,410
Washington	Navy	NSB Bangor	Relocate Encumbered Waterfront Shops	5,900		5,900
Washington	Navy	NS Bremerton	BEQ Shipboard Ashore	35,120		35,120
Washington	Navy (Transfer from DERF)	NS Bremerton	Ship Movements Office with Control Tower		2,200	2,200
Washington	Navy	NS Bremerton	Waterfront Revitalization	8,550		8,550
Washington	Navy	NM Port Hadlock	Ammunition Wharf Improvements	4,030		4,030
Washington	Navy	NSY Puget Sound	Industrial Waste Treatment Facility	11,390		11,390
Washington	Navy	NSY Puget Sound	Waterfront Support Facilities	21,072		21,072
Washington	Navy	NSY Puget Sound	AT/FP Improvements	21,670		21,670
Washington	Navy	NAS Whidbey Island	Aircraft Direct Refueling Facility	9,180		9,180
Washington	Army National Guard	Spokane	Combined Readiness Center		11,598	11,598
Washington	Navy (Transfer from DERF)	NAS Whidbey Island	Ault Field Security Fencing		8,400	8,400
West Virginia	Army National Guard	Summersville	Readiness Center	6,800		6,800
West Virginia	Army National Guard	Lewisburg	Readiness Center		5,624	5,624
West Virginia	Air National Guard	Martinsburg	Site Improvements & Utilities		12,200	12,200
Wisconsin	Army National Guard	Camp Williams	United States Prop. & Fiscal Office Warehouse	6,045		6,045
Wisconsin	Army National Guard	Madison	United States Property And Fiscal Office	5,245		5,245
Wisconsin	Army Reserve	Fort McCoy	Battalion Dining Facility	5,117		5,117
Wisconsin	Army Reserve	Ft. McCoy	Battle Simulation Center		3,863	3,863
Wyoming	Air Force	F.E. Warren AFB	Storm Drainage System, Phase I		10,000	10,000
Wyoming	Naval Reserve (Transfer from DERF)	Cheyenne	Harden NRC Building		1,240	1,240
Conus Various	JCS (Transfer from DERF)	Unspecified Worldwide Locations	CINC HQ for Homeland Defense		25,000	25,000
Bahrain	Navy	NSA Bahrain	Installation Service Support Center	25,970		25,970
Belgium	Army	SHAPE HQ	Barracks Complex - Chievres	13,600		13,600
Belgium	DODEA	Mons	SHAPE ES Classroom Addition	1,410		1,410
Belgium	DODEA (DERF)	Mons	SHAPE ES Classroom Addition		163	163
Cuba	Navy (Transfer from DERF)	NS Guantanamo	Security Upgrades		4,280	4,280

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Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Germany	Army	Bamberg	Child Development Center	7,000		7,000
Germany	Army	Bamberg	Barracks Complex - Warner Bldg 7002	10,200		10,200
Germany	Army (Transfer from DERF)	Cambell Barracks	Window Replacement		8,300	8,300
Germany	Army (Transfer from DERF)	Coleman Barracks	Upgrade Access Cotrol/Perimeter Security		1,350	1,350
Germany	Army	Darmstadt	Modified Record Fire Range, Automated	3,500		3,500
Germany	Army	Grafenwoehr	Brigade Complex-Site Preparation	10,000		10,000
Germany	Army	Grafenwoehr	Brigade Complex - Utilities Infrastructure	46,666		46,666
Germany	Army	Grafenwoehr	Brigade Complex-Barracks	13,200		13,200
Germany	Army (Transfer from DERF)	Landstuhl Hospital	Upgrade Access Control/Facilities		1,100	1,100
Germany	Army (Transfer from DERF)	Landstuhl Hospital	Upgrade Access Control/Perimeter Security		1,300	1,300
Germany	Army	Mannheim	Barracks Complex - Coleman Bldg 18	42,000		42,000
Germany	Army	Schweinfurt	Central Vehicle Wash Facility	2,000		2,000
Germany	Air Force (Transfer from DERF)	Ramstein AB	Large Vehicle Security Inspection Station		1,600	1,600
Germany	Air Force	Ramstein AB	Combined Fleet Service/In-Flight Kitchen	7,500		7,500
Germany	Air Force	Ramstein AB	KMC Center Support	21,300		21,300
Germany	Air Force	Ramstein AB	Passenger Terminal Annex	17,683		17,683
Germany	Air Force	Ramstein AB	Ramp 1, Phase 1	23,700		23,700
Germany	DODEA	Kaiserlautern AB	Ramstein ES Classroom Addition	858		858
Germany	DODEA (DERF)	Kaiserlautern AB	Ramstein ES Classroom Addition		99	99
Germany	DODEA	Spangdahlem AB	Spangdahlem ES Classroom Addition	894		894
Germany	DODEA (DERF)	Spangdahlem AB	Spangdahlem ES Classroom Addition		103	103
Germany	TRICARE	Spangdahlem AB	Hospital Replacement	39,629		39,629
Greece	Navy	Larissa	BEQ And Support Facility	14,800		14,800
Guam	Air Force	Andersen AFB	Fitness Center	16,000		16,000
Guam	Air Force (Transfer from DERF)	Andersen AFB	Replace Base Water Supply System		15,000	15,000
Guam	DLA	Andersen AFB	Replace Hydrant Fuel System, Phase IV	17,586		17,586
Iceland	Navy	NAS Keflavik	Combined Dining Facility	14,920		14,920
Italy	Army	Vicenza	Child Development Center	3,700		3,700
Italy	Army	Vicenza	Barracks Complex-Camp Ederle	31,000		31,000
Italy	Navy (Transfer from DERF)	NAS Sigonella	Off Base Access Road Improvements		11,300	11,300
Italy	Navy	NAS Sigonella	QOL Support II	33,530		33,530
Italy	Navy	NAS Sigonella	Parking Garage And Perimeter Security Upgrade	19,560		19,560
Italy	Air Force (Transfer from DERF)	Aviano Bachelor Housing Annex #1	Consolidate Area A1 & Area A2 for FP		5,000	5,000
Italy	Air Force (Transfer from DERF)	Aviiano AB	Large Vehicle Inspection Station		1,600	1,600
Italy	DODEA	Vicenza	Vicenza ES Classroom Addition	1,898		1,898

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Italy	DODEA (DERF)	Vicenza	Vicenza ES Classroom Addition		219	219
Italy	TRICARE	Naples	Medical/Dental Facility Replacement	41,449		41,449
Japan	Air Force (Transfer from DERF)	Kadena AB	Visitor & Traffic Control Fac & Security Fencing		6,000	6,000
Japan	DLA	Yokota AB	Bulk Fuel Storage Tanks	23,000		23,000
Korea	Army	Camp Carroll	Barracks Complex	20,000		20,000
Korea	Army	Camp Castle	Physical Fitness Training Center	6,800		6,800
Korea	Army	Camp Hovey	Barracks Complex	25,000		25,000
Korea	Army	Camp Humphreys	Barracks Complex	36,000		36,000
Korea	Army	Camp Walker	Barracks Complex	10,200		10,200
Korea	Army (Transfer from DERF)	Camp Tango	Communications and Commo Hardening		12,600	12,600
Korea	Army	K-16 Airfield	Barracks Complex	40,000		40,000
Korea	Air Force	Osan AB	Dormitory (156 Rm)	15,100		15,100
Korea	DODEA	Seoul	Seoul MS Replacement	28,409		28,409
Korea	DODEA (DERF)	Seoul	Seoul MS Replacement		3,274	3,274
Mariana Islands	Navy	Guam	BEQ Replacement	13,400		13,400
Mariana Islands	DLA	Guam	Marine Loading Arms	6,000		6,000
Portugal	DLA	Def FSP Lajes Field Azores	Replace Hydrant Fuel System	19,000		19,000
Portugal	DODEA	Lajes AB	Lajes ES Classroom Addition	1,069		1,069
Portugal	DODEA (DERF)	Lajes AB	Lajes ES Classroom Addition		123	123
Qatar	Army	Qatar	Unaccompanied Personnel Housing	8,600		8,600
Spain	Navy	Torrejon AB	NEX/MWR Facility	2,890		2,890
Spain	Navy (Transfer from DERF)	NS Rota	Security Complex		18,700	18,700
Spain	Air Force	NS Rota	Aircraft Parking Apron, Phase I	31,818		31,818
Spain	DLA	NS Rota	Hydrant Fuel System	23,400		23,400
Turkey	Air Force (Transfer from DERF)	Incirlik AB	Large Vehicle Security Inpsection Station		1,550	1,550
United Kingdom	Navy	NSF Diego Garcia	Physical Readiness Center	8,370		8,370
United Kingdom	Navy	NSF Diego Garcia	Waterfront Operations Support Facility	2,720		2,720
United Kingdom	Air Force	Diego Garcia	B-2 Aircraft Parking Apron, Phase I	17,100		17,100
United Kingdom	Air Force	RAF Fairford	B-2 Maintenance Hangar/Apron	19,000		19,000
United Kingdom	Air Force	RAF Lakenheath	Mobility Processing Facility	2,600		2,600
United Kingdom	Air Force	RAF Lakenheath	Add To And Alter Fitness Center	10,800		10,800
United Kingdom	DLA	RAF Fairford	Replace Hydrant Fuel System	17,000		17,000
Wake Island	Air Force	Wake Island	Repair Airfield Pavement, Phase II	24,900		24,900
Worldwide	OSD	Base Realignment & Closure, Defense	Base Closure Activities - Army	149,878	-149,878	0

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Worldwide	OSD	Base Realignment & Closure, Defense	Base Closure Activities - Navy	258,940	-258,940	0
Worldwide	OSD	Base Realignment & Closure, Defense	Base Closure Activities - Air Force	136,320	-136,320	0
Worldwide	OSD	Base Realignment & Closure, Defense	Base Realignment & Closure, Defense	-	545,138	545,138
Worldwide	Army	Unspecified Worldwide Locations	Classified Project	4,000		4,000
Worldwide	Army	Unspecified Worldwide Locations	Unspecified Minor Construction	20,500		20,500
Worldwide	Army	Unspecified Worldwide Locations	Planning and Design	119,824		119,824
Worldwide	Army (Transfer from DERF)	Unspecified Worldwide Locations	Planning And Design		5,340	5,340
Worldwide	Army	Unspecified Worldwide Locations	Host Nation Support	23,700		23,700
Worldwide	Army	Unspecified Worldwide Locations	Foreign Currency Fluctuations		-13,676	-13,676
Worldwide	Army	Unspecified Worldwide Locations	Civilian Personnel Accural Accounting Adjustment		-26,083	-26,083
Worldwide	Navy	Unspecified Worldwide Locations	Unspecified Minor Construction	23,262		23,262
Worldwide	Navy	Unspecified Worldwide Locations	Planning and Design	68,573	3,600	72,173
Worldwide	Navy (Transfer from DERF)	Unspecified Worldwide Locations	Planning And Design		17,630	17,630
Worldwide	Navy	Various Worldwide Locations	Host Nation Infrastructure	1,000		1,000
Worldwide	Navy	Unspecified Worldwide Locations	Foreign Currency Fluctuations		-1,340	-1,340
Worldwide	Navy	Unspecified Worldwide Locations	Civilian Personnel Accural Accounting Adjustment		-10,470	-10,470
Worldwide	Air Force	Classified Location	Classified Milcon Project	1,993		1,993
Worldwide	Air Force	Classified Location	C-17 Various Facilities	30,569	-30,569	0
Worldwide	Air Force	Classified Location	Various Facilities/Utilities/Infrastructure	23,000		23,000
Worldwide	Air Force	Various Worldwide Locations	Unspecified Minor Construction	11,500		11,500
Worldwide	Air Force	Various Worldwide Locations	Planning and Design	41,496	18,123	59,619
Worldwide	Air Force	Unspecified Worldwide Locations	Foreign Currency Fluctuations		-10,281	-10,281
Worldwide	Air Force (Transfer from DERF)	Various Worldwide Locations	Planning And Design		16,797	16,797
Worldwide	Air Force (Transfer from DERF)	Various Worldwide Locations	Planning And Design (Predator Bedown)		5,000	5,000
Worldwide	Chem Bio Defense Prgm	Unspecified Worldwide Locations	Planning and Design	5,000		5,000
Worldwide	Energy Cons Invest Prgm	Unspecified Worldwide Locations	Energy Conservation Improvement Program	49,531	1,000	50,531
Worldwide	DFAS	Unspecified Worldwide Locations	Unspecified Minor Construction	1,500		1,500
Worldwide	JCS	Unspecified Worldwide Locations	Unspecified Minor Construction	6,430		6,430
Worldwide	OSD (Contingency)	Unspecified Worldwide Locations	Contingency Construction	10,000		10,000
Worldwide	OSD (Minor Construction)	Unspecified Worldwide Locations	Unspecified Minor Construction	3,000		3,000
Worldwide	OSD (Planning & Design)	Unspecified Worldwide Locations	Planning and Design	20,000		20,000
Worldwide	SOCOM	Unspecified Worldwide Locations	Unspecified Minor Construction	2,000		2,000
Worldwide	SOCOM	Unspecified Worldwide Locations	Planning and Design	4,932	100	5,032
Worldwide	TRICARE	Unspecified Worldwide Locations	Unspecified Minor Construction	3,363		3,363
Worldwide	TRICARE	Unspecified Worldwide Locations	Planning and Design	14,200		14,200

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Worldwide	OSD	Unspecified Worldwide Locations	Foreign Currency Fluctuations		-2,976	-2,976
Worldwide	Army National Guard	Unspecified Worldwide Locations	Unspecified Minor Construction	4,930		4,930
Worldwide	Army National Guard	Unspecified Worldwide Locations	Planning and Design	14,724	1,705	16,429
Worldwide	Air National Guard	Unspecified Worldwide Locations	Unspecified Minor Construction	4,400		4,400
Worldwide	Air National Guard	Unspecified Worldwide Locations	Planning and Design	8,273	8,203	16,476
Worldwide	Air National Guard (Transfer from DERF)	Unspecified Worldwide Locations	Planning And Design		683	683
Worldwide	Army Reserve	Unspecified Worldwide Locations	Unspecified Minor Construction	2,850		2,850
Worldwide	Army Reserve	Unspecified Worldwide Locations	Planning and Design	6,965	350	7,315
Worldwide	Naval Reserve	Unspecified Worldwide Locations	Unspecified Minor Construction	780		780
Worldwide	Naval Reserve	Unspecified Worldwide Locations	Planning and Design	2,509		2,509
Worldwide	Naval Reserve (Transfer from DERF)	Unspecified Worldwide Locations	Planning And Design		377	377
Worldwide	Air Force Reserve	Unspecified Worldwide Locations	Judgment Fund Payment	11,900		11,900
Worldwide	Air Force Reserve	Unspecified Worldwide Locations	Unspecified Minor Construction	5,160		5,160
Worldwide	Air Force Reserve	Unspecified Worldwide Locations	Planning and Design	3,656	207	3,863
Worldwide	Air Force Reserve (Transfer from DERF)	Unspecified Worldwide Locations	Planning And Design		476	476
Worldwide	NATO Sec Invest Prgm	NATO Security Investment Program	NATO Security Investment Program	168,200		168,200
						0
			Total Military Construction	4,713,916	1,184,554	5,898,470
Alaska	Army	Fort Wainwright	Replace Family Housing (38 Units)	17,752		17,752
Arizona	Army	Yuma Proving Ground	Replace Family Housing (33 Units)	6,100		6,100
Arizona	Air Force	Luke AFB	Replace Family Housing, Phase II2 (140 Units)	18,954		18,954
California	Navy	NAS Lemoore	Replace Family Housing (178 Units)	40,981		40,981
California	Navy	MAGTFC Twentynine Palms	Replace Family Housing (76 Units)	19,425		19,425
California	Air Force	Travis AFB	Replace Family Housing, Phase III (110 Units)	24,320		24,320
Colorado	Air Force	Peterson AFB	Construct Family Housing, Phase I (2 Units)	959		959
Colorado	Air Force	U.S. Air Force Academy	Replace Family Housing, Phase I (71 Units)	12,424		12,424
Connecticut	Navy	NSB New London	Replace Family Housing (100 Units)	24,415		24,415
Delaware	Air Force	Dover AFB	Replace Family Housing, Phase II (112 Units)	19,615		19,615
Florida	Navy	NS Mayport	New Construction (1 Unit)	329		329
Florida	Air Force	Eglin AFB	Replace Family Housing, Phase IIA (134 Units)	15,906		15,906
Florida	Air Force	Eglin AFB	Housing Management Facility	597		597
Florida	Air Force	Macdill AFB	Replace Family Housing, Phase V (96 Units)	18,086		18,086

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Hawaii	Navy	MCB Kaneohe Bay	Replace Family Housing (65 Units)	24,797		24,797
Hawaii	Air Force	Hickam AFB	Replace Family Housing, Phase II (96 Units)	29,050		29,050
Idaho	Air Force	Mountain Home AFB	Replace Family Housing, Phase IV (95 Units)	24,392		24,392
Kansas	Air Force	McConnell AFB	Construct Mfh Maint Bldg & Roads	1,514		1,514
Maryland	Air Force	Andrews AFB	Replace Family Housing, Phase IA (53 Units)	9,838		9,838
Maryland	Air Force	Andrews AFB	Replace Family Housing, Phase IB (52 Units)	8,807		8,807
Mississippi	Navy	NAS Meridian	Replace Family Housing (56 Units)	9,755		9,755
Mississippi	Air Force	Columbus AFB	Mfh Management Office	412		412
Mississippi	Air Force	Keesler AFB	Replace Family Housing, Phase I (117 Units)	16,505		16,505
Missouri	Air Force	Whiteman AFB	Replace Family Housing, Phase III (22 Units)	3,977		3,977
Montana	Air Force	Malmstrom AFB	Replace Family Housing, Phase VIA (18 Units)	4,717		4,717
New Mexico	Air Force	Holloman AFB	Replace Family Housing (101 Units)	20,161		20,161
North Carolina	Navy	Camp Lejeune	Tarawa Terrace, Phase II Replace	43,650		43,650
North Carolina	Air Force	Pope AFB	Replace Housing Maintenance Bldg	991		991
North Carolina	Air Force	Seymour Johnson AFB	Replace Family Housing, Phase VII (126 Units)	18,615		18,615
North Dakota	Air Force	Grand Forks AFB	Replace Family Housing, Phase F (150 Units)	30,140		30,140
North Dakota	Air Force	Minot AFB	Replace Family Housing, Phase VIII (112 Units)	21,428		21,428
North Dakota	Air Force	Minot AFB	Replace Family Housing, Phase IX (102 Units)	20,315		20,315
Oklahoma	Air Force	Vance AFB	Replace Family Housing, Phase I (59 Units)	11,423		11,423
Pennsylvania	DLA	Def Distribution Depot New Cumberland	Whole House Revitalization	5,430		5,430
South Dakota	Air Force	Ellsworth AFB	Replace Family Housing, Phase II (22 Units)	4,794		4,794
South Dakota	Air Force	Ellsworth AFB	Housing Maintenance Facility	447		447
Texas	Air Force	Dyess AFB	Replace Family Housing, Phase III (85 Units)	14,824		14,824
Texas	Air Force	Randolph AFB	Replace Family Housing, Phase I (112 Units)	14,311		14,311
Texas	Air Force	Randolph AFB	Mfh Housing Maint Office	447		447
Virginia	Navy	MCAF Quantico	Replacement Housing, Phase III (290 Units)	41,843		41,843
Virginia	Air Force	Langley AFB	Const Housing Management Office	1,193		1,193
Germany	Army	Stuttgart	Replace Family Housing (1 Unit)	990		990
Germany	Air Force	Ramstein AB	Replace Family Housing (19 Units)	8,534		8,534
Greece	Navy	Larissa	New Construction (2 Units)	1,232		1,232
Korea	Army	Yongsan	Replace Family Housing (10 Units)	3,100		3,100
Korea	Air Force	Osan AB	Construct Family Housing, Phase I (113 Units)	35,705		35,705
Korea	Air Force	Osan AB	Replace Furnishings Mgt Whse	834		834
United Kingdom	Navy	St Mawgan	New Construction (62 Units) Family Housing Office	18,524		18,524
United Kingdom	Air Force	RAF Lakenheath	Family Housing Management Facility	2,203		2,203

FY2003 Authorization of Appropriations for Military Construction
(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Worldwide	Army	Unspecified Worldwide Locations	Construction Improvements	239,751		239,751
Worldwide	Army	Unspecified Worldwide Locations	Planning and Design	15,653		15,653
Worldwide	Army	Unspecified Worldwide Locations	Management Account	91,567		91,567
Worldwide	Army	Unspecified Worldwide Locations	Services Account	41,846		41,846
Worldwide	Army	Unspecified Worldwide Locations	Furnishings Account	48,673		48,673
Worldwide	Army	Unspecified Worldwide Locations	Miscellaneous Account	1,321		1,321
Worldwide	Army	Unspecified Worldwide Locations	Utilities Account	212,432		212,432
Worldwide	Army	Unspecified Worldwide Locations	Leasing	215,251		215,251
Worldwide	Army	Unspecified Worldwide Locations	Maintenance Of Real Property	485,257		485,257
Worldwide	Army	Unspecified Worldwide Locations	Servicemen's Mortgage Insurance Premium	1		1
Worldwide	Army	Unspecified Worldwide Locations	Privatization Support Costs	25,926		25,926
Worldwide	Army	Unspecified Worldwide Locations	Foreign Currency Fluctuations		-4,920	-4,920
Worldwide	Army	Unspecified Worldwide Locations	Civilian Personnel Accrual Accounting Adjustment		-3,267	-3,267
Worldwide	Navy	Unspecified Worldwide Locations	Construction Improvements	139,468		139,468
Worldwide	Navy	Unspecified Worldwide Locations	Planning and Design	11,281		11,281
Worldwide	Navy	Unspecified Worldwide Locations	Furnishings Account	30,344		30,344
Worldwide	Navy	Unspecified Worldwide Locations	Management Account	82,114		82,114
Worldwide	Navy	Unspecified Worldwide Locations	Miscellaneous Account	913		913
Worldwide	Navy	Unspecified Worldwide Locations	Services Account	62,583		62,583
Worldwide	Navy	Unspecified Worldwide Locations	Utilities Account	174,219		174,219
Worldwide	Navy	Unspecified Worldwide Locations	Leasing	129,085		129,085
Worldwide	Navy	Unspecified Worldwide Locations	Maintenance Of Real Property	381,388		381,388
Worldwide	Navy	Unspecified Worldwide Locations	Svcm's Mortgage Insurance Premium	71		71
Worldwide	Navy	Unspecified Worldwide Locations	Privatization Support Costs	7,071		7,071
Worldwide	Navy	Unspecified Worldwide Locations	Foreign Currency Fluctuations		-2,652	-2,652
Worldwide	Air Force	Unspecified Worldwide Locations	Construction Improvements	226,068		226,068
Worldwide	Air Force	Unspecified Worldwide Locations	Planning and Design	34,188		34,188
Worldwide	Air Force	Unspecified Worldwide Locations	Furnishings Account	35,619		35,619
Worldwide	Air Force	Unspecified Worldwide Locations	Management Account	48,473		48,473
Worldwide	Air Force	Unspecified Worldwide Locations	Services Account	25,178		25,178
Worldwide	Air Force	Unspecified Worldwide Locations	Utilities Account	132,945		132,945
Worldwide	Air Force	Unspecified Worldwide Locations	Miscellaneous Account	1,511		1,511
Worldwide	Air Force	Unspecified Worldwide Locations	Leasing	103,690		103,690
Worldwide	Air Force	Unspecified Worldwide Locations	Maintenance of Real Property	476,485		476,485
Worldwide	Air Force	Unspecified Worldwide Locations	Servicemen's Mortgage Insurance Premium	36		36

FY2003 Authorization of Appropriations for Military Construction
(Dollars in Thousands)

Location	Service/Agency/Program	Installation	Project Title	FY03 Auth Request	Senate Change	Senate Authorized
Worldwide	Air Force	Unspecified Worldwide Locations	Privatization Support Costs	20,482		20,482
Worldwide	Air Force	Unspecified Worldwide Locations	Foreign Currency Fluctuations		-8,782	-8,782
Worldwide	Air Force (Transfer from DERF)	Unspecified Worldwide Locations	AT/FP Facility Upgrades		29,631	29,631
Worldwide	DIA	Unspecified Worldwide Locations	Furnishings Account	3,689		3,689
Worldwide	DIA	Unspecified Worldwide Locations	Leasing	26,220		26,220
Worldwide	DLA	Unspecified Worldwide Locations	Furnishings	26		26
Worldwide	DLA	Unspecified Worldwide Locations	Services Account	76		76
Worldwide	DLA	Unspecified Worldwide Locations	Utilities Account	410		410
Worldwide	DLA	Unspecified Worldwide Locations	Management Account	308		308
Worldwide	DLA	Unspecified Worldwide Locations	Maintenance of Real Property	510		510
Worldwide	DLA	Unspecified Worldwide Locations	Civilian Personnel Accrual Accounting Adjustment		-37	-37
Worldwide	NSA	Unspecified Worldwide Locations	Construction Improvements	50		50
Worldwide	NSA	Unspecified Worldwide Locations	Furnishings Account	120		120
Worldwide	NSA	Unspecified Worldwide Locations	Management Account	15		15
Worldwide	NSA	Unspecified Worldwide Locations	Miscellaneous Account	58		58
Worldwide	NSA	Unspecified Worldwide Locations	Services Account	339		339
Worldwide	NSA	Unspecified Worldwide Locations	Utilities Account	407		407
Worldwide	NSA	Unspecified Worldwide Locations	Leasing	9,643		9,643
Worldwide	NSA	Unspecified Worldwide Locations	Maintenance of Real Property	611		611
Worldwide	Family Housing Improvement Fund	Unspecified Worldwide Locations	Family Housing Improvement Fund	2,000		2,000
			Total Family Housing	4,220,133	9,973	4,230,106
			Total Military Construction/Family Housing	8,934,049	1,194,527	10,128,576

FISCAL YEAR 2003 AUTHORIZATION OF APPROPRIATIONS FOR MILITARY CONSTRUCTION

TITLE XXI—ARMY

Summary

The Army requested authorization of $1,476.5 million for military construction and $1,405.6 million for family housing for fiscal year 2003. The committee recommends authorization of $1,602.0 million for military construction and $1,397.4 million for family housing for fiscal year 2003.

The amounts authorized for military construction and family housing reflect a reduction of $18.6 million to be achieved from savings in the foreign currency account and $29.4 million from accrual accounting adjustments. This reduction shall not cancel any military construction authorized by title XXI of this bill.

Authorized Army construction and land acquisition projects (sec. 2101)

This section contains the list of authorized Army construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is the binding list of the specific projects authorized at each location.

Family housing (sec. 2102)

This section would authorize new construction and planning and design of family housing units for the Army for fiscal year 2003. It would also authorize funds for facilities that support family housing, including housing management offices and housing maintenance and storage facilities.

Improvements to military family housing units (sec. 2103)

This section would authorize improvements to existing Army family housing units for fiscal year 2003.

Authorization of appropriations, Army (sec. 2104)

This section would authorize specific appropriations for each line item contained in the Army's military construction and family housing budget for fiscal year 2003. This section also provides an overall limit on the amount the Army may spend on military construction projects.

Modification of authority to carry out certain fiscal year 2002 projects (sec. 2105)

The committee recommends a provision that would amend sections 2101 and 2104 of the Military Construction Act for Fiscal Year 2002 (division B of Public Law 107–107) to increase the fund-

ing authorization for barracks projects at Fort Carson, Colorado and Fort Jackson, South Carolina by a total of $4.0 million.

Modification of authority to carry out certain fiscal year 2000 project (sec. 2106)

The committee recommends a provision that would amend section 2401 of the Military Construction Authorization Act for Fiscal Year 2000 (division B of Public Law 106–65) to increase the project authorization for a chemical demilitarization facility at Blue Grass Army Depot, Kentucky, by $36.3 million.

Modification of authority to carry out certain fiscal year 1999 project (sec. 2107)

The committee recommends a provision that would amend the Military Construction Authorization Act for Fiscal Year 1999 (division B of Public Law 105–261) to increase the total project authorization for a chemical demilitarization facility at Newport Army Depot, Indiana by $102.3 million.

Modification of authority to carry out certain fiscal year 1997 project (sec. 2108)

The committee recommends a provision that would amend section 2401 of the Military Construction Authorization Act for Fiscal Year 1997 (division B of Public Law 104–201), as amended, to increase the total project authorization for the Chemical Weapons and Munitions Destruction facility at Pueblo Chemical Activity, Colorado by $57.5 million.

TITLE XXII—NAVY

Summary

The Navy requested authorization of $895.1 million for military construction and $1,243.5 million for family housing for fiscal year 2003. The committee recommends authorization of $1,237.3 million for military construction and $1,240.8 million for family housing for fiscal year 2003.

The amounts authorized for military construction and family housing reflect a reduction of $4.0 million to be achieved from savings in the foreign currency account and $10.5 million from accrual accounting adjustments. This reduction shall not cancel any military construction authorized by title XXII of this bill.

Authorized Navy construction and land acquisition projects (sec. 2201)

This section contains the list of authorized Navy construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is the binding list of the specific projects authorized at each location.

Family housing (sec. 2202)

This section would authorize new construction and planning and design of family housing units for the Navy for fiscal year 2003. It would also authorize funds for facilities that support family housing, including housing management offices and housing maintenance and storage facilities.

Improvements to military family housing units (sec. 2203)

This section would authorize improvements to existing Navy and Marine Corps family housing units for fiscal year 2003.

Authorization of appropriations, Navy (sec. 2204)

This section would authorize specific appropriations for each line item in the Navy's military construction and family housing budget for fiscal year 2003. This section also provides an overall limit on the amount the Navy may spend on military construction projects.

Modification of authority to carry out certain fiscal year 2000 projects (sec. 2205)

The committee recommends a provision that would amend the Military Construction Authorization Act for Fiscal Year 2002 (division B of Public Law 107–107) to increase the total project authorization for the projects at Naval Station, Norfolk, Virginia by $280,000. The provision would also correct the number of housing units authorized for a project at Quantico, Virginia from 60 units to 39 units.

The committee notes that the table on page 755 of the star print of the statement of managers accompanying the National Defense Authorization Act for Fiscal Year 2002 (H. Rept. 107–333) contained a similar error on the number of units. That table also incorrectly stated the number of units of family housing to be constructed at Marine Corps Base Kaneohe, Hawaii as 212 units rather than the 172 units authorized in section 2202.

In addition, the reference in that table to housing construction at "NCBC Gulfport" in Mississippi should have read "Naval Station, Pascagoula". Section 2202 of that act was so modified by section 1003 of the Department of Defense and Emergency Supplemental Appropriations for Recovery from and Response to Terrorist Attacks on the United States Act, 2002 (Public Law 107–117).

TITLE XXIII—AIR FORCE

Summary

The Air Force requested authorization of $644.1 million for military construction and $1,521.1 million for family housing for fiscal year 2003. The committee recommends authorization of $1,055.3 million for military construction and $1,542.0 million for family housing for fiscal year 2003.

The amounts authorized for military construction and family housing reflect a reduction of $19.1 million to be achieved from savings in the foreign currency account. This reduction shall not cancel any military construction authorized by title XXIII of this bill.

Authorized Air Force construction and land acquisition projects (sec. 2301)

This section contains the list of authorized Air Force construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is the binding list of the specific projects authorized at each location.

Family housing (sec. 2302)

This section would authorize new construction and planning and design of family housing units for the Air Force for fiscal year 2003. It would also authorize funds for facilities that support family housing, including housing management offices and housing maintenance and storage facilities.

Improvements to military family housing units (sec. 2303)

This section would authorize improvements to existing Air Force family housing units for fiscal year 2003.

Authorization of appropriations, Air Force (sec. 2304)

This section would authorize specific appropriations for each line item in the Air Force's budget for fiscal year 2003. This section would also provide an overall limit on the amount the Air Force may spend on military construction projects.

OTHER ITEMS OF INTEREST

Training facilities for military operations in urban terrain

The committee understands and has supported the construction of facilities to train our forces for military operations in urban terrain (MOUT) at the combat training centers as well as for home-station training. The fiscal year 2003 budget request for the Defense Emergency Response Fund included $19.0 million for two MOUT facilities at Lackland Air Force Base.

The committee recommends authorization of these projects but directs that no funds be obligated for the construction of these projects until the Secretary of Defense submits a report describing the requirement for MOUT facilities. The report would include the desired distribution and total number of such facilities, the extent to which MOUT facilities can be shared among the military departments and active and reserve components, and whether such facilities are required at installations, such as Lackland Air Force Base, conducting basic and advanced training in addition to operational units.

TITLE XXIV—DEFENSE AGENCIES

Summary

The defense agencies requested authorization of $687.5 million for military construction and $49.9 million for family housing for fiscal year 2003. The committee recommends authorization of $722.0 million for military construction and $49.9 million for family housing in fiscal year 2003.

The amounts authorized for military construction and family housing reflect a reduction of $3.0 million to be achieved from savings in the foreign currency account. This reduction shall not cancel any military construction authorized by title XXIV of this bill.

Authorized defense agencies construction and land acquisition projects (sec. 2401)

This section contains the list of authorized defense agency construction projects for fiscal year 2003. The authorized amounts are listed on an installation-by-installation basis. The state list contained in this report is the binding list of the specific projects authorized at each location.

Improvements to military family housing units (sec. 2402)

This section would authorize improvements to existing defense agency family housing units for fiscal year 2003.

Energy conservation projects (sec. 2403)

This section would authorize the Secretary of Defense to carry out energy conservation projects. The committee recommends an increase of $1.0 million to the budget for this program for the integration of photovoltaic power systems into new construction or facility renovation projects. The committee directs the Department of Defense to study which locations and facilities offer the greatest potential for incorporating photovoltaic projects and to select those projects and technologies that offer the best performance and reliability.

Authorization of appropriations, defense agencies (sec. 2404)

This section would authorize specific appropriations for each defense agency military construction program for fiscal year 2003. This section also would provide an overall limit on the amount that may be spent on such military construction projects.

OTHER ITEMS OF INTEREST

Bio-defense research laboratory facility at Fort Detrick

The budget request included $5.0 million in the Defense-wide military construction account for planning and design of a new

Center for Biological Counterterrorism Research at Fort Detrick, Maryland as part of the Chemical-Biological Defense Program (CBDP). This proposed new center, which would begin with one-year additional funding in the CBDP to address homeland security concerns, is intended to take advantage of the world-class scientific and technical expertise at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) located at Fort Detrick. According to the budget request, the Office of Homeland Security envisions that the center would conduct biological threat assessment research, investigate countermeasures to those threats, and perform biological forensics in support of the Department of Defense and other national requirements.

The committee directs the Army to expand its planning and design effort to include consideration of a possible new USAMRIID facility that would permit USAMRIID to accomplish its full range of assigned missions in support of the warfighter and to accomplish additional missions assigned in light of the terrorist attacks of 2001. In addition, the committee directs the Department of Defense and the Army to explore collaboration and cooperation with the Department of Health and Human Services and the National Institutes of Health (NIH) and the Office of Homeland Security to determine whether a single new facility at Fort Detrick could meet the needs of each agency for its biological defense research and development requirements.

Following the anthrax mail attacks on the Senate and elsewhere in 2001, USAMRIID played a critical role in the Nation's response. It analyzed the anthrax that was sent to the Senate, determined which antibiotics would work against the anthrax illness, and analyzed more than 16,600 samples of suspicious materials that may have contained biological warfare agents. This work was managed in conjunction with USAMRIID completing its assigned missions to support U.S. Armed Forces. This predicament caused difficult space and personnel conditions.

In the conference report to accompany H.R. 3338, the Department of Defense Appropriations Act for Fiscal Year 2002 (H. Rept. 107–350), the Army was required to conduct a feasibility study to finalize the mission of USAMRIID and determine the infrastructure requirements and associated costs needed to accommodate USAMRIID's expanded role. The Army is completing this study but has not submitted it to Congress as of May 9, 2002. The committee is aware that USAMRIID has already outgrown its existing facilities and is in need of expanded and modernized facilities to accomplish its critical mission. This situation will be exacerbated should USAMRIID's workload and space requirements be increased. There are some 14 vaccines under development, each of which will require testing, in addition to a growing number of therapeutics and new technologies being developed or investigated.

Rather than planning for two or more new or expanded facilities for USAMRIID and for an additional NIH facility at Fort Detrick, the committee believes it would be better for both agencies to collaborate and try to design one facility that could meet their combined needs.

TITLE XXV—NORTH ATLANTIC TREATY ORGANIZATION INVESTMENT PROGRAM

Summary

The Department of Defense requested authorization of $168.2 million for the North Atlantic Treaty Organization (NATO) Security Investment Program for fiscal year 2003. The committee recommends an authorization of $168.2 million for fiscal year 2003.

Authorized North Atlantic Treaty Organization construction and land acquisition projects (sec. 2501)

This section would authorize the Secretary of Defense to make contributions to the North Atlantic Treaty Organization (NATO) Security Investment Program in an amount equal to the sum of the amount specifically authorized in section 2502 of this title and the amount of recoupment due to the United States for construction previously financed by the United States.

Authorization of appropriations, North Atlantic Treaty Organization (sec. 2502)

This section would authorize appropriations of $168.2 million for the United States' contribution to the North Atlantic Treaty Organization (NATO) Security Investment Program for fiscal year 2003.

TITLE XXVI—GUARD AND RESERVE FORCES FACILITIES

Summary

The Department of Defense requested a military construction authorization of $297.3 million for fiscal year 2003 for National Guard and Reserve facilities. The committee recommends authorizations for fiscal year 2003 of $568.6 million to be distributed as follows:

Army National Guard	$183,000,000
Air National Guard	204,000,000
Army Reserve	63,000,000
Air Force Reserve	59,900,000
Naval and Marine Corps Reserve	58,700,000
Total	568,600,000

Authorized Guard and Reserve construction and land acquisition projects (sec. 2601)

This section would authorize appropriations for military construction for the National Guard and Reserve by service components for fiscal year 2003. The state list contained in this report is the binding list of the specific projects authorized at each location.

TITLE XXVII—EXPIRATION AND EXTENSION OF AUTHORIZATIONS

Expiration of authorizations and amounts required to be specified by law (sec. 2701)

This section would provide that authorizations for military construction projects, repair of real property, land acquisition, family housing projects, contributions to the North Atlantic Treaty Organization infrastructure program, and National Guard and Reserve military construction projects would expire on October 1, 2005, or the date of enactment of an act authorizing funds for military construction for fiscal year 2006, whichever is later. This expiration would not apply to authorizations for projects for which appropriated funds have been obligated before the later of October 1, 2005, or the date of enactment of an act authorizing funding for military construction for fiscal year 2006.

Extension of authorizations of certain fiscal year 2000 projects (sec. 2702)

This section would extend the authorizations for certain fiscal year 2000 military construction projects until October 1, 2003, or the date of enactment of an act authorizing funds for military construction for fiscal year 2004, whichever is later.

Extension of authorizations of certain fiscal year 1999 projects (sec. 2703)

This section would extend the authorizations for certain fiscal year 1999 military construction projects until October 1, 2003, or the date of enactment of an act authorizing funds for military construction for fiscal year 2004, whichever is later.

Effective date (sec. 2704)

This section would provide that titles XXI, XXII, XXIII, XXIV, XXV, and XXVI of this act shall take effect on October 1, 2002, or the date of enactment of this act, whichever is later.

TITLE XXVIII—GENERAL PROVISIONS

SUBTITLE A—MILITARY CONSTRUCTION PROGRAM AND MILITARY FAMILY HOUSING CHANGES

Lease of military family housing in Korea (sec. 2801)

The committee recommends a provision that would amend section 2828(e) of title 10, United States Code, to increase, from 800 to 1,175 units, the number of family housing units the Secretary of the Army may lease in Korea for which the maximum annual lease cost per unit is $25,000. The provision would also newly authorize the Secretary to lease no more than 2,400 family housing units for which the maximum annual lease cost is $35,000 per unit. Further, the provision would make certain conforming changes.

The committee directs the Secretary of the Army, as executive agent for housing in Korea, and the Commander, United States Forces Korea, to ensure that these additional leased housing units are allocated in order to make additional housing available for commands or military units that are currently significantly under the authorized 10 percent level of accompanied tours.

Repeal of source requirements for family housing construction overseas (sec. 2802)

The committee recommends a provision that would repeal section 803 of the Military Construction Authorization Act, 1984 (Public Law 98–115), which requires the use of housing manufactured or fabricated in the United States in family housing constructed in foreign countries.

SUBTITLE B—REAL PROPERTY AND FACILITIES ADMINISTRATION

Agreements with private entities to enhance military training, testing, and operations (sec. 2811)

The committee recommends a provision that would authorize the Secretary of Defense or the secretaries of the military departments to enter into agreements with private entities that would enhance or protect military training. These entities would acquire interests in lands adjacent to military installations that would serve to limit development or preserve habitat.

This authority would be used to enter into agreements intended to enhance or protect military training and operations by making additional lands available either for training directly on such lands or as buffer zones between military training or operating areas and the surrounding civilian population. Such buffer zones may in some cases also serve to create or preserve habitat that would reduce the burden on military installations to provide such habitat. These authorities are not intended to be used broadly to acquire interests

in lands for any and all land use needs that military installations might have; rather, they should be used to protect training and other military operations or to provide habitat that is compatible with environmental requirements and military training operations.

The committee has included a separate provision that would authorize $20.0 million for a Range Enhancement Initiative Fund that would be available to finance the cost of agreements entered into under this authority in a separate provision in title III of this act. The committee intends that funds in this account would be used primarily to purchase restrictive easements on property adjacent to military installations rather than to acquire the lands to be owned and managed by the military departments. The committee directs the Department of Defense to use this authority, and the funding in the Range Enhancement Initiative Fund, to implement those agreements that have the highest potential to enhance or protect military training.

Conveyance of surplus real property for natural resource conservation (sec. 2812)

The committee recommends a provision that would authorize the secretaries of the military departments to convey surplus real property to State or local governments or to private entities who have as their primary purpose the conservation of open space or natural resources. Property would be conveyed under this authority under the condition that it be used to preserve open space or the natural resources on such property. Any property conveyed that was no longer being used for such purposes would revert to the United States.

Real property would be eligible for conveyance under this authority if it is suitable for natural resource conservation; surplus property for purposes of title II of the Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471 et seq.); and has been available for public benefit conveyance for a sufficient period of time. The real property may be conveyed only if the conveyee agrees that the property will be used and maintained for natural resource conservation. Any subsequent conveyance would be subject to written secretarial approval, prior notification to Congress, and to the condition that the property be maintained for natural resource conservation in perpetuity. Any property that was no longer being maintained in accordance with these provisions would revert to the United States.

Modification of demonstration program on reduction in long-term facility maintenance costs (sec. 2813)

The committee recommends a provision that would amend section 2814 of the Military Construction Act for Fiscal Year 2002 (division B of Public Law 107–107) to authorize the Department of Defense to expand the number of demonstration projects on reduction of long-term facility maintenance costs from three to 12. The provision would amend the Act to expand the program to the Department of the Navy and the Department of the Air Force while providing for the continuation of ongoing Army demonstration projects.

SUBTITLE C—LAND CONVEYANCES

Conveyance of certain lands in Alaska no longer required for National Guard purposes (sec. 2821)

The committee recommends a provision that would authorize the Secretary of the Army to convey lands that are under the jurisdiction of the Department of the Army in the State of Alaska to the State, any local government entity, Native Corporation, or Indian tribe in the State of Alaska, as the Secretary determines to be in the public interest.

The Secretary may convey any property in the State of Alaska if he determines that the real property is any of the following: (1) currently under the jurisdiction of the Department of the Army; (2) was under the jurisdiction of the Department of the Army for use of the Alaska National Guard before December 2, 1980; (3) is located in a unit of the National Wildlife Refuge System designated in the Alaska National Interest Lands Conservation Act (94 Stat. 2371: 16 U.S.C. 1301 note); (4) is excess to the needs of the Alaska National Guard and Department of Defense; and (5) the cost of retaining the property exceeds the value of the property or such property is unsuitable for retention by the United States. The provision would authorize the Secretary to convey the property with or without consideration. Any amounts received in consideration could be used, subject to appropriations, to pay any costs associated with the conveyance.

Land conveyance, Fort Campbell, Kentucky (sec. 2822)

The committee recommends a provision that would authorize the Secretary of the Army to convey, without consideration, to the City of Hopkinsville, Kentucky, a parcel of real property consisting of approximately 50 acres and containing an abandoned railroad spur at Fort Campbell, Kentucky. The purpose of the conveyance would be for storm water management, recreation, transportation, and other public purposes. As a condition of the conveyance, the City would be required to pay all associated costs.

Modification of authority for land transfer and conveyance, Naval Security Group Activity, Winter Harbor, Maine (sec. 2823)

The committee recommends a provision that would amend section 2845 (b) of the Military Construction Act for Fiscal Year 2002 (division B of Public Law 107–107) to modify the authority of the Secretary of the Navy to convey 485 acres located at the former Naval Security Group Activity, Winter Harbor, Maine. The provision would authorize the Secretary to convey to the State of Maine, political subdivision of the State, or any tax-supported agency in the State, without consideration, approximately 50 acres known as the Corea Operating Site and approximately 23 acres comprising three parcels containing family housing. The provision would further authorize the Secretary to convey approximately 404 acres of the Corea site to the Secretary of the Interior for inclusion in the National Wildlife Refuge System.

The committee further recommends that the conveyance be exempt from the requirement to screen the property for further fed-

eral use pursuant to section 2696 of title 10, United States Code. The committee recommends this exemption only because this property has already been screened for purposes of carrying out the underlying provision that this provision would modify. The conveyance of part of this property to the Secretary of the Interior under this section reflects the interest expressed by the Department of the Interior under that screening.

Land conveyance, Westover Air Reserve Base, Massachusetts (sec. 2824)

The committee recommends a provision that would authorize the Secretary of the Navy to convey, without consideration, to the City of Chicopee, Massachusetts, property consisting of 30.4 acres, including 188 housing units and other improvements that are no longer required for defense purposes, located at Westover Air Reserve Base, Massachusetts. The property would be used by the city for economic development. The provision would authorize the Secretary to require the City of Chicopee to reimburse the Navy for the administrative costs related to the conveyance.

Land conveyance, Naval Station Newport, Rhode Island (sec. 2825)

The committee recommends a provision that would authorize the Secretary of the Navy to convey to the State of Rhode Island, or any political subdivision thereof, a parcel of real property consisting of approximately 34 acres, together with any improvements thereon, known as the Melville Marina site. The conveyance would be by sale for fair market value.

Land exchange, Buckley Air Force Base, Colorado (sec. 2826)

The committee recommends a provision that would authorize the Secretary of the Air Force to convey to the State of Colorado property consisting of approximately 72 acres, including improvements, known as the Watkins Communication Site in Arapahoe County, Colorado. In exchange, the State would convey to the Air Force real property consisting of approximately 41 acres, including improvements, that is contiguous to Buckley Air Force Base, Colorado. The property conveyed to the Air Force would be used to build additional housing and would not be subject to general land laws, including mining and mineral and geothermal leasing laws. The provision would authorize additional terms and conditions, which may include a payment by one party to the other to reflect the difference in the value of the two parcels of property. Because the acquisition of this land has not yet received the approval normally required by the Office of the Secretary of Defense, the provision specifies that this exchange would require the concurrence of the Secretary of Defense.

Land acquisition, Boundary Channel Drive Site, Arlington, Virginia (sec. 2827)

The committee recommends a provision that would authorize the Secretary of Defense, using amounts authorized to be appropriated by section 2401, to acquire approximately 7.2 acres of real property

in Arlington County, Virginia, known as the Boundary Channel Drive Site. The provision would direct that, upon the purchase of the site, the property shall be included in the Pentagon Reservation as defined in section 2674 (f)(1) of title 10, United States Code.

Land conveyances, Wendover Air Force Base Auxiliary Field, Nevada (sec. 2828)

The committee recommends a provision that would authorize the Secretary of the Interior to convey, without consideration, to the City of West Wendover, Nevada two parcels of real property that are no longer required. The purpose of the conveyance would be to establish a runway protection zone and to develop an industrial park. The provision would also provide for a separate conveyance of the portion of these lands that lie in Utah to Tooele County, Utah for a runway protection and aircraft accident prevention zone.

SUBTITLE D—OTHER MATTERS

Transfer of funds in lieu of acquisition of replacement property for National Wildlife Refuge system in Nevada (sec. 2841)

The committee recommends a provision that would authorize the Secretary of the Air Force to transfer $15.0 million in funds appropriated for the acquisition of land at Nellis Air Force Base, Nevada that are authorized to be appropriated in this Act to the Secretary of Interior, on behalf of the United States Fish and Wildlife Service, to fulfill the Air Force's obligations to replace National Wildlife Refuge lands that were withdrawn for use by the Air Force in section 3011 of the Military Lands Withdrawal Act of 1999 (Title XXX of the National Defense Authorization Act for Fiscal Year 2000, Public Law 106–65). This provision would allow the Air Force to fulfill its obligations under the Memorandum of Agreement between the Air Force and the Fish and Wildlife Service dated July 26, 2000.

OTHER ITEMS OF INTEREST

Accompanied tours in Korea

General Thomas Schwartz, Commander of United States Forces, Korea, has stated a goal of significantly increasing the supply of family housing for United States military forces stationed in the Republic of Korea to allow the percentage of personnel stationed in Korea on accompanied tours to increase from the 10 percent level currently authorized to 25 percent within 10 years.

While the committee believes that such an initiative has the potential to improve retention, improve quality of life and morale, and reduce turbulence in the personnel system, such benefits would require a significant expenditure of resources. The committee believes the costs of such a proposal must be understood in advance so that the Department of Defense and Congress can weigh the costs and benefits.

Therefore, the committee directs the Under Secretary of Defense for Personnel and Readiness to report to the congressional defense committees, no later than March 1, 2003, on the additional costs

of providing the facilities and services necessary to support accompanied tours for 25 percent of our forces in Korea, including family housing, medical and child care facilities and services, and force protection. The report should also contain the Secretary's views on such a proposal, a discussion of a schedule for implementing any proposal the Secretary endorses, and a discussion of the cost-sharing of any such proposal between the United States and the Republic of Korea.

Aircraft carrier basing plans

The Committee notes that the Navy is considering extending the life of the USS Constellation beyond its scheduled decommissioning in fiscal year 2003 to meet operational requirements and stabilize rotation schedules. This and other possible extensions, the completion of the USS Ronald Reagan, and the development and construction of CVNX–1 raise the possibility that the Navy will have more than the current twelve aircraft carriers in service at one time in the coming years. Given the cost of manning, operating, maintaining and basing aircraft carriers, the committee directs the Chief of Naval Operations to report to the congressional defense committees within 180 days of enactment of this bill on the Navy's basing plans for aircraft carriers through the year 2015.

Availability of excess lands for school construction

In some cases, military installations may have excess land that could be used by State or local governments for the construction of public schools, including the construction of charter schools, as evidenced at the Naval Air Station Joint Reserve Base, Belle Chasse, Louisiana. The committee requests that the Department of Defense study the feasibility and advisability of supporting local communities by identifying any excess property at military installations that could be transferred to the Secretary of Education for conveyance to state and local school districts for the construction of new schools.

DIVISION C—DEPARTMENT OF ENERGY NATIONAL SECURITY AUTHORIZATIONS AND OTHER AUTHORIZATIONS

TITLE XXXI—DEPARTMENT OF ENERGY NATIONAL SECURITY PROGRAMS

SUBTITLE A—NATIONAL SECURITY PROGRAMS AUTHORIZATIONS

Atomic energy defense activities

Title XXXI authorizes appropriations for the atomic energy defense activities of the Department of Energy for fiscal year 2003, including: the purchase, construction, and acquisition of plant and capital equipment; research and development; nuclear weapons; naval nuclear propulsion; environmental restoration and waste management; operating expenses; and other expenses necessary to carry out the purpose of the Department of Energy Organization Act (Public Law 95–91). The title would authorize appropriations in five categories: National Nuclear Security Administration (NNSA); defense environmental management; defense environmental management privatization; other defense activities; and defense nuclear waste disposal.

The budget request for fiscal year 2003 for atomic energy defense activities totaled $15.4 billion, a 4.4 percent increase over the adjusted fiscal year 2002 level. Of the total amount requested: $8.2 billion was for NNSA; $6.4 billion was for defense environmental management activities; $158.4 million was for defense environmental management privatization; $479.6 million was for other defense activities; and $315.0 million was for defense nuclear waste disposal.

The committee recommends $15.7 billion for atomic energy defense activities, an increase of $300.1 million to the budget request. The committee recommends $8.1 billion for the National Nuclear Security Administration (NNSA), an increase of $121.3 million to the budget request. The amount authorized for NNSA is as follows: $6.0 billion for weapons activities, an increase of $118.8 million to the budget request; $1.1 billion for defense nuclear nonproliferation, an increase of $15.5 million to the budget request; $707.0 million for naval reactors, a reduction of $1.0 million below the budget request; and $335.7 million for the Office of the Administrator, a reduction of $12.0 million below the budget request. The committee further recommends $6.9 billion for defense environmental management, including defense facility closure projects, an increase of $261.1 million to the budget request. The committee recommends $158.4 million for defense environmental management privatization, the amount of the budget request. The committee recommends $489.9 million for other defense activities, an increase of $17.7 mil-

lion to the budget request; and $215.0 million for defense nuclear waste disposal, a reduction of $100.0 million to the budget request.

The following table summarizes the budget request and the committee recommendations:

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Atomic Energy Defense Activities (053)				
National nuclear security administration				
Weapons activities	5,531,746	5,869,379	118,809	5,988,188
Defense nuclear nonproliferation	993,780	1,113,630	15,500	1,129,130
Naval reactors	688,045	708,020	-1,000	707,020
Office of the administrator	312,596	347,705	-12,000	335,705
Total, National nuclear security administration	**7,526,167**	**8,038,734**	**121,309**	**8,160,043**
Environmental and other defense activities:				
Defense environmental restoration and waste management	5,230,372	4,558,360	43,100	4,601,460
Defense environmental cleanup reform	——	800,000	200,000	1,000,000
Defense facilities closure projects	1,092,878	1,091,314	18,000	1,109,314
Environmental management privatization	153,537	158,399	——	158,399
Other defense activities	497,544	472,156	17,727	489,883
Defense nuclear waste disposal	280,000	315,000	-100,000	215,000
Total Department of Energy/NNSA	**14,780,498**	**15,433,963**	**300,136**	**15,734,099**

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
National Nuclear Security Administration:				
Weapons Activities				
Directed stockpile work				
Stockpile research and development	357,014	467,149	(15,500)	451,649
Stockpile maintenance	347,963	401,157		401,157
Stockpile evaluation	174,391	197,184		197,184
Dismantlement/disposal	26,342	24,378		24,378
Production support	132,250	137,706		137,706
Field engineering, training and manuals	6,270	6,893		6,893
Total, Directed stockpile work	**1,044,230**	**1,234,467**	**-15,500**	**1,218,967**
Campaigns				
Science campaigns				
Primary certification	50,848	47,159		47,159
Dynamic materials properties	90,282	87,594		87,594
Advanced radiography				
Operations and maintenance	82,343	52,925		52,925
Secondary certification and nuclear systems margins	42,439	47,790		47,790
Total, Science campaigns	**265,912**	**235,468**	—	**235,468**
Engineering campaigns				
Enhanced surety	32,197	37,713		37,713
Weapons system engineering certification	25,726	27,007		27,007

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Nuclear survivability	21,902	23,394		23,394
Enhanced surveillance	73,685	77,155		77,155
Advanced design and production technologies	68,432	74,141		74,141
Total, Engineering campaigns	**221,942**	**239,410**	—	**239,410**
High energy density physics campaign				
Operations and maintenance	260,373	237,748	10,694	248,442
Construction:				
96-D-111 National ignition facility (NIF), LLNL, Livermore, CA	245,000	214,045	10,000	224,045
Total, High energy density physics campaign	**505,373**	**451,793**	**20,694**	**472,487**
Advanced simulation and computing				
Operations and maintenance	662,792	669,527		669,527
Construction:				
01-D-101 Distributed information systems laboratory, SNL, Livermore, CA	8,400	13,305		13,305
00-D-103, Terascale simulation facility, LLNL, Livermore, CA	22,000	35,030		35,030
00-D-107 Joint computational engineering laboratory, SNL, Albuquerque, NM	13,377	7,000		7,000
Total, Construction	**43,777**	**55,335**	—	**55,335**
Total, Advanced simulation and computing	**706,569**	**724,862**	—	**724,862**

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Pit manufacturing and certification	194,461	194,484	5,000	199,484
Readiness campaigns				
Stockpile readiness	46,315	61,027		61,027
High explosives manufacturing and weapons assembly/disassembly readiness	6,722	12,093	-1,000	11,093
Non-nuclear readiness	17,857	22,398	-2,000	20,398
Materials readiness	1,188	——		
Tritium readiness				
Operations and maintenance	41,584	56,134		56,134
Construction:				
98-D-125 Tritium extraction facility, Savannah River plant, Aiken, SC	81,125	70,165		70,165
Total, Tritium readiness	**122,709**	**126,299**	——	**126,299**
Total, Readiness campaigns	**194,791**	**221,817**	**-3,000**	**218,817**
Total, Campaigns	**2,089,048**	**2,067,834**	**22,694**	**2,090,528**
Readiness in technical base and facilities				
Operations of facilities	903,221	949,920	40,000	989,920
Program readiness	192,305	208,089		208,089
Special projects	51,155	37,744	6,900	44,644
Material recycle and recovery	94,268	98,816		98,816

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Containers	7,990	17,721		17,721
Storage	10,398	14,593		14,593
Nuclear weapons incident response	88,923	91,000		91,000
Subtotal, Readiness in technical base and facilities	**1,348,260**	**1,417,883**	**46,900**	**1,464,783**
Construction:				
03-D-101 Sandia underground reactor facility SURF, SNL, Livermore, CA	—	2,000		2,000
03-D-103 Project engineering and design various locations	—	15,539	2,300	17,839
03-D-121 Gas transfer capacity expansion, Kansas City Plant, Kansas City, MO	—	4,000		4,000
03-D-122 Prototype purification facility, Y-12 plant, Oak Ridge, TN	—	20,800		20,800
03-D-123 Special nuclear materials Requalification, Pantex plant, Amarillo, TX	—	3,000		3,000
02-D-103 Project engineering and design, various locations	22,647	27,245	-2,300	24,945
02-D-105 Engineering technology complex upgrade (ETCU), LLNL, Livermore, CA	4,674	10,000		10,000

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
02-D-107 Electrical power systems safety communications and bus upgrades, Nevada Test Site	3,451	7,500		7,500
01-D-103 Project engineering and design (PE&D), various locations	16,379	6,164		6,164
01-D-107 Atlas relocation and operations Nevada Test Site	3,300	4,123		4,123
01-D-108 Microsystem and engineering science applications (MESA), SNL, Albuquerque, NM	63,500	75,000		75,000
01-D-124 HEU storage facility, Y-12 plant, Oak Ridge, TN	——	25,000		25,000
01-D-126 Weapons Evaluation Test Laboratory Pantex Plant, Amarillo, TX	7,700	8,650		8,650
01-D-800 Sensitive compartmented information facility, LLNL	12,993	9,611		9,611
99-D-103 Isotope sciences facilities, LLNL, Livermore, CA	4,400	4,011		4,011
99-D-104 Protection of real property (roof				

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
reconstruction-Phase II), LLNL, Livermore, CA	300	5,915		5,915
99-D-127 Stockpile management restructuring initiative, Kanas City plant, Kansas City, MO	22,200	29,900		29,900
99-D-128 Stockpile management restructuring initiative, Pantex plant, Amarillo, TX	3,300	407		407
98-D-123 Stockpile management restructuring initiative, Tritium factory modernization and consolidation, Savannah River plant, SC	13,700	10,481		10,481
96-D-102 Stockpile stewardship facilities revitalization, Phase VI, various locations	2,900	1,000		1,000
Total, Construction	**181,444**	**270,346**	**——**	**270,346**
Total, Readiness in technical base and facilities	**1,529,704**	**1,688,229**	**46,900**	**1,735,129**
Facilities and infrastructure recapitalization program	196,800	242,512		242,512
Secure transportation asset				
Operations and equipment	101,640	100,863	1,715	102,578
Program direction	44,428	54,505		54,505
Total, Secure transportation asset	**146,068**	**155,368**	**1,715**	**157,083**

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Safeguards and security				
Operations and maintenance	545,281	501,054	65,000	566,054
Construction:				
99-D-132 SMRI nuclear material safeguards and security upgrade project, LANL, Los Alamos, NM	9,600	8,900		8,900
Total, Safeguards and security	**554,881**	**509,954**	**65,000**	**574,954**
Subtotal, Weapons Activities	**5,560,731**	**5,898,364**	**120,809**	**6,019,173**
Adjustments				
Less security charge for reimbursable work	-28,985	-28,985		(28,985)
Civilian personnel accrual accounting adjustment			-2,000	(2,000)
Total, Weapons Activities	**5,531,746**	**5,869,379**	**118,809**	**5,988,188**
Defense Nuclear Nonproliferation				
Nonproliferation and verification R&D				
Operation and maintenance	286,500	283,407	15,500	298,907
Total, Nonproliferation & verification R&D	**286,500**	**283,407**	**15,500**	**298,907**
Nonproliferation and international security	75,741	92,668		92,668
Nonproliferation programs with Russia				
International nuclear materials protection and cooperation	293,000	233,077		233,077

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Russian transition initiatives	57,000	39,334		39,334
HEU transparency implementation	13,950	17,229		17,229
International nuclear safety	20,000	14,576		14,576
Elimination of weapons-grade plutonium production program	——	49,339		49,339
Fissile materials disposition				
U S surplus materials disposition	135,089	194,000		194,000
Russian surplus materials disposition	61,000	98,000		98,000
Construction:				
01-D-407 Highly enriched uranium (HEU) blend down, Savannah River, SC	29,340	30,000		30,000
99-D-141 Pit disassembly and conversion facility, Savannah River, SC	11,000	33,000		33,000
99-D-143 Mixed oxide fuel fabrication facility, Savannah River, SC	65,993	93,000		93,000
Total, Construction	**106,333**	**156,000**	——	**156,000**
Total, Fissile materials disposition	**302,422**	**448,000**	——	**448,000**
Total, Nonproliferation programs with Russia	**762,113**	**894,223**	——	**894,223**
Program direction	3,000	——		0
Subtotal, Defense Nuclear Nonproliferation	**1,051,613**	**1,177,630**	**15,500**	**1,193,130**
Adjustments:				

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Use of prior year balances	-57,833	-64,000		(64,000)
Total, Defense Nuclear Nonproliferation	**993,780**	**1,113,630**	**15,500**	**1,129,130**
Naval reactors development				
Operation and maintenance	652,245	671,290		671,290
Construction:				
03-D-201 Cleanroom technology facility	——	7,200		7,200
01-D-200 Major office replacement building, Schenectady, NY	9,000	2,100		2,100
90-N-102 Expended core facility dry cell project, Naval Reactors Facility, ID	4,200	2,000		2,000
Total, Construction	**13,200**	**11,300**	——	**11,300**
Total, Naval reactors development	**665,445**	**682,590**	——	**682,590**
Program direction	22,600	25,430	-1,000	24,430
Total, Naval Reactors	**688,045**	**708,020**	**-1,000**	**707,020**
Office Of The Administrator	**312,596**	**347,705**	**-12,000**	335,705
Total, National Nuclear Security Administration	**7,526,167**	**8,038,734**	**121,309**	**8,160,043**

Defense Environmental Restoration & Waste Management

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Site/project completion				
Operation and maintenance	927,620	779,706		779,706
Construction:				
02-D-402 Intec cathodic protection system expansion project, INEEL, Idaho Falls, ID	3,152	1,119		1,119
02-D-420 Plutonium packaging and stabilization, Savannah River, SC	20,000	2,000		2,000
01-D-414 Preliminary project, engineering and design (PE&D), various locations	4,244	5,125		5,125
86-D-103 Decontamination and waste treatment facility, LLNL, Livermore, CA		——	6,000	6,000
	762			
Total, Construction	**28,158**	**8,244**	**6,000**	**14,244**
Total, Site/project completion	**955,778**	**787,950**	**6,000**	**793,950**
Post 2006 completion				
Operation and maintenance	2,062,755	1,702,241	2,100	1,704,341
Uranium enrichment D&D fund contribution	420,000	——		
Construction:				
93-D-187 High-level waste removal from filled waste tanks, Savannah River, SC	6,754	14,870		14,870

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Office of river protection				
Operation and maintenance	319,881	226,256		226,256
Construction:				
03-D-403 Immobilized high-level waste interim storage facility, Richland, WA	——	6,363		6,363
01-D-416 Tank waste remediation system, RL	665,000	619,000		619,000
97-D-402 Tank farm restoration and safe operations, Richland, WA	33,473	25,424		25,424
94-D-407 Initial tank retrieval systems, Richland, WA	6,844	20,945		20,945
Total, Construction	**705,317**	**671,732**	——	**671,732**
Total, Office of river protection	**1,025,198**	**897,988**	——	**897,988**
Total, Post 2006 completion	**3,514,707**	**2,615,099**	**2,100**	**2,617,199**
Science and technology	249,782	92,000		92,000
Excess facilities	4,874	1,300		1,300
Multi-Site activities				
Uranium enrichment D&D fund contribution	——	442,000	-1,000	441,000
Other activities	——	37,871	-37,871	0
Total, Multi-Site activities	——	**479,871**	**-38,871**	**441,000**

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Safeguards and security	213,821	228,260	50,000	278,260
Program direction	355,761	358,227	37,871	396,098
Subtotal, Defense environmental restoration and waste management	**5,294,723**	**4,562,707**	**57,100**	**4,619,807**
Use of prior year balances	-58,960	——		0
Civilian personnel accrual adjustment			-14,000	(14,000)
Less security charge for reimbursable work	-5,391	-4,347		(4,347)
Total, Defense Environmental Restoration And Waste Management	**5,230,372**	**4,558,360**	**43,100**	**4,601,460**
Environmental Management Cleanup Reform				
Environmental management cleanup reform	——	800,000	200,000	1,000,000
Defense Facilities Closure Projects				
Site closure	1,038,903	1,054,153		1,054,153
Safeguards and security	53,975	37,161	18,000	55,161
Total, Defense Facilities Closure Projects	**1,092,878**	**1,091,314**	**18,000**	**1,109,314**
Defense Environmental Management Privatization				
Privatization initiatives, various locations	**153,537**	**158,399**		158,399
Total, Defense Environmental Management	**6,476,787**	**6,608,073**	**261,100**	**6,869,173**
Other Defense Activities				
Energy security and assurance				

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
Energy security	—	23,411	-23,411	0
Program direction	—	4,275	-4,275	0
Total, Energy security and assurance	**—**	**27,686**	**(27,686)**	**0**
Office of Security				
Nuclear safeguards and security	120,000	91,102	65,000	156,102
Security investigations	44,927	45,870		45,870
Program direction	79,000	50,246		50,246
Chief information officer				
Corporate management information program	10,000	—		0
Total, Office of Security	**253,927**	**187,218**	**65,000**	**252,218**
Intelligence	40,844	41,559	2,000	43,559
Counterintelligence	46,000	46,083	2,000	48,083
Independent oversight and performance assurance	14,904	22,615		22,615
Environment, safety & health				
Environment, safety and health (defense)	95,688	81,892	5,000	86,892
Program direction	22,000	18,018		18,018
Total, Environment, safety and health	**117,688**	**99,910**	**5,000**	**104,910**
Worker and community transition				
Worker and community transition	18,000	22,965		22,965
Program direction	2,000	2,809		2,809
Total, Worker and community transition	**20,000**	**25,774**	**—**	**25,774**

Department of Energy National Security Programs
(Dollars in Thousands)

	FY 2002 Current Approp.	FY 2003 Request to Congress	Senate Change	Senate Authorized
National security programs administration support	22,000	25,587	-25,587	0
Office of hearings and appeals	2,893	3,136		3,136
Subtotal, Other defense activities	**518,256**	**479,568**	**20,727**	**500,295**
Adjustments:				
Use of prior year balances	-20,000	-6,700		(6,700)
Civilian personnel accrual adjustment			-3,000	(3,000)
Less security charge for reimbursable work	-712	-712		(712)
Total, Adjustments	**-20,712**	**-7,412**	**-3,000**	**-10,412**
Total, Other Defense Activities	**497,544**	**472,156**	**17,727**	**489,883**
Defense Nuclear Waste Disposal				
Defense nuclear waste disposal	280,000	315,000	-100,000	215,000
Total, Environmental and Other Defense Activities	**7,254,331**	**7,395,229**	**178,827**	**7,574,056**
TOTAL, Atomic Energy Defense Activities	**14,780,498**	**15,433,963**	**300,136**	**15,734,099**

National Nuclear Security Administration (sec. 3101)

The committee recommends a provision that would authorize $8.2 billion to be appropriated to the Department of Energy (DOE) for fiscal year 2003 for the National Nuclear Security Administration (NNSA) to carry out programs necessary to national security.

Weapons activities

The committee recommends $6.0 billion for weapons activities, a $118.8 million increase above the amount requested for fiscal year 2003. The amount authorized is for the following activities: $1.2 billion for directed stockpile work, a decrease of $15.5 million to the budget request; $2.1 billion for campaigns, an increase of $22.7 million above the request; $1.7 billion for readiness in the technical base, an increase of $46.9 million above the request; $157.1 million for secure transportation assets, an increase of $1.7 million above the request; $575.0 million for safeguards and security, an increase of $65.0 million above the request; and $242.5 million for facilities and infrastructure, the amount of the request. The amounts authorized are reduced by $30.0 million, an offset for security charges for reimbursable work and $1.0 for civilian personnel accrual.

Directed stockpile work

The committee recommends $1.2 billion for directed stockpile work, a reduction of $15.5 million to the budget request. The directed stockpile account supports work directly related to weapons in the stockpile, including day-to-day maintenance as well as research, development, engineering, and certification activities to support planned life extension programs. It also includes fabrication and assembly of weapons components, weapons dismantlement and disposal, training, and support equipment. The committee recommends no funds for the Robust Nuclear Earth Penetrator.

The committee believes that as the reductions in operationally deployed nuclear warheads occur, as announced in the December 2001 Nuclear Posture Review (NPR), there will be an increased demand for weapons dismantlement associated with the W–62 warhead, which is being retired from the Minuteman III land based Intercontinental Ballistic Missile, and there may be additional increases in demand in the future. The NNSA has indicated that the capacity at the Pantex plant in Texas is fully utilized with the planned life extension programs and the planned W–79 and W–56 dismantlement efforts. This NNSA plan anticipates that all weapons in the stockpile as of today, with the exception of the W–62, will require life extension. The plan also assumes the direction in the NPR that no warheads will be taken out of the stockpile with the exception of the W–62.

The committee directs NNSA to study alternatives to existing facilities at Pantex for dismantlement. The Nevada Test Site has a new modern facility that was completed in the early 1990s to support nuclear weapons testing before the United States imposed a unilateral moratorium on underground nuclear weapons testing. This facility has capabilities similar to those of the Pantex plant. The facility, known as the Device Assembly Facility (DAF), is substantially underutilized. Its current mission is to deal with damaged nuclear weapons and to support subcritical experiments; how-

ever, DAF has the potential to be the main weapons dismantlement facility, thus relieving some of the pressure on the Pantex facility cited in the NPR. The DAF also has the potential to conduct the stockpile surveillance mission, either by taking over the surveillance mission or by supplementing the Pantex capabilities.

The committee directs the Administrator to conduct a study on the full range of potential uses for DAF, including dismantlement and surveillance, and report to the congressional defense committees on the result of this study no later than March 1, 2003. In looking at the DAF the Administrator should take into consideration the security, transportation, personnel and other costs of dismantlement at the DAF, as well as the cost of additional facilities that would be needed at Pantex. The Administrator should also make sure that no program added to the DAF will delay our test readiness capabilities, nor should the Administrator make the DAF unsuitable for ongoing subcritical tests.

Campaigns

The committee recommends $2.1 billion for campaigns, an increase of $22.7 million above the amount requested. The campaigns focus on science and engineering efforts involving the three weapons laboratories, the Nevada Test Site, and the weapons plants. Each campaign is focused on a specific activity to support and maintain the stockpile without underground nuclear weapons testing. These efforts maintain and enhance the safety, security, and reliability of the existing stockpile. The campaigns are divided into three major categories: science campaigns, readiness campaigns, and engineering campaigns.

The committee recommends $7.0 million, a $5.0 million increase, for the pit manufacturing and certification campaign to allow the Environmental Impact Statement (EIS) for a new pit facility to go forward. The EIS work can begin now because it is needed to support analysis for a number of facility options and facility sizes. The committee notes that the only validated pit requirement is for a small number of W–88 pits, which could be produced at the Los Alamos National Laboratory. Moreover, the committee urges NNSA to ensure that the requirements are well understood for this $2–$4 billion facility.

The committee urges NNSA and Department of Defense (DOD) to establish a valid annual pit requirement. The NNSA should not begin construction activities on this billion-dollar facility until there is a valid requirement that has been approved by DOE and DOD.

The committee recommends a reduction of $1.0 million in the high explosives campaign and a reduction of $2.0 million in the non-nuclear readiness campaigns. These reductions are available as some of the planned work in these campaigns is not adequately linked to requirements in the February 2001 NNSA stockpile life extension plan.

The committee recommends an increase of $10.7 million in the High Energy Density Physics (HEDP) campaign to keep the cryogenic target and National Ignition Facility (NIF) diagnostics on schedule with the planned NIF ignition schedule and to provide for the petawatt laser initiative.

Finally, the committee notes that no funding was requested for the High Average Power Laser (HAPL) program. The HAPL is a promising laser program that has both energy and defense potential. The hybrid nature of the HAPL is one of the reasons that it is not funded in either DOE science programs or NNSA. The committee urges the DOE to review the potential national value of the HAPL and to determine if there is an overriding national interest in funding the HAPL through a joint program or project office.

The committee provides an additional $10.0 million in the NIF construction line item to account for a funding reduction taken in the program two years ago.

Readiness in the technical base

The committee recommends $1.7 billion in readiness in the technical base and facilities (RTBF), an increase of $46.9 million. This account funds facilities and infrastructure in the weapons complex to ensure the operational readiness of the complex and includes construction funding for new facilities.

The budget request included $10.0 million in the operations of facilities sub-account in RTBF for the Center for Combating Terrorism. The committee recommends an increase of $40.0 million for the Center. This center serves as a test bed for a variety of technologies and will allow the unique capabilities of NNSA to be brought to bear on one of the nation's most urgent priorities. One of the results of NNSA center and work, in conjunction with DOD, was the successful testing of the thermobaric bomb.

The budget request included $37.7 million in the special projects sub-account in RTBF. The committee recommends an increase of $6.9 million to allow NNSA to make the annual payment to the Los Alamos Foundation established by section 3167(a) of the 1998 National Defense Authorization Act, to support schools in the Los Alamos, New Mexico area.

The budget request included two project engineering and design lines (PE&D) in the RTBF. The NNSA uses these accounts to fund project engineering and design activities that support conceptual design work for construction projects before funding is requested in a specific construction line item. Each year there is a new PE&D account request that would provide funds for design work planned to begin in the year requested.

The budget request included two projects in the fiscal year 2002 PE&D account, 02–D–103, that would begin in fiscal year 2003. The committee recommends a reduction of $2.3 million in construction line 02–D–103 and an increase of $2.3 million in construction line 03–D–103 to reflect the transfer of these two projects to the fiscal year 2003 PE&D account. The committee directs DOE and NNSA to include in a PE&D for any fiscal year only those projects that would receive initial funding in that year.

The committee also notes that there are a substantial number of very large construction projects that are included in the PE&D accounts for fiscal years 2002 and 2003. The committee is concerned that the out-year costs of all of these projects may be unaffordable. Moreover, these projects would increase the overall size of the NNSA complex at a time when Congress has been supportive of NNSA efforts to reduce the number of buildings in the complex and

catch up on years of deferred maintenance. Almost none of the projects in the PE&D accounts explain how the costs of tearing down current buildings to make way for the new buildings will be covered.

The committee is concerned that the large number of the new projects that are requested, without any plan to tear down the buildings that are being replaced, will place NNSA in a never-ending maintenance backlog cycle. The committee directs NNSA to include the costs of tearing down the facilities that are being replaced in the costs of all new projects. The committee also directs the Administrator to submit a report to the congressional defense committees certifying that the new buildings planned in the fiscal year 2002 and 2003 PE&D accounts are fully funded in the NNSA future years budget plan. The report should also include a plan for a net reduction of the square footage of buildings under the control of the NNSA.

The committee is also concerned about the Microsystems Engineering and Science Applications (MESA) complex. The budget request includes $75.0 million to support construction of all five phases of the full MESA complex. An established requirement exists for the first three phases: the utilities upgrades, the retooling of the Microelectronics Development Laboratory (MDL), and the Microsystems Fabrication building, which is the replacement for the older Compound Semiconductor Research Laboratory. There is no approved requirement for the remaining two phases, the Microsystems Laboratory and the Weapons Integration Facility.

The committee directs that before NNSA commits to the 391,000-square-foot full MESA project at a cost of $504.0 million dollars, the NNSA Administrator shall certify that the full complex is required for the Stockpile Life Extension Program outlined in the February 2001 NNSA Stockpile Life Extension Plan.

Secure transportation asset

The committee recommends $157.1 million for the secure transportation asset, a $1.7 million increase above the amount requested. The secure transportation asset is responsible for transportation of nuclear weapons, weapons materials and components, and other materials requiring safe and secure transport. The committee has provided an additional $1.7 million to maintain increased security for this most important mission. This increase is part of an overall $199.7 million increase recommended by the committee to ensure that security is adequately funded and maintained at DOE. The committee is concerned that, as discussed in recent press reports, there are significant and serious shortfalls in security funding at DOE.

Safeguards and security

The committee recommends $575.0 million for weapons safeguards and security, an increase of $65.0 million above the request. The weapons safeguards and security account provides funding for all safeguards and security at all the NNSA complex sites. As a result of the attacks of September 11, NNSA is working on a new design basis threat (DBT) against which to design its security posture of the future. In the meantime, however, the fiscal year 2003 budg-

et request funds only a pre-September 11 level of security. The committee recommends the additional $65.0 million to maintain at least the level of security maintained in 2002, until the new DBT is in place and to provide improvements to NNSA's cyber-security posture. This $65.0 million increase is part of the overall $199.7 million increase for security.

Facilities and Infrastructure

The committee recommends $242.5 million for the facilities and infrastructure activities, the amount of the request. The committee notes that NNSA has recently established standards and criteria to begin to address the real property maintenance backlog in the NNSA complex. The committee supports this much needed effort. NNSA must also work to ensure that the NNSA complex does not continue to have a maintenance backlog in the future. In order to prevent this situation, NNSA is establishing a strong cadre of professional facilities managers to ensure that the real property assets of NNSA are adequately maintained. The committee supports NNSA and urges it to expand its efforts in this area.

Defense Nuclear Nonproliferation

The committee recommends $1.1 billion for Defense Nuclear Nonproliferation, a $15.5 million increase above the amount of the budget request. The Office of Defense Nuclear Nonproliferation provides management and oversight for the nonproliferation programs in the National Nuclear Security Administration (NNSA). The amount authorized would fund the following activities: $298.9 million for nonproliferation and verification research and development; $92.7 million for nonproliferation and international security; and $894.2 million for nonproliferation programs with Russia and the states of the Former Soviet Union, including $233.1 million for international nuclear materials protection and cooperation, $39.3 million for the Russian transition initiatives, $17.2 million for Highly Enriched Uranium (HEU) transparency, $14.6 million for international nuclear safety, $49.3 million for the elimination of weapons grade plutonium production, and $448.0 million for fissile materials disposition.

Of the amount recommended for nonproliferation and verification research and development, the committee includes $15.5 million for research to develop a new generation of radiation detectors for homeland defense missions.

Of the amount recommended for the Russian transition initiative, the committee recommends $16.7 million for the Nuclear Cities Initiative (NCI) program, the amount of the request. The committee supports both of the programs under the Russian transition initiatives but believes that they serve different missions in support of the same goal. The committee urges NNSA to set aside a portion of the Initiatives for Proliferation Prevention (IPP) program funds to be used for specific IPP commercialization projects in the Russian cities under the NCI program. On the other hand, the committee believes that the NCI program should focus on working with the Russian cities to support broader economic development missions that are not within the purview of the IPP program. In carrying out the NCI program, the committee urges NNSA to work

with other federal agencies with expertise in economic development and with local communities to further the ongoing Sister Cities efforts between U.S. and Russian cities.

Naval Reactors

The committee recommends $707.0 million for Naval Reactors, a reduction of $1.0 million below the amount of the request.

Office of Administrator

The committee recommends $335.7 million for program direction for the National Nuclear Security Administration a reduction of $12.0 million below the amount of the request. This account includes program direction funding for all elements of the National Nuclear Security Administration with the exception of the Naval Reactors Program and the Secure Transportation Asset.

Defense Environmental Management (sec. 3102)

The committee recommends a provision that would authorize $6.7 billion to be appropriated to the Department of Energy (DOE) for fiscal year 2003 for environmental management activities, an increase of $261.1 million above the amount requested. This amount includes a reduction of $14.0 million to reflect the civilian personnel accrual adjustment.

The amount requested is for the following activities: $793.9 million for site and projection completion, an increase of $6.0 million above the amount of the request; $2.6 billion for post 2006 completion, an increase of $2.1 million above the amount of the request, and including $897.9 million for the Office of River Protection; $92.0 million for science and technology, the amount of the request; $1.3 million for excess facilities, the amount of the request; $441.0 million for multi-site activities, a reduction of $38.9 million below the amount of the request; $278.3 million for safeguards and security, an increase of $50.0 million above the amount of the request; $396.1 million for program direction, an increase of $37.9 million above the request; $1.0 billion for environmental management cleanup reform, an increase of $200.0 million above the request; and $1.1 billion for defense closure projects, an increase of $18.0 million above the amount of the request.

Closure projects

The committee recommends $1.1 billion for closure projects, an increase of $18.0 million above the request. The closure projects account provides funds for the cleanup of those sites that will complete cleanup and close by the end of 2006. The committee recommends the additional funds to cover additional security costs that may be needed at the Rocky Flats site if there is any delay in shipping plutonium to the Savannah River Site. The committee notes that the Rocky Flats plant may be closed as early as 2005 and supports the effort to accelerate closure.

Site and projection completion

This account funds those projects that will be completed by 2006 at sites that will continue to be DOE sites beyond 2006. The committee recommends $793.9 million for site and project completion,

an increase of $6.0 million above the request. Last summer the Office of Environmental Management completed a new modern hazardous waste storage building at Lawrence Livermore National Laboratory (LLNL). This new building will house both hazardous and radioactive waste. LLNL submitted the safety basis documents needed to operate the facility in June 2001. Because the DOE Office of Environmental Management has not yet finished its review of the documents, the waste remains stored outside. The budget request for fiscal year 2003 fails to provide the needed funds to complete the safety basis review process and move the waste into the new buildings. The committee recommends the additional $6.0 million in the construction line for the facility 86–D–103, in order to complete the necessary documents and move the radioactive and hazardous waste into the building. Continuing to store the waste outside is contrary to safety, environmental, and security best practices.

Post 2006 completion

The committee recommends $2.6 billion for post 2006 completion, an increase of $2.1 million above the budget request. This account funds cleanup projects that will require funding beyond 2006. The committee recommends an additional $2.1 million to support the continuing process to transfer excess land at the Los Alamos National Laboratory to the community.

Included in the post 2006 completion account is a sub-account for the Office of River Protection. The Office of River Protection provides funds to treat the tank waste and ultimately close the tanks at the Hanford, Washington site. The committee recommends $897.9 million for the Office of River Protection, the amount of the request.

Science and technology

The committee recommends $92.0 million for science and technology for environmental management, the amount of the request. This account supports research and development to develop new or improved technologies for cleanup and waste treatment. The funding level contained in the budget request is significantly less than the fiscal year 2002 appropriated level of $247.8 million. The committee is concerned that DOE has underfunded this account to the long-term detriment of the cleanup process. Many of the sites continue to have cleanup challenges for which the current technology is either too expensive or not available. The committee urges DOE to revisit the approach to research and development over the course of the coming year.

Excess facilities

The committee recommends $1.3 million for excess facilities, the amount of the request. This account provides funds to stabilize facilities that are being transferred by other DOE programs to the Office of Environmental Management for future disposal.

Safeguards and security

The committee recommends $278.3 million for safeguards and security, an increase of $50.0 million. The committee recommends

this increase as part of the overall increase of $199.7 million for DOE to ensure that the security of weapons and materials is maintained. The Office of Environmental Management has responsibility for a wide range of material that includes weapons grade materials as well as other hazardous and radioactive materials. The committee is concerned that the amount of funding included in the fiscal year 2003 budget request for security for environmental management is not adequate to maintain the post-September 11 level of security at environmental sites and facilities.

Multi-site/Uranium enrichment decontamination and decommissioning fund

The committee recommends $441.0 million for the contribution to the uranium decontamination and decommissioning fund, a reduction of $38.9 million. The committee recommends $37.9 million for multi-site activities be transferred to program direction "to provide management and direction for various crosscutting initiatives, establish and implement national and departmental policy; and to conduct analyses and integrate activities across the DOE complex." The committee believes that these are the same functions that are carried out in the program direction account and sees no reason why there should be two separate accounts.

Environmental management cleanup reform

The committee recommends $1.0 billion for environmental management cleanup reform, an increase of $200.0 million. This account is a new account to supplement the site and project base funding after new or amended cleanup agreements are reached with state and federal regulators. The committee is concerned that DOE has substantially underfunded the cleanup accounts and is at risk of violating several of the cleanup agreements. In section 3131 of this Act, the committee recommends a provision that would establish criteria for this account before funds from it could be obligated.

Program direction

The committee recommends $396.1 million for program direction, an increase of $37.9 million transferred from multi-site activities as discussed above.

Other Defense Activities (sec. 3103)

The committee authorizes $489.9 million for other defense activities, an increase of $17.7 million to the budget request.

Energy Security and Assistance

The fiscal year 2003 budget request included $27.7 million for Energy Security and Assistance. The committee recommends no funds for these activities. The activities contained in this request are largely ongoing activities that are part of the non-defense activities of the Department of Energy (DOE). While the committee shares the view that energy security is important, the activities that would be funded in this account include: the development of a national strategy for energy assurance, attendance at energy assurance-related forums, the maintenance of energy-related data-

bases, and monitoring the national energy supply. The committee believes these activities should continue to be funded out of the Energy, non-defense accounts at DOE, particularly when the defense-related security accounts are substantially underfunded. The committee notes that the program is fully authorized at $25.0 million for fiscal year 2003 in section 1261 of H.R. 4, as amended, the Senate Energy bill.

Office of Security

The budget request included $187.2 million for the Office of Security. The committee notes that this amount is a 30 percent reduction from the fiscal year 2002 appropriated level. The committee recommends an additional $65.0 million for nuclear safeguards and security. This request is part of an overall increase of $199.7 million for DOE and NNSA for nuclear security. The committee is very concerned that the budget request for security is significantly lower than the fiscal year 2002 appropriated level. This concern is heightened by the recent press reports that DOE had requested, but was denied by the Office of Management and Budget, approximately $300 million in additional funding for fiscal year 2002. The committee understands that of this additional $300.0 million requested, about $198.0 million was for defense facilities. It is clear that the amount requested for fiscal year 2003 is inadequate to maintain the current fiscal year 2002 level of security funding, which, apparently, does not even provide adequate protection.

Intelligence

The committee recommends $43.6 million for Intelligence, an increase of $2.0 million above the amount of the budget request.

Counterintelligence

The committee recommends $48.0 million for counterintelligence, an increase of $2.0 million above the amount of the request. The committee notes that a portion of the funding for the Office of Counterintelligence in the National Nuclear Security Administration (NNSA) is funded from this account. While it is important that the DOE and NNSA offices of counterintelligence work closely, the committee believes that the funding for the two offices should be separate. The committee directs the Secretary of Energy to transfer the $5.0 million that is contained in this account for NNSA directly to the Administrator at the beginning of the fiscal year, to be obligated by the NNSA office of counterintelligence. The committee directs that in the future the NNSA Office of Counterintelligence be adequately funded in the NNSA accounts.

Independent oversight and performance assurance

The committee recommends $22.6 million for Office of Independent Oversight, the amount of the request. The committee supports the work of the office and believes that it plays a valuable role in ensuring the safety and security of DOE and NNSA facilities.

Environment safety and health

The committee recommends $104.9 million for environment, safety and health, an increase of $5.0 million above the amount requested. The committee recommends $2.5 million to continue pollution prevention efforts, formerly conducted by the Office of Environmental Management, to identify ways to reduce the amount of waste generated by the DOE complex. The committee also recommends $2.5 million for enhanced medical screening of current and former workers at DOE nuclear facilities, including the three gaseous diffusion plants. The committee believes DOE should take the steps necessary to ensure that medical screening, including the use of advanced techniques for early lung cancer detection, is made available to the current and former workers. The committee encourages the DOE to request sufficient funds in the future to conduct the medical screening on all current and former workers who wish to have the screening.

Worker and community transition

The committee recommends $25.8 million for worker and community transition, the amount of the budget request.

National nuclear security administrative support

The budget request included $25.6 million for national security programs administrative support. The committee recommends no funds for national security administrative support. For the second year in a row, DOE has failed to provide any justification materials for this request. The committee believes that the NNSA program direction adequately supports NNSA.

Defense environmental management privatization (sec. 3104)

The committee recommends $158.4 million for environmental management privatization, the amount of the budget request.

Defense Nuclear Waste Disposal (sec. 3105)

The committee recommends a provision that would authorize $215.0 million for defense nuclear waste disposal, a $100.0 million reduction below the budget request of $315.0 million. Recent delays in the program have deferred the requirements for the defense contribution to the waste fund this year.

SUBTITLE B—RECURRING GENERAL PROVISIONS

Reprogramming (sec. 3121)

The committee recommends a provision that would prohibit the reprogramming of funds in excess of 115 percent of the amount authorized for the program or in excess of $5.0 million above the amount authorized for the program, whichever is less, until: (1) the Secretary of Energy submits a report to the congressional defense committees; and (2) a period of 30 days has elapsed after the date on which the report is received. The committee recommends reinstating reprogramming authority for the Department of Energy. The committee notes that the threshold level for reprogramming actions had been $10.0 million prior to 1995 when it was reduced

to $1.0 million in the National Defense Authorization Act for Fiscal Year 1995. The committee believes that $5.0 million is a realistic reprogramming threshold.

Limits on minor construction projects (sec. 3122)

The committee recommends a provision that would authorize the Secretary of Energy to carry out minor construction projects using operation and maintenance funds or facilities and infrastructure funds if the total estimated cost of the minor construction project does not exceed $5.0 million. In addition, the provision would require the Secretary to submit an annual report identifying each minor construction project undertaken during the previous fiscal year. The committee directs the Secretary to submit this report at the same time the Secretary submits the Department of Energy budget request for fiscal year 2004, or as soon thereafter as possible.

Limits on construction projects (sec. 3123)

The committee recommends a provision that would permit any construction project to be initiated and continued only if the estimated cost for the project does not exceed, by 25 percent, the higher of either the amount authorized for the project or the most recent total estimated cost presented to Congress as justification for such a project. The Secretary of Energy may not exceed such limits until 30 legislative days after the Secretary submits to the congressional defense committees a detailed report setting forth the reasons for the increase. This provision would also specify that the 25 percent limitation would not apply to projects estimated to be a minor construction project under $5.0 million.

Fund transfer authority (sec. 3124)

The committee recommends a provision that would permit funds authorized by this Act to be transferred to other agencies of the government for performance of work for which the funds were authorized and appropriated. The provision would permit the merger of such transferred funds with the authorizations of the agency to which they are transferred. The provision would also limit, to no more than 5 percent of the account, the amount of funds authorized by this Act that may be transferred between authorization accounts within the Department of Energy.

Authority for conceptual and construction design (sec. 3125)

The committee recommends a provision that would limit the Secretary of Energy's authority to request construction funding until the Secretary has completed a conceptual design. This limitation would apply to construction projects with a total estimated cost greater than $5.0 million. If the estimated cost to prepare the construction design exceeds $600,000, the provision would require the Secretary to obtain a specific authorization to obligate such funds. If the estimated cost to prepare a conceptual design exceeds $3.0 million, the provision would require the Secretary to request funds for the conceptual design before requesting funds for construction. The provision would further require the Secretary to submit to Congress a report on each conceptual design completed under this

provision. The provision would also provide an exception to these requirements in the case of an emergency.

Authority for emergency planning, design, and construction activities (sec. 3126)

The committee recommends a provision that would permit the Secretary of Energy to perform planning and design with any funds available to the Department of Energy pursuant to this title, including those funds authorized for advance planning and construction design, whenever the Secretary determines that the design must proceed expeditiously to protect the public health and safety, to meet the needs of national defense, or to protect property. The provision would require the Secretary of Energy to submit to Congress a report on each construction project to be completed under this provision prior to exercising the authority that would be provided by this provision.

Funds available for all national security programs of the Department of Energy (sec. 3127)

The committee recommends a provision that would authorize, subject to section 3121 of this Act and appropriations acts, amounts appropriated for management and support activities and for general plant projects to be made available for use in connection with all national security programs of the Department of Energy.

Availability of funds (sec. 3128)

The committee recommends a provision that would authorize amounts appropriated for operating expenses or for plant and capital equipment for the Department of Energy to remain available until expended. Program direction funds would remain available until the end of fiscal year 2004.

Transfer of defense environmental management funds (sec. 3129)

The committee recommends a provision that would provide the manager of each field office of the Department of Energy with limited authority to transfer up to $5.0 million in fiscal year 2003 defense environmental management funds from one program or project, including site project and completion and post 2006 completion funds. Each manager would be able to use this authority up to three times in a fiscal year. Each transfer shall not exceed $5.0 million, and the transfers shall not be aggregated.

Transfer of weapons activities funds (sec. 3130)

The committee recommends a provision that would provide the manager of each Department of Energy/National Nuclear Security Administration (DOE/NNSA) office with limited authority to transfer up to $5.0 million in fiscal year 2003 weapons activities funds from one program or project under the manager's jurisdiction to another. Each manager would be able to use this authority up to three times in a fiscal year. Each transfer shall not exceed $5.0 million, and the transfers shall not be aggregated.

SUBTITLE C—PROGRAM AUTHORIZATIONS, RESTRICTIONS, AND LIMITATIONS

Availability of funds for environmental cleanup reform (sec. 3131)

The Department of Energy (DOE) budget request for fiscal year 2003 included $800.0 million for a new initiative, the environmental cleanup reform account. The committee recommends an additional $200.0 million for the account. According to the DOE budget justification material, the purpose of the new account is "to enable the Department, the States and the American taxpayer to begin realizing the benefits immediately of alternative cleanup approaches that will produce more real risk reduction, accelerate cleanup, or achieve much needed cost and schedule improvements." While the committee supports the goal of faster cleanup, DOE has not provided any details as to how this goal will be achieved by the creation of this new account or how the money that would be in the account will be spent, nor have they identified the "alternative cleanup up approaches" that would be funded by the account.

The committee recommends a provision that would require the Secretary of Energy to establish and publish selection criteria for the environmental management cleanup reform account. The provision would also provide the Secretary of Energy authority to dissolve the account, in the event the Secretary opts not to establish selection criteria, and redistribute the funds in the account to the sites and projects on a pro rata basis according to fiscal year 2002 funding levels.

The overall budget request for fiscal year 2003 for Environmental Management for DOE is $6.6 billion, slightly higher than the $6.5 billion appropriated for fiscal year 2002. To create the cleanup reform account within an essentially flat budget, the DOE reduced almost all of the DOE cleanup site budgets below their fiscal year 2002 appropriated levels. DOE plans to have the various sites, in essence, compete for the funds in the cleanup reform account. How the sites would do this, or on what time table this would happen, is not clear. DOE has provided no guidance or direction to Congress, the States, or the sites on how this competition is to occur or to be judged.

Most of the DOE cleanup effort is required by agreements between DOE and the various host States or the Environmental Protection Agency (EPA). In some instances DOE, the State, and the EPA are all parties to the agreements. These agreements establish cleanup schedules and standards for each site. These agreements also include provisions that require that DOE and its operating contractors pay fines and penalties if the schedule for work required by the agreements is not met. By under-funding each site, DOE is potentially at risk of violating a number of these agreements.

The committee supports the idea of DOE, the States, and the EPA reviewing the various agreements to ensure that the cleanup at each site is being conducted as efficiently as possible. On the other hand, the committee does not support any effort to reduce the cleanup standards and potentially put at risk the health and safety

of communities or the DOE workers in order to reduce cleanup costs.

The committee notes that the cleanup effort at Rocky Flats in Colorado was a successful partnership among the State, the community, the DOE, and the EPA, to accelerate cleanup significantly ahead of the original schedule. This accelerated cleanup will save money in the long run, as the total cost of cleanup will be significantly reduced. Rocky Flats is a success story because substantial additional funds were provided to the site to accelerate the cleanup, not because funds were withheld from the site.

The committee supports innovative approaches to accelerate cleanup and reduce costs. Providing additional funds for the sites may, in fact, generate the accelerated cleanup sought by DOE. The committee is concerned that the approach announced by the Department may be premature.

The committee supports the general idea of providing the possibility of additional funds to accelerate cleanup. In providing the funds however, DOE must spell out clearly, and with input from the States, the communities, and the regulators, how the funds will made available. The provision recommended by the committee would require such criteria be established before funds from the cleanup reform account could be obligated.

In the event that the idea of the cleanup reform account is premature for fiscal year 2003, then the Secretary could dissolve the account and transfer the money to the sites and projects based on the level of funding the sites and projects received in fiscal year 2002. The committee encourages DOE to continue to explore the idea of providing additional funds to accelerate cleanups at as many sites as possible.

Robust Nuclear Earth Penetrator (sec. 3132)

The committee recommends a provision that would require the Secretary of Defense, in consultation with the Secretary of Energy, to submit a report to the congressional defense committees no later than February 3, 2003, on the Robust Nuclear Earth Penetrator (RNEP) that sets forth (1) the military requirements for the RNEP; (2) the nuclear weapons employment policy for the RNEP; (3) the detailed categories or types of targets that the RNEP is designed to hold at risk; and (4) an assessment of the ability of conventional weapons to address the same types of categories of targets that the RNEP is designed to hold at risk.

The budget request included $15.5 million for the RNEP. The committee recommends no funds for the RNEP.

Database to track notification and resolution phases of significant finding investigations (sec. 3133)

The committee recommends a provision that would establish at the national laboratories of the National Nuclear Security Administration (NNSA) a database to track the notification and resolution phases of significant finding investigations (SFIs). The provision would require the Administrator of NNSA to develop and implement a laboratory-wide database to monitor the laboratories' progress on resolving SFIs. The Department of Energy's Inspector General (DOE–IG) recommended a central SFI tracking system in

a December 2001 report. The DOE–IG determined that DOE was plagued with a system that frequently missed self-imposed time frames for initiating and conducting investigations of defects and malfunctions in nuclear weapons. The committee believes that DOE should place a high priority on correcting this problem.

Requirements for specific request for new or modified nuclear weapons (sec. 3134–3135)

The committee recommends a provision that would require the Secretary of Energy specifically to request funds before beginning research and development and engineering and production activities to support any new or modified nuclear weapon. The committee also recommends a provision that would require a specific authorization for these funds before they, or any other national security program funds or activities under the Atomic Energy Act of 1954, could be obligated or expended.

The provision would apply to new weapons and to modifications to existing weapons to meet a new military requirement. The provision would require a specific request in a specific line item or items at two distinct points in time for any new or modified nuclear weapon. This requirement is consistent with past practices at the Department of Energy (DOE) and similar to current acquisition practices for major weapons systems at the Department Defense (DOD), and similar to the way DOE budgets for construction projects.

A new weapon would be defined by the provision as any weapon that contains a pit or secondary which is not in the stockpile or not in production on the date of enactment of this Act. Development of nuclear weapons is conducted using a formal phased acquisition process. This process was developed jointly by the Atomic Energy Commission, the predecessor to DOE, and DOD in a memorandum of understanding signed in 1953. There are eight phases (numbered 1, 2, 2A, 3, 4, 5, 6 and 7) in the development process starting with the first phase, which is concept development, and ending in phase 7, which is warhead retirement or storage.

Under the provision recommended by the committee, the requirement for specific authorization for the first phase of a new nuclear weapon would apply to research and development activities leading to and including phase 1 and 2, the concept development phase. A specific request and authorization would also be required before engineering and manufacturing activities could begin to support phase 2A and beyond, development and engineering.

Modifications to nuclear weapons use a similarly phased acquisition process. In the process applicable to weapons modifications, the phase begins with phase 6, which is quantity production and stockpile, and overlays phases 1–7 onto phase 6. Thus, when modifications are made to existing nuclear weapons, the first phase would be phase 6.1, the concept development phase, and would continue through phase 6.6, for an existing weapon.

Under the provision recommended by the committee, a specific request for funds would have to be received from the Secretary of Energy and a specific authorization would have to be provided by Congress for activities to support work leading to and including phase 6.1 and 6.2, concept development for modifications, and

again for phase 6.3 and beyond, development and engineering for modifications to existing nuclear weapons.

The specific line item for the work leading to and including phase 1 and 2 and phase 6.1 and 6.2 would be analogous to the current practice with respect to planning, engineering, and design money for construction activities. The line items for the work for phases 2A and beyond, and 6.2A and beyond, would be analogous to construction line items for individual construction projects. The committee expects each individual weapon would have a dedicated line item when it moves to phase 2A or 6.2A.

The provision would not apply to the stockpile life extension programs (SLEPs) that are scheduled for each of the weapons that will remain in the stockpile. In February 2002, the Administrator of the National Nuclear Security Administration (NNSA) submitted the Comprehensive Stockpile Life Extension Program plan to Congress. This plan lays out the refurbishment schedule for the existing nuclear weapons stockpile. Under this plan, NNSA and DOD have identified detailed schedules and activities for each of the weapons in the stockpile through 2025.

The provision would not be construed to modify, repeal, or in any way affect the provisions of section 3136 of the National Defense Authorization Act for Fiscal Year 1994.

Limitation on availability of funds for program to eliminate weapons grade plutonium production (sec. 3136)

The committee recommends a provision that would limit the amount of money that could be obligated or expended for the program to eliminate weapons grade plutonium production before an agreement with Russia is signed. The provision would prohibit the Administrator of the National Nuclear Security Administration from obligating or expending more than $100.0 million until 30 days after the Administrator submits a copy of the agreement to the congressional defense committees.

SUBTITLE D—PROLIFERATION MATTERS

Administration of program to eliminate weapons grade plutonium production in Russia (sec. 3151)

The committee recommends a provision that would direct the transfer of the program to eliminate weapons grade plutonium in Russia from the Department of Defense (DOD) to the Department of Energy (DOE). The provision would also direct that the funds, which had been previously appropriated to DOD, be transferred to and merged with DOE funds. In addition, the provision would allow DOE to spend the funds for the program without regard to the restrictions that had been placed on the funds when DOD managed the program.

The program to eliminate weapons grade plutonium production in Russia would shut down the remaining three plutonium producing reactors in Russia. The program was originally created to modify the reactor cores so they would not produce plutonium. Due to technical difficulties in changing the reactor cores and the age of the reactors, the program shifted from converting the reactor cores to building alternative power sources. The three reactors, in

addition to producing plutonium, also produce energy for the communities in which they are located. In order to shut down the reactors, an alternative power supply must be provided.

The 2003 budget request transferred this program from DOD to the DOE National Nuclear Security Administration (NNSA) as a result of concern in Congress that this program should not be a DOD program, but rather a DOE effort. In order to implement the program at DOE, the various restrictions that were put on the program at DOD must be removed. This provision would allow NNSA to carry out the program without the funding limitations and restrictions placed on the program when it was a DOD program.

The committee notes that this program is a very complicated program to implement, involving substantial financial contributions and coordination with the Russian government. There are many unresolved issues that NNSA will have to resolve with Russia before any actual construction activities can begin. The committee directs the Secretary of Energy and the Administrator of NNSA not to begin any construction work on the alternative power sources until there is an agreement or agreements in place with Russia that include a firm commitment to shut down the reactors and a firm schedule for Russian actions that support the shutdown, including the portions of the program that must be completed by Russia before the reactors can be shut down.

A related aspect of this program is an ongoing NNSA program to upgrade the reactors until they can be shut down. The reactor upgrade program was an NNSA program already underway and is not part of the transfer from DOD. The committee remains concerned that any upgrades to the reactors be for short-term safety improvements and will not extend the life of these reactors.

Security of nuclear materials and facilities worldwide (sec. 3152)

The committee recommends a provision that would express the sense of Congress that the Secretary of Energy, in consultation with the Secretaries of State and Defense, should work to develop a program of activities, with Russia, other G–8 countries, and allies, to encourage all countries to secure stockpiles of highly enriched uranium (HEU) and plutonium and to adhere to or adopt standards equivalent to the International Atomic Energy Agency standards on the Physical Protection of Nuclear Materials and Nuclear Facilities. The provision would also direct the Secretary of Energy, acting through the Administrator of the National Nuclear Security Administration (NNSA), to conduct a study to determine the feasibility and advisability of developing a program to secure radiological materials outside the United States, other than HEU and plutonium, that present a threat to U.S. national security and to submit a report to Congress on the review one year after the date of enactment. Finally, the provision would direct the Secretary of Energy, in consultation with the Chairman of the Nuclear Regulatory Commission, to conduct a study on the feasibility and advisability of various actions to reduce risks associated with terrorist attacks on nuclear power plants outside the United States. The Secretary would be required to submit to Congress a report on the

results of this study nine months after the date of enactment of the National Defense Authorization Act for Fiscal Year 2003.

Repeal of requirement for reports on obligation of funds for programs on fissile materials in Russia (sec. 3153)

The committee recommends a provision that would repeal the semi-annual report on the Department of Energy fissile Materials Protection, Control and Accounting (MPC&A) program required by section 3131 of the National Defense Authorization Act for Fiscal Year 1996. This report is no longer needed as the information is included in the annual MPC&A report.

Expansion of annual reports on status of nuclear Materials Protection, Control and Accounting program (sec. 3154)

The committee recommends a provision that would amend the annual reporting requirement for the Department of Energy (DOE) Materials Protection, Control and Accounting (MPC&A) program to include countries other than Russia. The DOE MPC&A program works to protect weapons grade nuclear materials in the countries of the Former Soviet Union, including Russia. The provision would also amend the MPC&A report to require the Secretary of Energy to identify the nature of the work performed in each country outside of Russia, the amount of material secured, the amount of material remaining to be secured, and the total amount spent by country.

Export Control Operations program

The budget request included $92.7 million for the Nonproliferation and International Security program. This request included $15.5 million for the Export Control Operations program in the Office of the Deputy Administrator for Defense Nuclear Nonproliferation. The program conducts proliferation reviews of U.S. dual-use export licenses, regulates U.S. nuclear technology transfers, plays a leading role in implementing multilateral export control regimes, and works with governments worldwide by providing assistance and training to develop effective and enforceable national systems of nuclear export control. Because of the terrorist attacks of September 11, 2001, and heightened concerns that countries that support terrorism are increasing efforts to acquire dual-use technologies and nuclear materials, the committee is very concerned that weak export control systems and ineffective enforcement worldwide pose a danger to U.S. national security. Therefore, the committee recommends that the Export Control Operations program accelerate its efforts to promote the use of nonproliferation export controls with emerging supplier states and regions of concern, work with transit states to train and equip experts in identifying illicit transfers of controlled nuclear and other weapons of mass destruction-related exports, and strengthen the National Nuclear Security Administration's role in the technical evaluation of proliferation threats and of exports and imports reviewed by U.S. Customs. The committee recommends an additional $3.0 million above the budget request to be used to support these efforts.

SUBTITLE E—OTHER MATTERS

Indemnification of Department of Energy contractors (sec. 3161)

The committee recommends a provision that would amend section 170d(1)(A) of the Atomic Energy Act of 1954 to allow the Department of Energy to continue to enter into contracts for indemnification for an additional 10 years, through August 1, 2012.

Worker health and safety rules for Department of Energy facilities (sec. 3162)

The committee recommends a provision that would amend section 234B of the Atomic Energy Act of 1954 (42 U.S.C. 2282b) to require the Secretary of Energy to impose fines and penalties against contractors and subcontractors of the Department of Energy (DOE) who violate DOE construction health and safety regulations that the Secretary is required to promulgate. The regulations must be promulgated pursuant to the Administrative Procedure Act not later than 270 days from the date of enactment of this Act. The regulations would take effect one year from the date they are promulgated. The Secretary may provide in the regulations variances or exemptions to the extent necessary to avoid serious impairment of the national security of the United States. The provision would also require the Secretary to establish a process under which the variance or waiver would be granted. In enforcing the regulations on the structures, buildings facilities or other improvements that are being closed, demolished or transferred, the Secretary shall evaluate on a case by case basis whether they should or should not be brought into conformance. The committee includes this direction to the Secretary to prevent improvements to such facilities. In making any such determination the decision shall not diminish or effect the worker health and safety regulations applicable to the surveillance, decontamination or demolition work on such facilities. Penalties may be assessed up to $0.1 million per day per violation. The provision provides that a non-profit or not-for-profit entity shall not be assessed fines and penalties, that, when aggregated with all other fines and penalties, would exceed the amount of the contract fee.

One-year extension of authority of Department of Energy to pay voluntary separation incentive payments (sec. 3163)

The committee recommends a provision that would amend section 3161(a) of the National Defense Authorization Act for Fiscal Year 2000 to provide a one-year extension of the Department of Energy (DOE) authority to make voluntary separation incentive payments. The committee is aware that DOE would like to extend the ability to encourage voluntary separations and avoid any future need to conduct a reduction in force. This provision would allow DOE to do long-term planning for reductions as a result of future reorganizations.

Support for public education in the vicinity of Los Alamos National Laboratory, New Mexico (sec. 3164)

The committee recommends a provision that would authorize $6.9 million to be paid by the Department of Energy (DOE) to the Los Alamos Education Foundation in fiscal year 2003. The committee recommends an additional $6.9 million in readiness in the technical base, special projects, for this payment. The foundation was established by section 3167(a) of the National Defense Authorization Act for Fiscal Year 1998. The foundation provides for educational support to students and schools in the Los Alamos area.

The budget request for the National Nuclear Security Administration (NNSA) includes $8.0 million for the Los Alamos Public Schools to offset the cost of living for school teachers teaching in the public schools. The contract between NNSA and the Los Alamos schools, pursuant to which this annual payment is made, expires at the end of fiscal year 2003. The provision would also amend section 3136 of the National Defense Authorization Act for Fiscal Year 2002 to allow NNSA to extend the current contract with the Los Alamos Public Schools to provide for cost of living adjustments for the school teachers through fiscal year 2013. This amendment is necessary to allow NNSA to include the annual payment in its fiscal year 2004 budget request and in subsequent years budget requests.

SUBTITLE F—DISPOSITION OF WEAPONS-USABLE PLUTONIUM AT SAVANNAH RIVER, SOUTH CAROLINA

Disposition of weapons-usable plutonium at Savannah River, South Carolina (sec. 3181–3183)

The committee supports the ability of the United States to meet its obligations under the Plutonium Disposition Agreement with Russia, signed in September 2000. The United States and Russia agreed to dispose of 34 metric tons each of excess weapons grade plutonium, all of which the Department of Energy has planned to dispose of by 2019 through the conversion of the plutonium to a mixed oxide (MOX) fuel for use in commercial nuclear reactors. This conversion would take place at the Savannah River Site's MOX plutonium conversion facility at Aiken, South Carolina. Because of the importance of the MOX facility for plutonium disposition, the committee has created a detailed set of certifications, plans, corrective processes, and, if necessary, monetary payments to be made by the Secretary of Energy to ensure the effective functioning of the MOX facility. The provision also defines the term "MOX production objective" as production at the MOX facility at the Savannah River Site of MOX fuel from defense plutonium and defense plutonium materials at an average rate equivalent to not less than one metric ton of MOX fuel per year. This average rate would be based on measurements of production at the MOX facility from the date on which the Nuclear Regulatory Commission (NRC) declares the MOX facility operational through the date of assessment.

The committee included a section that would direct the Secretary of Energy, no later than February 1, 2003, to submit to Congress a plan for the construction and operation of a MOX plutonium facil-

ity at the Savannah River Site. The committee recommends that the plan include a schedule for construction and operations to ensure that as of January 1, 2009, and thereafter, the production of MOX fuel and that production of one metric ton of MOX fuel is achieved by December 31, 2009. This schedule must also ensure the delivery of 34 metric tons of defense plutonium and defense plutonium materials to the Savannah River Site to be processed into MOX fuel by January 1, 2019.

To ensure that the MOX fuel construction and operation schedule as mandated is on-time and on-budget, the committee recommends that, starting in 2004, not later than February 15 of each year, and continuing for as long as the MOX facility at the Savannah River Site is in use, the Secretary of Energy shall submit to Congress a report on the implementation of the plan described above. For those reports submitted to Congress under this section before the year 2010, the Secretary must include an assessment of compliance with the schedule contained in the plan and a certification by the Secretary that the MOX production objective can be met by January 2009. For each report after 2009, the Secretary must address whether MOX production objectives have been met and also the status of U.S. obligations under the Plutonium Management and Disposition Agreement with the Russian Federation. For reports submitted after 2017, the Secretary must continue to include assessments of compliance with the MOX production objective, and if for any reason compliance with the production objective is not met, the Secretary must supply a plan for compliance with the MOX production objective and the removal of all remaining defense plutonium and defense plutonium materials from the State of South Carolina.

Due to the unique nature and obvious benefits of the MOX facility, the committee recommends a process for corrective actions taken if any of the reports due before January 1, 2009, indicate that construction or operation of the MOX facility is behind the planned schedule by 12 months or more. In such a circumstance, the section directs the Secretary to submit to Congress, no later than August 15 of the year in which the report is submitted, a plan to be implemented that will ensure that the MOX facility is capable of meeting the MOX production objective by January 1, 2009. If the plan submitted is in any year after 2008, it must include corrective actions to be implemented by the Secretary ensuring that the MOX production objective is met. Any such plan for corrective action must also include established milestones for compliance with MOX production goals.

If before January 1, 2009, the Secretary determines that MOX milestones as set forth by the Secretary's corrective action plan will not be met by 2009, all transfers of defense plutonium and defense plutonium materials must be suspended until the schedule risk is addressed by the Secretary and the Secretary certifies that MOX production objectives can be met by 2009. If after January 1, 2009, the Secretary determines that milestones under the Secretary's corrective action plan have been slipped and the MOX production objective cannot be met, the Secretary must suspend further transfers of defense plutonium and defense plutonium materials until the Secretary can certify that the MOX production objective can be

met. In either case, either before or after January 1, 2009, if the Secretary makes such determinations, then the Secretary must submit to Congress a plan specifying options for the removal from the State of South Carolina an amount of defense plutonium or defense plutonium materials equal to the amount of such materials transferred to the State of South Carolina after April 15, 2002. These reports must be specific in setting forth options, including the costs and schedules of implementation for each of the options examined, and any consideration of requirements for removal under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.), and commensurate with the submittal, any analyses which may be required under the National Environmental Policy Act of 1969 must also be initiated.

In the eventuality that the MOX production schedule is not met, and the Secretary makes any of the determinations under this section that would require removal of defense plutonium and defense plutonium materials from the State of South Carolina in compliance with the National Environmental Policy Act of 1969 and any other applicable laws, the committee recommends several requirements for that removal process. If the MOX production objective is not met by January 1, 2009, the Secretary must remove, no later than January 1, 2011, no less than one metric ton of all defense plutonium and defense plutonium materials from the State of South Carolina, and no later than January 1, 2017, the amount of defense plutonium or defense plutonium materials transferred to the Savannah River Site between April 15, 2002, and January 1, 2017, but not yet processed at the MOX facility.

If the MOX production objective is not met on January 1, 2011, the committee has included a section that would require the Secretary to make payments to the State of South Carolina each year, starting on or after that date, until 2016, in order to assist with the economic impact on the State of not meeting the MOX production objective. The amount of the payment is $1.0 million per day until the passage of 100 days in such a year, the MOX production objective is achieved, or the Secretary has removed from the State of South Carolina in such a year at least 1 metric ton of defense plutonium or defense plutonium materials. If the MOX production objective has not been met by January 1, 2017, the Secretary will make payments to the State of South Carolina each year, beginning on or after that date, through 2024 of $1.0 million per day until the passage of 100 days in such a year, the MOX production objective is achieved, or the Secretary has removed an amount of defense plutonium or defense plutonium materials from the State of South Carolina equal to the amount of defense plutonium or defense plutonium materials transferred to the Savannah River Site between April 15, 2002 and January 1, 2017, but not yet processed by the MOX facility. All payments made according to this section would be from amounts authorized to be appropriated to the Department of Energy.

In case any injunctions obtained by the State of South Carolina would prevent the Department of Energy from taking actions necessary under these sections, the committee recommends that any deadlines specified be extended for the period of time during which the court-ordered injunction is in effect.

If on July 1 of each year, beginning in the year 2020, and continuing for as long as the MOX facility at the Savannah River Site is in use, the planned plutonium disposition obligation under the agreement with the Russian Federation of 34 metric tons is not met through processing at the MOX facility, the Secretary must submit to Congress a plan for the complete processing of the full 34 metric tons of defense plutonium and defense plutonium materials at the MOX facility or the removal of all such material from the State of South Carolina in an amount equal to all such material transferred to the Savannah River Site after April 15, 2002, but not yet processed into MOX fuel.

The committee further directs that if after one year of the date on which the MOX facility ceases operation any MOX fuel remains at the Savannah River Site, the Secretary must submit to Congress a report detailing when such fuel would be transferred for use in commercial nuclear reactors or a plan for its removal from the State of South Carolina.

Engineering, construction, and project management

The committee continues to support the Department of Energy (DOE) and National Nuclear Security Administration (NNSA) efforts to improve project management. The Office of Engineering and Construction Management (OECM) within DOE and the Office of Project Management (OPM) within NNSA have been integral to the progress that DOE has made in the last several years in significantly improving project and construction management. The management discipline these two offices have brought to both construction and other types of projects, such as NNSA approach to weapons pit manufacturing and certification, have enabled DOE and NNSA to manage costs and schedules better and to improve long-term planning. The committee notes that the close working relationship of the two offices has been key to the overall success of each.

More remains to be done however. The committee believes that each office could benefit from a small amount of additional resources. The committee urges the Administrator of NNSA to provide at least $5.0 million for the NNSA OPM to allow the OPM to continue its own project oversight work but also to provide training and mentoring programs to improve the skills of DOE project managers. The committee believe this training should include training for key DOE managers so that they can become certified project managers.

Disposition of special nuclear material from the Rocky Flats Site

The committee is concerned about possible delays in removing Special Nuclear Material (SNM) from the Department of Energy (DOE) Rocky Flats Site. These delays could ultimately threaten the scheduled closure of the Rocky Flats Site by December 15, 2006. The committee directs the Secretary of Energy to provide a report describing how the DOE proposes to remove all SNM from the Rocky Flats Site on a schedule to enable the closure of the Rocky Flats Site by December 15, 2006. The report shall be submitted to the congressional defense committees 90 days after the date of en-

actment of this Act. The report shall be initiated and developed within the Department of Energy by the Assistant Secretary of Environmental Management.

This report shall include:

(1) an assessment by the Secretary of the current cost and schedule for the closure of the Rocky Flats Site and whether the project to close the Site is on track to complete closure by December 15, 2006, and what steps, if any, are needed to keep the project on schedule to close Rocky Flats by December 15, 2006.

(2) an assessment by the Secretary of the cost and schedule impacts, if any, to the effort to close the Rocky Flats Site by December 15, 2006 that are the result of delays in removing SNM from Rocky Flats.

(3) the DOE strategy and schedule for removing all SNM from the Rocky Flats Sites to achieve closure of the Rocky Flats Site by December 15, 2006, including the destination of all SNM removed from the Rocky Flats Site, the short and long term plan and schedule for disposition of the SNM removed from the Rocky Flats Site, and any additional funding that may be needed to achieve closure of Rocky Flats Site by December 15, 2006.

(4) a strategy and schedule for closure of the Rocky Flats Site at the earliest possible date in the event the Secretary determines that it is not possible to close the Rocky Flats Site by December 15, 2006, and funds that would be need to achieve closure by the revised date.

The Secretary shall provide to the congressional defense committees updates to this report, every 60 days, until the Rocky Flats Site is closed. The updates shall include cost and schedule impacts from delays in removing the SNM from the Rocky Flats Sites, any changes to the SNM disposition plans and schedules, and any additional funds that would be needed at the Rocky Flats Sites or elsewhere to address any schedule or cost differences.

TITLE XXXII—DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Defense Nuclear Facilities Safety Board (sec. 3201)

The committee recommends $19.5 million, the amount of the fiscal year 2003 request, for the Defense Nuclear Facilities Safety Board (DNFSB).

Authorization of appropriations for the Formerly Used Sites Remedial Action Program in the Corps of Engineers (sec. 3202)

The committee recommends $141.0 million for the Formerly Used Sites Remedial Action (FUSRAP) program in the Corps of Engineers for fiscal year 2003, the amount requested.

LEGISLATIVE REQUIREMENTS

Departmental Recommendations

By letter dated April 19, 2002, the General Counsel of the Department of Defense forwarded to the President of the Senate proposed legislation "To authorize appropriations for fiscal year 2003 for military activities of the Department of Defense, to prescribe military personnel strengths for fiscal year 2003, and for other purposes." The transmittal letter and proposed legislation were officially referred as Executive Communication 6576 to the Committee on Armed Services on April 25, 2002. Executive Communication 6576 is available for review at the committee. Senators Levin and Warner introduced this legislative proposal as S. 2225, by request, on April 23, 2002.

Committee Action

In accordance with the Legislative Reorganization Act of 1946, as amended by the Legislative Reorganization Act of 1970, there is set forth below the committee vote to report the National Defense Authorization Act for Fiscal Year 2003.

In favor: Senators Levin, Kennedy, Byrd, Lieberman, Cleland, Landrieu, Reed, Akaka, Nelson of Florida, Nelson of Nebraska, Carnahan, Dayton, Bingaman, Thurmond, McCain, Collins, and Bunning.

Opposed: Senators Warner, Smith, Inhofe, Santorum, Roberts, Allard, Hutchinson, and Sessions.

Vote: 17–8.

The roll call votes on amendments to the bill which were considered during the course of the markup have been made public and are available at the committee.

Congressional Budget Office Cost Estimate

It was not possible to include the Congressional Budget Office cost estimate on this legislation because it was not available at the time the report was filed. It will be included in material presented during floor debate on the legislation.

Regulatory Impact

Paragraph 11(b) of rule XXVI of the Standing Rules of the Senate requires that a report on the regulatory impact of the bill be included in the report on the bill. The committee finds that there is no regulatory impact in the case of the National Defense Authorization Bill for Fiscal Year 2003.

Changes in Existing Law

Pursuant to the provisions of paragraph 12 of rule XXVI of the Standing Rules of the Senate, the changes in existing law made by certain portions of the bill have not been shown in this section of the report because, in the opinion of the committee, it is necessary to dispense with showing such changes in order to expedite the business of the Senate and reduce the expenditure of funds.

ADDITIONAL VIEWS OF SENATOR CARNAHAN

Upon considerable reflection and advice from fellow members of the Committee, I have decided to vote against the Santorum amendment to strike measures pertaining to "core logistics capabilities." I have thoroughly reviewed the provision at issue in light of claims that it would divert work from the private sector to Department of Defense Depot Maintenance facilities.

However, having consulted with other members of the Committee as well as the professional Committee staff, I determined that this provision does not require any reductions in private sector jobs in the areas of acquisition logistics, supply management, systems engineering, maintenance, and modifications management.

The provision at issue requires the Secretary of Defense, in consultation with the Joint Chiefs of Staff, to consider a broader, more explicit set of functions when determining which services shall be considered "core logistics capabilities" than currently exists under the law. It is my understanding that in spite of this authorization, this Administration is not likely to expand the type of logistical work conducted at the military's depot facilities.

I intend to continue consulting my constituents on this matter following completion of mark-up of the Fiscal Year 2003 National Defense Authorization Bill. I may reconsider my position if it becomes clear that work conducted by logistics and maintenance contractors in Missouri would be jeopardized.

JEAN CARNAHAN.

ADDITIONAL VIEWS OF SENATOR MCCAIN

Overall, the Senate Armed Services Committee has produced a bill which is supportive of the outstanding servicemen and women in our armed forces—in terms of training, pay, family quality-of-life benefits, and providing modern equipment and weapon systems. Building upon evaluations and recommendations regarding growing readiness and modernization problems throughout the services, the Committee has done an admirable job of addressing some of the more pressing issues contributing to the multiple problems that have been brought to its attention over the past several years.

On most issues, I support the Committee's recommendation in drafting of the FY 2003 defense authorization bill. However, I have additional views on several issues addressed in this bill.

LEASING BOEING 767 AERIAL REFUELING TANKER AIRCRAFT

I forcefully endorse the Committee's inclusion of an amendment that will direct the Secretary of the Air Force to obtain specific authorization and appropriation to lease 100 Boeing 767 tanker aircraft that was previously approved by the Department of Defense Appropriations Act of Fiscal Year 2002. However, I am disappointed that the Report language accompanying this legislative provision was drafted in such a way as to not adequately reflect the full discussion during the mark-up of this critical issue.

Specifically, a majority of the members present felt as I do, that the payment of leasing of major weapon systems—aircraft, vessels, and combat vehicles—should not come from critical funds providing for readiness spending, such as training, spare parts, flying hours, and maintenance of weapons systems and barracks. There appeared to be a sense of agreement that any lease for major weapon systems should instead be funded from the procurement accounts.

During posture hearings, the Service Secretaries and Chiefs confirmed that readiness unfunded requirements still exist and submitted lists to meet their readiness requirements. Robbing "Peter to pay Paul" so that the Air Force can modernize their tanker fleet is questionable at best and several recent reports by the GAO, OMB and CBO bear this out. I regret that the Chairman and Ranking Member did not reflect this in the Report, despite the fact that considerable debate occurred related to the lease in question.

BALLISTIC MISSILE DEFENSE (BMD) FUNDING

The Committee failed to provide full funding of President Bush's missile defense program—cutting $812 million. Particularly disturbing is the fact that Republicans attempted several times to restore critical funding in the ballistic missile defense programs but were opposed by the Chairman and his colleagues. In an age of missile proliferation, we need a fully funded and vigorous missile

defense program, the deployment of which becomes more urgent as each year passes.

NATIONAL SERVICE PLAN (CALL TO SERVICE ACT)

I fully support the Committee's unanimous inclusion of the "National Call to Service Act," which provides for strong incentives to encourage young Americans to enlist in the Armed Services.

The Committee adopted provision is the military component of the "Call to Service Act," introduced by Senator Evan Bayh (D-IN) and myself, which also expands civilian service opportunities in AmeriCorps and SeniorCorps and in other service organizations.

This is a very significant boost to a bill that will give Americans concrete opportunities to serve in causes greater than self interest. By encouraging more military enlistments, this legislation could greatly assist our war against terror.

Under the National Call to Service Act, individuals who volunteer to serve under this new program would be required to serve on active duty for 15 months in the Armed Services after completion of initial entry training and could complete the remainder of their military service obligation by choosing service on active duty, in the Selected Reserve or in the Individual Ready Reserve. The reserve obligation could also be fulfilled by serving in a civilian national service program such as the Peace Corps or AmeriCorps.

In return for service, the legislation provides the choice of incentives including a $5,000 bonus, repayment of a student loan up to $18,000, an educational allowance under the Montgomery GI Bill.

The measure also encourages and facilitates military service by requiring federally funded institutions of higher learning to provide the same access to military recruiters as is provided to other employers.

At this time of national challenge, Americans are yearning for opportunities to serve. I hope Congress will expeditiously take action on this entire legislation to create more options in both the areas of military and civilian service.

INCREASE IN AUTHORIZED END STRENGTHS FOR THE SERVICE ACADEMIES

I applaud the Committees recommendation that would increase the authorized end strengths to 4,400 midshipmen or cadets at the military academies: U.S. Naval Academy, U.S. Military Academy and U.S. Air Force Academy. The provision would also clarify that the service secretary can permit a variance above that limitation by 1 percent. This provision along with the National Service Plan program should open more opportunities for young Americans to serve their country in military service.

FORCE MODERNIZATION

It is odd to me that although the President added $48 billion to the defense budget the Navy would buy only 5 ships in 2003. The Navy is struggling to maintain a fleet of 300 ships, down from over 500 in the early 1990s. The Future Years' Defense Plan will not support a Navy of even 200 ships. The Marine Corps saves money in spare parts by retreading light trucks and Humvees, so as to af-

ford small arms ammunition for forward deployed Marines. The list goes on and on, but what must be recognized is the scale of these very serious modernization problems in the Navy and Marine Corps that continue to grow and must be reversed if this nation's ability to execute major operations in the future is to be assured. I support the Committee's recommendation to add funding for 4 additional F/A–18s and in shipbuilding, particularly CVN(X), DDG–51, LPD–17 and LHA(R).

Funding LHA(R) was accomplished by redirecting money from LHD–9 advance procurement after it was discovered that the DOD Comptroller mistakenly deleted the funding for LHA(R) RDT&E and added it to the LHD–9 shipbuilding and construction account. After considerable testimony from the CNO, Marine Corps Commandant, and other senior Navy and Marine Corps officials, the Committee was able to amend the defense bill to correct this unfortunate mistake. I strongly support this provision.

MEMBER-ADDS NOT REQUESTED BY THE DEFENSE DEPARTMENT

As usual, this year's defense bill emerged from committee with a large number of programs totaling more than $2 billion that were not requested by the Defense Department. This number is $1 billion more than last year's bill. In the past, there has been an increasing tendency to manipulate the process by which the services produce their unfunded priorities lists—lists which are important to the Committee's ability to allocate funds added by Congress to the Administration's budget request. In addition to questionable Member-adds that are reflected on those lists, there continue to be too many programs added to the bill that were neither requested nor included on those lists.

In my view, the Congress should stop compelling the military to pursue research programs that do not meet their requirements. Spending nearly $55 million for "21st Century Truck," previously known as James Bond's "Smart Truck" is an unconscionable waste of taxpayer dollars. These kinds of programs should be funded by private industry. Even Detroit's automotive industry can afford to pursue these purely scientific, high-tech, endeavors that the consumer will only pay for later on the dealer showroom.

I would like to mention one further example of wasteful spending. For the last several years, Congress has added money for Cultural and Historic Preservation Activities, which is funded through a program call the Legacy Resource Management Program, fancy terminology for pork. The fiscal year 2003 defense authorization bill will add $3.3 million to this program. Last year, the Senate Armed Services Committee added $8 million principally for recovery and preservation of the C.S.S. Virginia, which ran aground near Craney Island near the James and Elizabeth Rivers and was set on fire after being abandoned in May 1862. I enjoy reading history, especially Civil War history, but there are more pressing readiness and modernization issues than raising Civil War ironclads.

PERSONNEL INITIATIVES: PAY RAISE, RECRUITMENT, RETENTION, AND RETIREMENT BENEFITS

The bill contains a package of benefits for servicemembers and their families that would go a long way toward addressing the readiness problems facing all the services. It includes a 4.1 percent across-the-board pay raise for all active and reserve servicemembers, with an additional targeted pay raise ranging from 5.5% to 6.5% for sergeants, petty officers and chiefs.

Military pay, by almost all accounts, has fallen considerably behind civilian pay. Arguments can be made as to the precise pay differential, and at which pay grades and mission areas the gap is greatest, but there is no credible argument as to whether or not we need to address the issue of compensation.

Additionally, the Committee approved a provision that would authorize a new assignment incentive pay of up to $1,500 per month to encourage servicemembers to serve in difficult-to-fill assignments, like Korea or the Persian Gulf region.

The Committee approved a significant legislative provision directing the Secretary of Defense to review personnel compensation laws and policies, including the Reserve retirement system, to determine how well they address the needs of Guard and Reserve servicemembers. This provision is particularly noteworthy since the Secretary of Defense recalled nearly 95,000 Reserve Component servicmembers for Operations Enduring Freedom and Noble Eagle. Often times the collective memory of our active duty, including active duty reserve servicemembers, is short and a comprehensive examination of reserve force policies, if done right, will help address waning retention of reservists and continued support by employers of reservists.

CONCURRENT RECEIPT

It is tremendously important to me that the committee included language in the defense authorization bill and report that would authorize payment of retired pay and disability pay for military retirees with disabilities rated at 60% or more—a practice known as "concurrent receipt." For the past 11 years, I have offered legislation on this issue. This matter is of great significance to many of our country's military retirees, because it would reverse existing, unfair regulations that strip retirement pay from military retirees who are also disabled, and costs them any realistic opportunity for post-service earnings. I am pleased that the committee, for the first time, has included an authorization to begin to address a longstanding inequity in the compensation of military retirees' pay over previous attempts in the past.

We must do more to restore retirement pay for those military retirees who are disabled. I have stated this before, and I am compelled to reiterate now—retirement pay and disability pay are distinct types of pay. Retirement pay is for service rendered through 20 years of military service. Disability pay is for physical or mental pain or suffering that occurs during and as a result of military service. In this case, members with decades of military service receive the same compensation as similarly disabled members who

served only a few years; this practice fails to recognize their extended, more demanding careers of service to our country.

This is patently unfair, and I will continue to work with the Committee to diligently correct this inequity for all career military servicemembers who are disabled.

Enacting this provision is yet another step forward to ensuring that we recognize the military service of those military retirees who by no fault of their own become disabled during their career military service.

MILITARY CONSTRUCTION PROJECTS

Military construction continues to fall victim to funding gimmicks and undue Congressional management. Congress, once again, promptly added a number of military construction projects, totaling around $640 million, that are not priority items for the Department of Defense. This practice of Congressional adds is detrimental to the budget process and continues to make a mockery of other earnest attempts to save and wisely spend our taxpayers' dollars.

F–16 ENGINE FIXES

The recent spate of F–16 crashes has focused attention on vital safety issues involving that aircraft. The Department of the Air Force identified specific engine component failures based on shoddy work and defective materials discovered an aviation depot at Tinker Air Force Base. In addition, its investigation revealed that certain F–16 components common throughout the fleet had a high probability to fail. The Air Force has researched the cost and schedule of fixing or replacing these components, and has outlined a required funding profile.

The F–16 is the Air Force's front line fighter. The total Air Force F–16 inventory is over 1,400 aircraft, of which a number are currently deployed to Afghanistan. Additionally, F–16s continue to enforce both the southern and northern no-fly zones over Iraq and have been one of the mainstay aircraft of every conflict since Desert Storm. I continue to support all efforts to identify and fix the engine problems being experienced by our F–16 fleet. I firmly believe that the safety of our aircrew and the combat readiness of our Air Force are top priority concerns that require our immediate attention. For that reason, the Committee's decision to add $60 million in funding for F–16 engine modifications is essential to maintain that aircraft's readiness.

"BUY AMERICA" RESTRICTIONS

I support the Committee's recommendation submitted by the Administration to waive certain "Buy America" restrictions. The Committee authorized the Secretary of Defense to waive domestic source or content requirements for close defense allies that provide reciprocal treatment for our defense products. "Buy America" restrictions divert necessary funds to ensure our military is properly equipped. An additional $5 billion can be saved per year by eliminating "Buy America" restrictions that are protected by the Berry Amendment that only undermine U.S. competitiveness overseas.

Every dollar we spend on archaic procurement policies, like "Buy America," is a dollar we cannot spend on training our troops, keeping personnel quality of life at an appropriate level, maintaining force structure, replacing old weapons systems, and advancing our military technology.

SUMMARY

In closing, it should be reemphasized that the Committee continues to try to address extremely serious near-and long-term readiness and modernization problems within an exceptionally constrained budgetary environment. While the tendency of Members to continue business-as-usual practices of adding programs and earmarking for parochial reasons needs to be curtailed, vitally important retention issues have been addressed that will aid immeasurably in reversing a very serious decline in the services' ability to retain skilled personnel. For that, the Committee should be commended.

JOHN MCCAIN.

MINORITY VIEWS OF SENATORS WARNER, SMITH OF NEW HAMPSHIRE, INHOFE, SANTORUM, ROBERTS, ALLARD, HUTCHINSON, AND SESSIONS

For the second consecutive year, the Senate Armed Services Committee has divided along party lines, primarily over the issue of missile defense. Sincere, good-faith efforts were made by Republican Members to find common ground and compromise on this issue, but these efforts were voted down. The National Defense Authorization Bill for Fiscal Year 2003, as reported to the Senate for floor action, in our view fundamentally alters the President's national security priorities and fails to send a clear message, on the issue of missile defense, to America's allies and adversaries that the Congress will provide the resources necessary to protect our homeland, our troops deployed overseas and our allies and friends from all known threats—including the very real and growing threat of missile attack.

The world as we knew it changed forever on September 11. We lost not only many lives and much property that day, but we also lost our uniquely American feeling of invulnerability; our feeling of safety within our shores and borders. But from our darkest hour, our nation has emerged stronger and more united than ever. Our President has rallied our country and many nations around the world to fight the evil of terrorism. As we complete committee deliberations on the National Defense Authorization Bill for Fiscal Year 2003, our nation is at war. U.S. soldiers, sailors, airmen and marines, together with their coalition partners, are engaged on the front lines in the global war against terrorism, with a mission to root out terrorism at its source in the hopes of preventing future attacks. Our armed forces have responded to the call of duty in the finest traditions of our nation.

Homeland security is now, without a doubt, our top priority. We have a solemn obligation to protect our nation and our citizens from all known and anticipated threats—whatever their source or means of delivery. As a candidate and as President, George W. Bush promised our nation that homeland security was his most urgent priority. Missile defense is an integral part of the overall defense of our homeland and our deployed troops.

Accordingly, our President submitted a responsible, prioritized budget request for fiscal year 2003 that addresses our most important security needs. The request for missile defense was reasonable. It was a request that represented no increase over last year's funding level, and that was less than two percent of the defense budget. As a nation, we have the wealth, the talent, and the technology to protect ourselves. We must use these resources to move forward now, without artificial limitations—either fiscal or legislative—on the ability of our nation to develop and deploy adequate defenses.

The National Defense Authorization Bill for Fiscal Year 2003 contains a drastic reduction, of over $800 million, from the President's request for missile defense programs, including over $400 million in reductions to theater missile defense programs. In addition, the bill contains a number of restrictions and excessive reporting requirements that will further hamper the rapid development of missile defenses. According to Lieutenant General Ronald Kadish, USAF, Director, Missile Defense Agency, the reductions contained in this bill, "* * * fundamentally undermine the Administration's transformation of missile defense capabilities * * *" and "* * * eliminate the opportunity for earliest-possible contingency against medium range ballistic missiles abroad." One clear and immediate consequence will be to further delay the fielding of theater missile defenses our troops needed over a decade ago in the Persian Gulf War.

Many in the Senate—including the undersigned—have long been in the forefront of efforts to develop missile defenses to protect our nation from limited ballistic missile attacks. It has been a long and arduous struggle, but we are on the threshold of success. In June, the United States will formally withdraw from the thirty-year-old Anti-Ballistic Missile (ABM) Treaty, which has hampered the U.S. missile defense program. With this action, all artificial restraints will be removed from the ability of the United States to research, develop and deploy effective missile defense systems. Congress should not now apply new limitations on the rapid, cost-effective development of defenses to protect our nation and deployed troops from missile attack. The funding reductions and program constraints contained in the bill reported out of committee are a significant step backward in our efforts to improve the security of our nation.

We strongly endorse the President's missile defense program. The threat of missile attack is real and growing. According to the January 2002 national intelligence estimate (NIE) on the missile threat, "The probability that a missile with a weapon of mass destruction will be used against U.S. forces or interests is higher today than during most of the Cold War, and will continue to grow as the capabilities of potential adversaries mature." Dozens of nations already have short- and medium-range ballistic missiles in the field that threaten U.S. interests, military forces, and allies; and others are seeking to acquire similar capabilities, including missiles that could reach the United States. Before September 11, who would have predicted that civilian airliners would be turned into missiles, aimed at thousands of innocent civilians? We must be prepared for the expected and unexpected.

We are also concerned with other key areas in the bill, particularly the level of funding for shipbuilding. Shipbuilding was severely underfunded in the President's budget request. While additional funds are contained in this bill for important programs that were not adequately funded in the request, the committee missed an important opportunity to add more money and key acquisition authorities for building ships that would have ultimately saved the U.S. taxpayers millions of dollars. A shipbuilding restoration initiative proposed by Republican Committee Members was rejected on a straight party-line vote. We are all aware that we are not cur-

rently building enough ships to maintain an adequate Navy for the future. Ultimately, there will be a high price to pay if this trend is not quickly reversed.

In addition, we note that this bill contains an assortment of across-the-board reductions, which could well have a negative impact on programs and readiness. These include an $850.0 million cut to services contracting, and a $250.0 million tax on research and development programs to fund a test and evaluation initiative. At this point, it is impossible to predict the specific impact of such large reductions on individual weapon systems or on the readiness of our force. In the case of services contracting, the bill imposes a tax, mainly in the readiness accounts, for so-called "savings" that are to be achieved through services contracting reform in fiscal year 2003. These savings simply cannot be achieved next year. The Department of Defense is just beginning reform in this area and it will be many years before the Department will be in a position to reap any savings from improved services contracting. As a result, the Department will be forced to tax important readiness programs to pay for these "savings." If the committee chooses to fund needed priorities through "savings" initiatives, it would be better to give the Secretary of Defense the discretion to identify real managerial efficiencies, as we did last year, that can be executed in the coming fiscal year rather than illusory ones.

Aside from these important concerns, we support much of what is contained in this bill. The National Defense Authorization Act for Fiscal Year 2003 contains the largest defense increase in over 20 years—an increase of $45.0 billion. In line with the request of the President, the bill significantly increases all major defense accounts, including, military personnel, procurement, research and development, and operations and maintenance. The bill also sets aside a $10.0 billion reserve fund, as requested by the Administration, to pay for ongoing and future military operations in the global war on terrorism. The threats to our nation and the on-going war on terrorism demand this increased investment in national security, both now and in the future.

In addition, the bill contains many key provisions which we support to improve the quality of life of our men and women in uniform, our retirees, and their families, including, a 4.1% pay raise for our uniformed personnel; additional funding for facilities and services that will greatly improve the quality of life for our service personnel and their families, at home and abroad; and the phased repeal of the prohibition on concurrent receipt of non-disability retired military pay and veterans disability pay for our military retirees with disabilities rated at 60% or higher. The committee also approved a committee amendment, which will be considered by the full Senate, to repeal fully and immediately the prohibition on concurrent receipt, a step which will allow all non-disability retired veterans with VA disability ratings to collect the full amount they have earned.

Despite the positive aspects of this legislation, we cannot support the Fiscal Year 2003 Defense Authorization Bill in its current form. We will continue to work closely with our colleagues in the Senate during the course of floor consideration and as we move to a conference with the House of Representatives, to support the Presi-

dent's defense priorities and to ensure that our most important capabilities are adequately funded. The American people and the men and women who serve in uniform to protect them deserve no less.

JOHN W. WARNER.
RICK SANTORUM.
WAYNE ALLARD.
TIM HUTCHINSON.
JEFF SESSIONS.
JIM INHOFE.
BOB SMITH.
PAT ROBERTS.

MINORITY VIEWS OF SENATOR ALLARD

I am again disappointed in the outcome of this year's defense mark. As the ranking member on the Strategic Subcommittee, I am worried that some very good provisions may be at risk due to the serious concerns with this bill.

One of my particular interests for several years has been the use of commercial imagery to help meet the nation's geospatial and imagery requirements. I do not believe that the Department of Defense has been aggressive enough either in crafting a strategy or in providing funding for this purpose. I am gratified that the Chairman's mark includes a substantial increase for commercial imagery acquisition, and some very helpful words in report language that I expect will drive the Department toward establishing a sound relationship with the commercial imagery industry.

I also appreciate the support of the new Department of Energy environmental cleanup reform initiative that will incentivize cleanup sites to do their important work faster and more efficiently. The accelerated cleanup initiative will reduce risk to the workers, communities and the environment, shorten the cleanup schedule by decades, and save tens of billions of dollars over the life of the cleanup. The bill added $200 million to this cleanup initiative and I expect DOE will make tremendous strides. In addition, the bill added $200 million for the safeguard and security accounts in order to address the many security issues which have arisen since September 11th.

I was also encouraged by the Committee's support for the Thurmond/Allard mixed oxide fuel amendment. I believe that by accepting this amendment, the Committee is showing the state of South Carolina their commitment to the MOX program.

Early in the process, I made it very clear that one of my top priorities was to assure that ballistic missile defense programs are adequately funded. I was deeply disappointed that the majority is proposing a net reduction to missile defense programs of over $800 million. This represents a 12 percent decrease to the missile defense request for fiscal year 2003, a request that was already less than was appropriated for fiscal year 2002. I believe that reductions of this magnitude are unjustified and will do extraordinary harm to the effort to develop and deploy effective missile defenses as efficiently as we can.

I must also note that more than half of the missile defense reductions can be reasonably described as pertaining to defense against shorter range missiles. Reductions to THAAD, MEADS, ABL, Navy Midcourse, terminal defense segment program operations, and SBIRS Low will all damage our theater missile defense effort, as will the reduction to the BMD System program element. I know this is an area where the Majority have said they support stronger

efforts, yet these reductions seem to be inconsistent with that support.

In the wake of the events of September 11, I believe that missile defense is more important than ever. As the Director of Central Intelligence George Tenet testified before our committee, we don't have the luxury of choosing the threats to which we respond, and missile threats have a way of developing faster than we expect. I strongly urge that these proposed missile defense reductions be restored. I want to assure my chairman that I am more than willing to work with him to find an acceptable solution and I hope we can reach that compromise. But I believe these reductions do deep and fundamental harm to our efforts to develop and deploy effective missile defenses.

Senator Warner, Senator Collins and I offered reasonable compromises which would have moved the $690 million back to missile defense while adding $1 billion to the shipbuilding accounts, which would have added over $210 million more for shipbuilding than the chairman's mark. I believe that the rejection of this amendment proves that this is not missile defense versus shipbuilding, but rather a strident ideology which opposes missile defense at all costs, even at the expense of shipbuilding.

I honestly believe that unless there is some compromise, this bill will have a very difficult time getting off the floor and through conference.

WAYNE ALLARD.

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[4] Mr. Aldridge e-mail; From: Aldridge, Pete, Hon, OSD-ATL, Sent: Tuesday, August 06, 2002 11:12 AM, To: Multiple Addresses, Subject: Top 5 Priorities

"Priorities and Acquisition"

Under Secretary of Defense (ATL)

E.C. "Pete" Aldridge, Jr.

MONTEREY COM Commander's Conference

"Priorities and Acquisition"

Remarks by

Under Secretary of Defense (AT&L)

E.C. "Pete" Aldridge, Jr.

Delivered to the

PEO/SYSCOM Commander's Conference

(November 22, 2002)

(Opening Salutations)
I'm very pleased to be addressing you once again. Many of you will perhaps recall our meeting one year ago. It took place only a couple of months after the attacks. At that time the atmosphere within the defense department was one of busy anticipation. We did not know exactly what the future held, but we were certain that there would be accelerations in operations, logistics, acquisition, transformation, and research and development.

All of those accelerations have come to pass – some with greater velocity than others; Some with higher urgency that others. But the promise of increased pacing has come to pass for just about all of us.

Your work as program managers has never been more important or anticipated. I have heard it said that only God can forgive Osama bin Laden and his fellow terrorists, but it is the job of our military to arrange the face-to-face meetings.

Today is the 284th anniversary of the violent death of a violent man – the foremost terrorist of his age: The pirate Edward Teach, also known as "Black Beard."

On this day in 1718, Teach was cornered aboard his ship, the Adventure, in the Outer Banks of Carolina. His pursuer was a young Royal Navy Lieutenant who, in a

dramatic hand-to-hand fight, cut off Black Beard's head with a cutlass. His headless body was thrown overboard and legend has it that before it sank, it swam around the ship several times.

This is vaguely familiar. Every time we receive another questionable audio tape from bin Laden, it is as if he has taken another lap around the ship.

But in this new age of effects based operations, having his head on a pike is not intrinsically important. Our troops are arranging the face-to-face meetings on a daily basis. Your job is to give them the tools to do that. And you have done that very well.

Last year, I told you about the five goals that comprise my agenda as head of defense acquisition. I also told you about some of the things we intended to do over the subsequent year to realize those goals.

This year, I would like to update you on the progress we have made on those original objectives, and let you know about five additional priorities that the secretary and I believe will best serve the needs of our country and the defense department in the months to come.

This summer Secretary Rumsfeld asked me to outline my top priorities for the next eighteen months. I did so and he approved them. Let me give you a quick overview of what those priorities are.

The first priority is to continue the progress we have made with my original five goals. As you know, those goals are to:

- Improve the credibility and effectiveness of the acquisition and logistics support process;
- To revitalize the quality and morale of the AT&L workforce;
- To improve the health of the defense industrial base;
- To rationalize the weapon systems and infrastructure with our defense strategy;
- And to initiate high leverage technologies to create the warfighting capabilities and strategies of the future.

Discussing in detail the progress we have made on each of those goals would be a speech in itself.
Nonetheless, the accomplishments of our acquisition workforce have been remarkable and I cannot proceed without at least a cursory rundown of some of our more important ones.

We have revitalized the Defense Acquisition Board, replacing the assistant secretaries for acquisition from each military service with the service secretaries themselves. This change better reflects the breadth of issues we face in acquisition

matters. It has brought some welcome stability to many programs, while reducing the decision time.

And it brings to bear all the resources of each Military Department.
We have mandated evolutionary, spiral development of weapons systems.
This will enable us to field capable equipment more rapidly at lower cost and less risk.

We are ensuring that programs are properly priced by, among other things, utilizing DoD's Cost Analysis Improvement Group's cost estimates in most cases.

We have put in place procedures to make sure interoperability is properly considered, and done so earlier in a program's life.

We have consolidated and dramatically improved our acquisition education.

This was vital if we are to exercise the innovative and progressive management of our technology and systems development efforts. I hope this seminar will help us further develop the education concepts we need for the future.

We have finally established parity between the acquisitions of equipment and the acquisitions of services in the review process.

We have implemented "Technology Readiness Assessments" to determine when a program is ready to proceed to the next step in its development.

We have contributed to the health of the defense industrial base by facilitating additional profitability among contractors.

We have restored the role of science and technology to our national defenses by setting the goal that three percent of the DoD budget be reserved for science and technology. We are now very close to that figure, and will continue to push for the entire three percent. We are also exploiting the enormous potential of Advanced Concept Technology Demonstrations. I'll have more to say on the role of technology in a moment.

We are by no means finished with these original five goals, and we will continue to push for the accomplishment of each one. We have a strong momentum going and we have no intention of squandering it.

Our second priority for the next eighteen months is to "Re-engineer" the office of Acquisition, Technology and Logistics. Over the years we have accumulated many "management" functions that are inappropriate for an office that should concentrate instead on policy and oversight.

We are going to eliminate marginal activities and transfer certain functions that can be better accomplished elsewhere.

This is consistent with the Secretary's direction to reduce the size of the Office of the Secretary of Defense and to focus our efforts on Excellence in Acquisition.

Something else that was directed by the Secretary is the war on bureaucracy.

The day before last year's attacks, he announced his determination to rationalize the DoD's dependence on bureaucracy, much of which is self-defeating in its outcome and mind-boggling in its execution. One of the engines of that effort within AT&L is the cancellation of the current DoD 5000.

In his memo dated October 30th, Deputy Secretary Wolfowitz was clear. He said that the objective of this action is to,
"…create an acquisition policy environment that fosters efficiency, flexibility, creativity, and innovation."

This is consistent with one of the President's guiding management principles – what he calls the "Freedom to Manage." From my perspective, that principle represents a welcome breath of fresh air.

I am a big believer in the dangers of micromanagement. It is often said that if you want to develop leadership, initiative and versatility among subordinates, assign them an objective, then avoid micromanaging their execution. The authors of the current DoD5000 series obviously did not follow this guidance.

Whatever replaces the 5000 will be much less prescriptive, and will allow managers more discretion. It will foster initiative, speed and efficiency. We hope to reduce the 250 pages of directive, with forty pages of guidance.

Many before me, many before the secretary, have given lip service to the notion that our people are our greatest strength. When the new guidance is in place, we will have acted on that belief by taking the shackles off of the talent, capability and creativity that I am looking at today.

Third, we are going to develop an "Acquisition Excellence" Plan for All Major Weapon Systems. The objectives here are three-fold: We intend to reduce acquisition cycle time, minimize program risks, enhance stability, and keep costs under control.

The importance of this goal is self evident when you consider the significance of some of the programs we have under way.
We have to keep the Joint Strike Fighter on track.
We must implement a deployment plan for missile defense;
We must decide the architecture for the Army's Future Combat System;

We must establish a development plan for the Navy's DD-X program and the resulting family of ships;
We need to develop a balanced program for "information dominance" to include a new wideband communications system;
We must rationalize the next generation of platforms for the new "strategic forces posture" that will result from the Nuclear Posture Review;
We need to complete the roadmap for Unmanned Aerial Vehicles and Unmanned Combat Aerial Vehicles;
and we need to complete the plan for the development and production of new precision munitions.

As my fourth priority, we will complete our plans for what we call the "Future Logistics Enterprise". I'm sure you have all heard the old saying that in discussions of war amateurs debate strategy, while professionals debate logistics. The objective of the Future Logistics Enterprise reflects that adage. Simply put, it is to transform our capabilities to project power and sustain the Joint Warfighter.

It establishes a clear vision by which our logistics will better support our operational requirements.

It will enable us to project and sustain our forces anywhere on the globe through end-to-end customer service and enterprise integration.

The Future Logistics Enterprise effort is divided among three areas: Weapon system support, Customer support, and Enterprise support. Progress has been made in all these areas, but the task is still in the early stages.

We must continue to push for the completion of a shared data environment and a new "Demand Management System" to reduce customer wait time, maximize customer satisfaction, reduce costs, and minimize inventories of supplies. We must also determine the proper organizational structure to implement the new logistics enterprise.

I told you a moment ago that I would return to the subject of technology. Our fifth priority is to accelerate the Flow of Technology to the Warfighter.

Let me read a quote to you from the noted British military historian and analyst, John Keegan:

"The brief Afghan campaign revealed that terrorists are as dependent as regular armies on bases and training facilities, on regular lines of supply and on infusions of manpower to replace casualties."

Clearly, terrorists have vulnerabilities just like any other human organization, and technology, though unable to exploit all of them, is certainly playing a dominant role in this war. In fact, if ever there was a techno-centric war, this one is surely it.

Already we have exploited our advantages in airlift, space dominance, communications, UAVs, precision guided munitions, and sensor technology to name just a few.

And we have uncovered a need to further develop bandwidth technology, unmanned combat air vehicles, information technology, interoperability and system of systems capabilities.

Our experiences this past year have underlined the need for vibrant and robust research. We have restored DARPA to the high risk, high payoff focus that characterized it years ago. We intend to keep that momentum going through commitment and money.

Quality R&D is not cheap, but it is worth every penny.
Every unmanned aircraft shot down, every bullet deflected by advanced body armor, represents a visit not paid to a spouse or parent by a military chaplain.

But current, or mature, technologies have also proven to have great utility when used in creative ways. And that could almost serve as the definition of Advanced Concept Technology Demonstrations. We intend to expand these demonstrations to take advantage of some of the valuable technologies already out there.

Clearly, the events of one year ago have had an effect on the course this office has steered. Our war footing has presented us with both challenges and opportunities. Yes, our work-load has increased. Yes, DoD's priorities have changed, and must remain flexible.

And yes, this war has elevated the need for the transformation of our defenses. That is most welcome. If you were here last year, you may recall a prediction I made. I stated that this war will either provide a springboard to transformation, or it will sanction the status quo. I also expressed my determination that history not record the latter option.

One year later, I am pleased to report that we are well on our way to recasting our military into a force that is truly prepared for the challenges of the 21st century.

Now is the time to recommit ourselves to maintaining this momentum. We must keep pushing for capabilities that are lighter, faster, and more interoperable.
We must continue to exploit our clear advantages in information technology and space dominance.

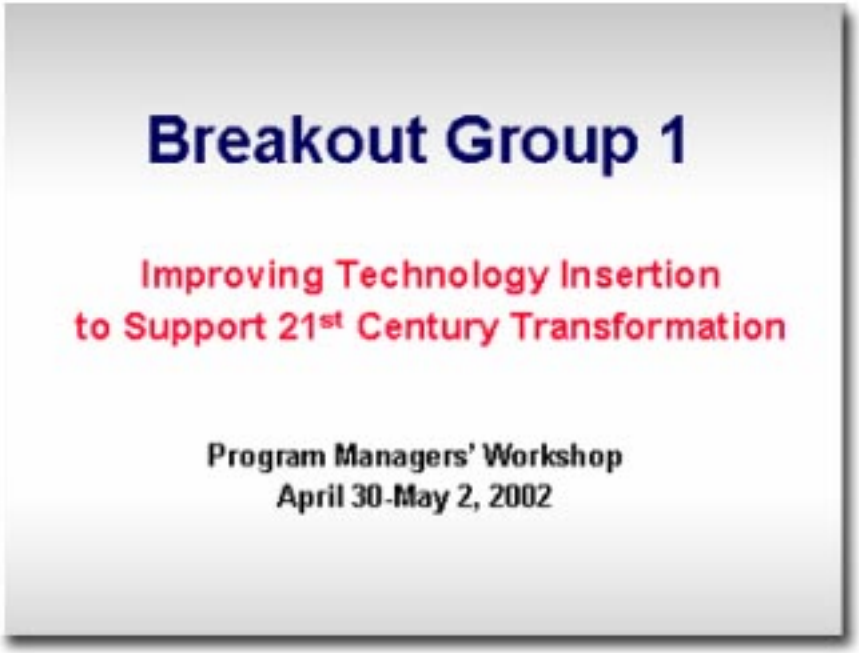
If we do so, we will be leveraging our forces with the greatest advantage that free nations possess over the tyrants who currently oppose us:

I'm talking about our traditions of free inquiry, vibrant debate, the scientific method, unfettered research, and capitalist production.

To say that this current war is one of liberty against oppression is not empty platitude. The benefits of the former over the limitations of the latter have always served us well, and will not fail us now.

Thank you.

[5] PEO/SYSCom Conference, Breakout Group Briefing, Breakout Group 1 Briefing, Improving Technology Insertion to Support 21st Century Transformation, Program Managers' Workshop April 30-May 2, 2002.



Breakout Group 1

Improving Technology Insertion to Support 21st Century Transformation

Program Managers' Workshop

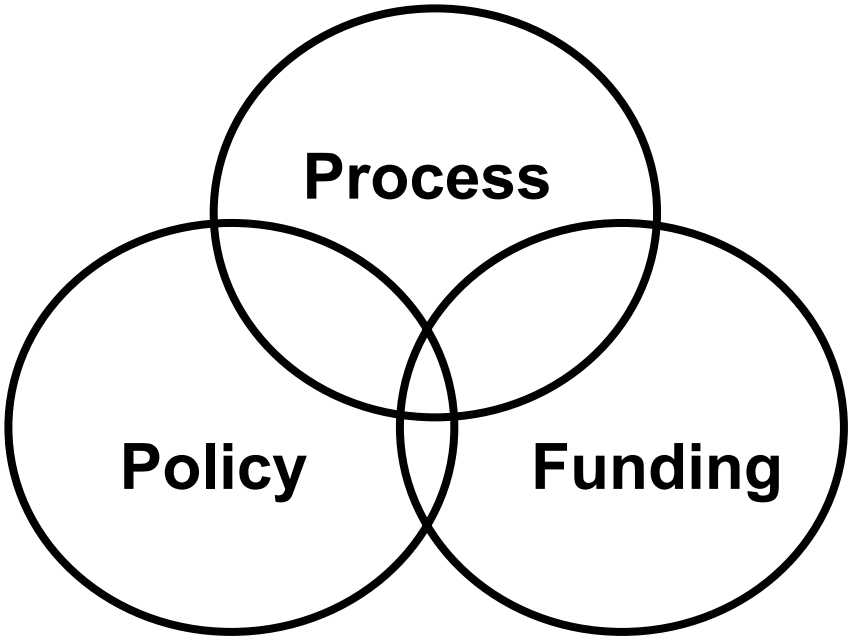
April 30-May 2, 2002

Breakout Group Information

- **Group Co-Chairs**
  - Al Shaffer, Director, ODDR&E Plans and Programs
  - John Gresham, Dep. PM, Army Recon, Surveillance and Target Acquisition
- **OSD Discussion Group Facilitators**
  - Policy: Ms. Beth Foster (Technology Readiness Assessment and Levels) and Mr. Dan Cundiff (Affordability Task Force and Transition Issues)
  - Funding: Ms. Joanne Spriggs (Quick Reaction Special Projects)
  - Process: Mr. Ben Riley (ACTD Programs)
- **Presentations**
  - Acquisition Initiatives and Intellectual Property / LtCol Greg Redick, OSD
  - ODUSD(S&T) Office of Technology Transition Programs / John Todaro
  - Army RAPT Program / Ron Mlinarchik
  - Air Force WRAP Program / LtCol Chris Warack
  - MDA Quality, Reliability, and Manufacturing Program / Anne Finney
  - Future Naval Capabilities / Rich Kikla
  - Air Force Applied Technology Council / Lanny Jines
- **Recorders**
  - Dr. Richard F. Parisse, Tiburon Associates
  - Ms. Becky F. Terry, AT&T Government Solutions
  - Ms. Elizabeth Leff, Booz Allen Hamilton

Issue Statement

Insertion of Technology Into Current and Emerging Operational Systems Does Not Work Well



Identify Five Barriers in Each

Macro

- **This is a hard, complex problem**
- **No singular solution / no silver bullet**

Insertion / Transition is a Contact Sport

“Big 5” Barriers

	Policy	Process	Funding
No Transition “Czar”	X	X	X
Industry & PM Not Incentivized	X		X
Lack of Flexible Funding	X	X	X
Inflexible Requirements Process	X	X	
Risk Aversion	X	X	X

Recommended Actions

Barrier	Actions
No Transition "Czar"	SAE Designate Senior SES with Budget Authority
Industry & PM Not Incentivized	Make Technology Insertion Plan a Part of the Regular Up-front Planning of All Acquisition Programs, Tied to Performance Bonuses
Lack of Flexible Funding	Establish / Support: - Execution Year Programs - Increased Re-programming Authority
Inflexible Requirements Process	- Implement Spiral Requirements Process - Implement Capabilities-based Requirements
Risk Aversion	Develop a Pilot Process to Fail Small, Fail Early

In Closing

- **Tech Transition / Insertion Issues Remain Unchanged**

- **…. Does It Matter?**

BACK-UP SLIDES

Dimensions to Technology Transition

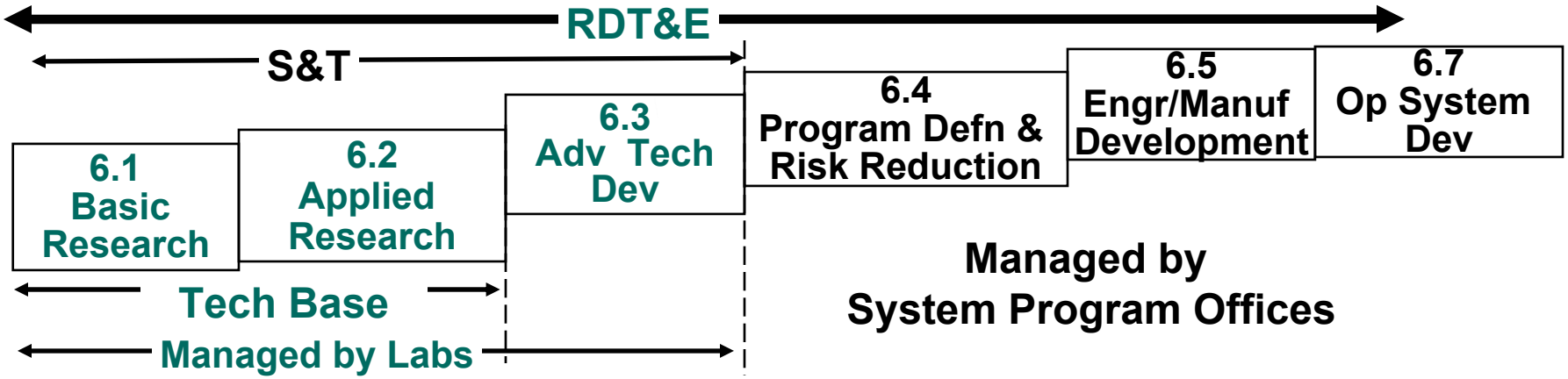
- Rate of Technology Change is Increasing
- Capabilities-based Planning Changes Requirements/Needs Process
- Acquisition Excellence and Spiral Insertion Provides New Transition Model
- Availability of Commercial Technology Increasing; Need to use to Maximum Extent
- Try Before Buy
- Fail Small, Fast, Early

Multiple Dimensions Mean Multiple Solutions Needed

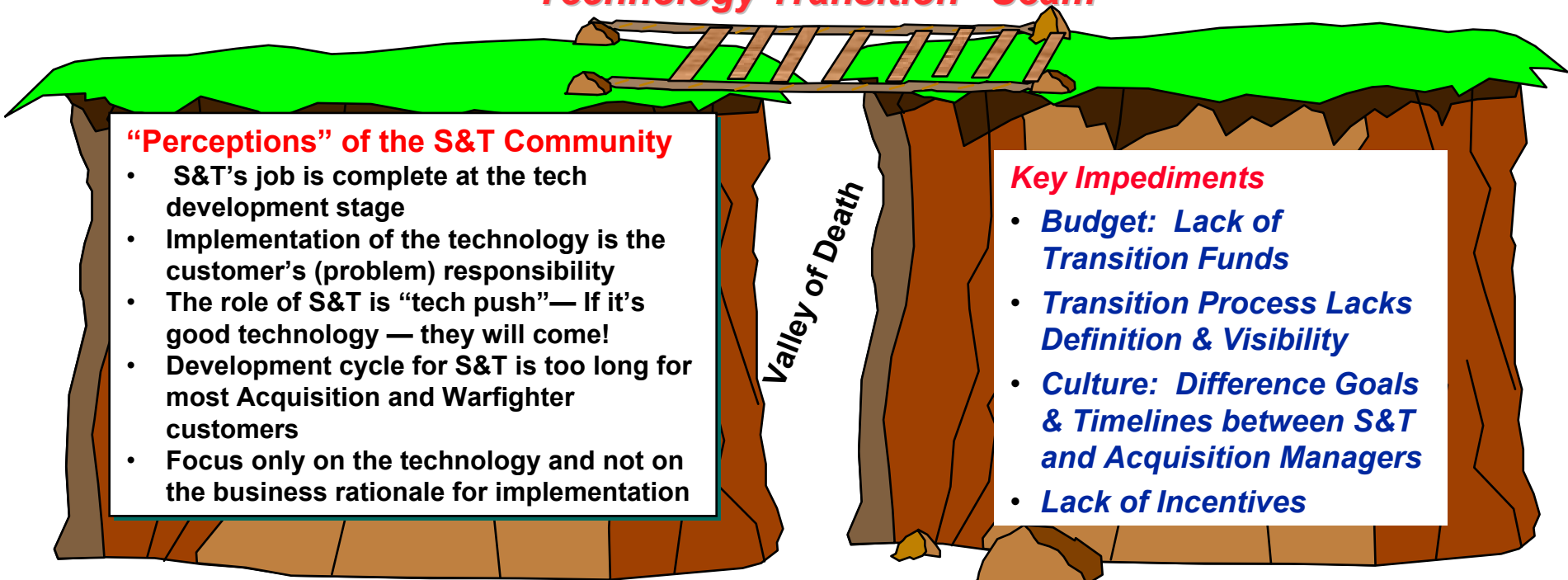
Facets of Transition
(R&D View)

- **Technology Transition**: Improving, moving, & speeding the movement of technology from the labs to acquisition systems, e.g.,
  - the next phase of acquisition; OR
  - an actual military system that has been or may be fielded; OR
  - a military / commercial test facility or depot
- **Technology Insertion**: The introduction, placement, and integration of a demonstrated defense or commercial technology into a military system, component, or application
- **Technology Transfer**: The process of sharing, transmitting, or conveying technology data and information between the government agencies, industry, and academia
- **Affordability**: Consideration of "best value" options that integrates performance, cost, producibility/manufacturability, reliability, supportability, and risk
  - Does not mean the "cheapest"

Speeding Technology Transition
"The Challenge"



Technology Transition "Seam"



"Perceptions" of the S&T Community

- S&T's job is complete at the tech development stage
- Implementation of the technology is the customer's (problem) responsibility
- The role of S&T is "tech push"— If it's good technology — they will come!
- Development cycle for S&T is too long for most Acquisition and Warfighter customers
- Focus only on the technology and not on the business rationale for implementation

Key Impediments

- ***Budget: Lack of Transition Funds***
- ***Transition Process Lacks Definition & Visibility***
- ***Culture: Difference Goals & Timelines between S&T and Acquisition Managers***
- ***Lack of Incentives***

Policy Discussion Group
Key Participants

- **OSD Facilitators**
  - Beth Foster, OSD Plans and Programs
  - Dan Cundiff, OSD Office of Tech Transition
- **Presenters and Topics of Discussion**
  - Dan Cundiff, OSD, Transition and Affordability
  - Beth Foster, OSD, Technology Readiness Levels
  - Colonel Greg Redick, OSD, Intellectual Property Issues
- **Recorder:** Becky Terry, AT&T Government Solutions, Inc.

Policy Discussion Group
Barriers and Solutions

- **Barrier: Risk Aversion vs. Risk Taking**
  - Policies / processes do not incentivize taking risks
  - Perception that S&T "pet rock" projects inhibit leap ahead
  - Limited S&T and acquisition funds
  - Commercial industry will not risk sharing their "best" technology; concerned with Intellectual Property Rights (IPR)
- **Solutions:**
  - Dual path funds for PEOs/PMs
    - Bring back 6.3b fund ?
  - Fewer programs in S&T and acquisition
    - more dollars per program
    - captures PM interest
  - Technology maturity agreements in key S&T and acquisition programs
  - Integrate IPR into key DAU acquisition / S&T courses

Policy Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: Lack of adequate funding for transition and insertion**
- **Solutions:**
  - **Make hard decisions on terminating S&T and acquisition programs (it's OK to "fail small")**
  - **Stop the "salami slicing"**
- **Barrier: Contractors & labs not incentivized to transition by law or policy**
- **Solutions:**
  - **Increase profit ceilings**
  - **Use of Other Technology Agreements (OTAs) for research and transition (e.g., initial production)**
  - **Allow government and contractor personnel to recoup % of savings due to cycle time reduction**

Policy Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: No Technology Broker**
  - Few PMs understand issues faced by S&T, acquisition and industry
  - Technology push versus requirements pull ?
- **Solutions:**
  - Chief scientist in PM office
  - Internships (e.g., trade S&T with PM people, and vice versa)
  - Partnering with industry
  - Include transition measures in both the S&T and Acquisition Manager's performance plan
  - Provide the broker resource authority
  - More discipline (6.3 <u>must</u> have customer)

Policy Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: Lack of established requirements / constantly changing requirements**
- **Solutions:**
  - **Prioritize via the Integrated Product Team**
  - **Use IPPD tools where applicable, e.g., Cost as an Independent Variable, Total Ownership Cost, Quality Function Deployment, Design for Six Sigma,**
  - **Potential Joint Staff / JROC issue**
    - **Potential breakthrough technologies not getting visibility**
    - **Address transition/insertion requirements in Operational Requirements Documents (ORDs)**

Funding Discussion Group
Key Participants

- **OSD Facilitator**
  - Joanne Spriggs, OSD Plans & Programs
- **Presenters and Topics of Discussion**
  - Joanne Spriggs, OSD, Quick Reaction Special Projects (QRSP)
  - John Todaro, OSD Office of Tech Transition (OTT), OTT Programs
  - Ron Mlinarchik, Army SAALT Program Office, Rapid Acquisition Program (RAPT)
  - LtCol Chris Warack, Air Force, Warfighters' Rapid Acquisition Program (WRAP)
  - Anne Finney, Missile Defense Agency (MDA), Quality, Reliability, and Manufacturing Program
- **Recorder**
  - Elizabeth Leff, Booz Allen Hamilton

Funding Discussion Group
Barriers and Solutions

- **Barrier: Program Planning and Budget System (PPBS) doesn't respond to needs**
  - **Too much time between identification of needs and receiving funds**
- **Solutions:**
  1. **Transition requirements in ORDs (becomes part of PM responsibility)**
  2. **Financial flexibility – larger management reserves**
- **Action: Develop policy for writing transition into ORDS and give direction on incorporation of transition requirements and funds**
- **Milestone: September 1, 2002, Policy memo, requirements generation change**
- **Points of Responsibility:**
  - **USD (AT&L) for policy**
  - **Joint staff for requirements generation change**

Funding Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: Lack of top level commitment to encourage insertion as part of PPBS**
- **Solutions:**
  1. **Policy to require technology transfer be planned as part of program**
  2. **DPG should include direction for technology transition and what is the right level of funding; OSD needs to enforce**
- **Actions:**
  1. **Develop top level policy for each Service to act upon relative to policy for technology insertion requirements**
  2. **Authority to fund policy for technology insertion**
- **Milestones:**
  1. **Policy to be approved to support 04 POM**
  2. **Program funding to support 04 POM**
- **Points of Responsibility:**
  1. **OSD**
  2. **Service Executives**

Funding Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: Inflexible PPBS Process**
- **Solutions:**
  1. **"No color" and "no year" money fund**
  2. **Increase reprogramming threshold**
  3. **Create and source fund without taxing**
- **Actions:**
  1. **Legislative action to create this capability (e.g., ~ Title III)**
  2. **Comptroller acting today**
  3. **POM 04 Initiative**
- **Milestone (1.-3.): DUSD(AT&L) and Comptroller define requirement prior to POM 04 review**
- **Points of Responsibility:**
  - **USD (AT&L)**
  - **Comptroller**

Funding Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: No single person responsibility for technology transition**
- **Solutions:**
  1. **Assign Service Acquisition Executives (SAEs) responsibility to stand up and ensure programmatic stability and execution of technology transition 'czar'**
     - **Resources with budgets**
  2. **OSD, S&T Executives, Comptroller also have responsibility**
     - **Establish metrics for Services**
- **Action: USD (AT&L) establishes policy to ensure Services assign SAEs, S&T Executives, Comptroller responsibility for technology insertion**
- **Milestone: Build into POM 04 cycle**
- **Responsibility: USD (AT&L)**

Funding Discussion Group
Barriers and Solutions (Cont'd.)

- **Barriers: No Incentive for PM, and industry to conduct IR&D-- risk with no reward**
- **Solution: Establish Rapid Technology Transition Program (RTTP) at $100M per year in each Service and at OSD (e.g., joint "pot" focused on ACTDs)**
- **Action: USD (AT&L) and SAEs establish RTTP**
- **Milestone: $100M/yr, POM 04–09, before POM lock**
- **Responsibility:**
  - **USD (AT&L) and SAEs**
  - **Service Chiefs**

Process Discussion Group
Key Participants

- **OSD Facilitator: Ben Riley, ACTD Program Office**
- **Presenters and Topics of Discussion**
  - **Ben Riley, Advanced Concept Technology Development (ACTD) Program Office, ACTD Process**
  - **CAPT Richard Kikla, Office of Naval Research, Future Naval Capabilities**
  - **Lanny Jines, AF Research Laboratory, Applied Technology Council**
- **Recorder: Richard Parisse, Tiburon Associates, Inc.**

Process Discussion Group

Barriers to Insertion - Prioritized

1. Lack of transition process / policy / guidance / responsibility
2. Requirements process does not foster innovation
3. Lack of communication
4. Lack of funding
5. Leadership instability

Process Discussion Group

Barriers and Solutions

- **Barrier: Lack of transition process / policy / guidance / responsibility**
- **Unconstrained Solutions:**
  - **Single purple manager at OSD (e.g., cradle to grave)**
  - **Outsource all PM functions to industry**
- **Pragmatic Solutions:**
  - **Establish a standard process**
  - **Tech transition champion in each Service**
  - **Technology roadmap "cradle to grave"**

Process Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: Requirements process does not foster innovation**
- **Unconstrained Solution**
  - **NEVER change requirements !!**
- **Pragmatic Solutions**
  - **Increase interaction between acquisition/ warfighter / S&T and requirements**
  - **Make spiral requirements mandatory**
    - **Iterative requirements development**

Process Discussion Group
Barriers and Solutions (Cont'd.)

- **Barrier: Lack of communication**
- **Unconstrained Solution: None**
- **Pragmatic Solutions – Ensure:**
  - **Processes mandate communication**
  - **Diversity of IPT membership**
  - **Proper IPT feedback and functioning**
  - **DoD disseminate vision / needs**
    - **Industry use for investment**

Process Discussion Group
Overall Actions

- **Establish DoD process for technology transition**
  - **Joint industry / government team should develop**
  - **Adopt common elements of Service processes**
  - **Issue a Directive and/or Instruction**
- **Milestones: TBD**

[6] DoD Inspector General Report, Army Transition of Advanced Technology Programs to Military Applications (D-2002-107) dated June 14, 2002.

June 14, 2002

Acquisition

Army Transition of Advanced Technology Programs to Military Applications
(D-2002-107)

Department of Defense
Office of the Inspector General

Quality Integrity Accountability

June 14, 2002

Acquisition

Army Transition of Advanced Technology Programs to Military Applications
(D-2002-107)

Department of Defense
Office of the Inspector General

Quality *Integrity* *Accountability*

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Acronyms

ACTD	Advanced Concept Technology Demonstration
AMC	Army Materiel Command
ATD	Advanced Technology Demonstration
S&T	Science and Technology
STO	Science and Technology Objective
TRL	Technology Readiness Level
TTA	Technology Transition Agreement

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-2884

June 14, 2002

MEMORANDUM FOR AUDITOR GENERAL, DEPARTMENT OF THE ARMY

SUBJECT: Audit Report on the Army Transition of Advanced Technology Programs to Military Applications (Report No. D-2002-107)

We are providing this report for review and comment. We considered management comments on a draft of this report when preparing the final report.

DoD Directive 7650.3 requires that all recommendations be resolved promptly. We request the Assistant Secretary of the Army for Acquisition, Logistics, and Technology provide additional comments to Recommendations A.1., A.2., A.3., and A.5. We also request that the Commander, Army Materiel Command provide comments to Recommendation B. Additional management comments should be received by July 15, 2002.

If possible, please provide management comments in electronic format (Adobe Acrobat file only). Send electronic transmission to the e-mail addresses cited in the last paragraph of this memorandum. Copies of the management comments must contain the actual signature of the authorizing official. We cannot accept the / Signed / symbol in place of the actual signature.

We appreciate the courtesies extended to the audit staff. For additional information on this report, please contact Mr. Bruce A. Burton at (703) 604-9071 (DSN 664-9071) (bburton@dodig.osd.mil) or Mr. Roger H. Florence at (703) 604-9067 (DSN 664-9067) (rflorence@dodig.osd.mil). See Appendix E for the report distribution. Audit team members are listed inside the back cover.

Thomas F. Gimble
Acting
Deputy Assistant Inspector General
for Auditing

Office of the Inspector General of the Department of Defense

Report No. D2002-107 **June 14, 2002**
(Project No. D2001AB-0105)

Army Transition of Advanced Technology Programs to Military Applications

Executive Summary

Who Should Read This Report and Why? Science and technology officials in the Office of the Secretary of Defense and the Department of the Army should read this report because it evaluates the Army's current process for enhancing the likelihood that emerging technology would reach the warfighter.

Background. Congress and DoD officials have voiced concern that technology has not quickly transitioned to the warfighter. A goal of the Department of the Army is to modernize its forces by introducing technology capabilities at a more rapid pace without incurring the need for additional funds. In October 1999, the Army announced its new Objective Force initiative to develop a more mobile and responsive force that is able to deploy troops anywhere in the world in a short period of time. To help achieve the objective, the Army had about 260 separate funded advanced technology projects or tasks from FYs 1999 through 2001, with an average aggregate funding level of more than $700 million to develop capabilities for introduction to military applications.

Results. Acquisition program officials were not adequately involved in fully facilitating and supporting the successful and timely transition to the warfighter. We reviewed 20 science and technology projects with expenditures of $441.5 million that included 6 advanced technology demonstration programs and 14 science and technology objective programs. Improvements were needed because:

- none of the 18 projects had formally agreed to technology readiness levels,
- five science and technology projects that were advanced technology demonstrators did not have acquisition program funding necessary for transitioning, and
- of two science and technology projects that transitioned with expenditures of $36.3 million, one did not meet the exit criteria before it transitioned and the other required substantial additional development by the receiving acquisition program office.

As a result, unless recommended measures are undertaken to effectively coordinate formal acquisition program support for the 18 science and technology projects that have planned additional funding of $244.4 million, the Army cannot make fully informed and prudent decisions on whether continued investment is warranted. See the Finding section for the detailed recommendations (finding A).

Management did not use the performance appraisal process effectively to assist in achieving DoD performance goals and the Army Materiel Command's corporate objective. Science and technology officials' management performance plans need to include technology transitioning as a performance element. See the Finding section for the detailed recommendations (finding B).

Management Comments. The Deputy Assistant Secretary of the Army (Research and Technology) commented on the draft report. We did not receive comments from the Commander, Army Materiel Command to the draft issued on February 25, 2002. The Deputy Assistant Secretary concurred with most of the recommendations and stated that the recommended policies had been put in place for advanced technology demonstrations programs; however, science and technology objective programs should not be held to the same standard because they are in earlier stages of development. He nonconcurred with reviewing technology paths for technologies included in the audit, stating that, by nature, those projects will not always be successful in transitioning to acquisition and only the most technically mature efforts should be planned for transitioning. The Deputy Assistant Secretary concurred with linking personnel performance plans to program performance and stated that the linkage should apply only to advanced technology demonstration managers and not to the less mature science and technology objective programs. Management comments are discussed in each finding and the complete text is included in the Management Comments section.

Audit Response. Management comments were generally nonresponsive. We believe that there is no significant difference between advanced technology demonstration and science and technology objective programs because both use advanced technology development funds. Based on the audit's results, the Army's policies for coordination are not being followed in all respects, and additional Army procedures for advanced technology development programs need to be issued. We request that the Assistant Secretary of the Army for Acquisition, Logistics, and Technology and the Commander, Army Materiel Command provide comments to the final report. The comments should be received by July 15, 2002.

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Background

DoD Acquisition Policy. DoD Directive 5000.1, "The Defense Acquisition System," (Incorporating Change 1, January 4, 2001) October 23, 2000, states that science and technology (S&T) projects shall address user needs. Programs will be broad based, spanning all DoD S&T, to anticipate future needs and those technologies not being pursued by civil or commercial communities. The S&T projects will preserve long-range research and should enable rapid transition from the S&T base to useful military products. Specific S&T projects must focus on increasing the effectiveness of a capability, decreasing cost, increasing operational life, and improving the capabilities of systems through planned upgrades.

Science and Technology Guidance. An affordability task force chartered by the Director for Defense Research and Engineering issued a handbook and the Deputy Under Secretary of Defense (Science and Technology) issued a guide to the Military Departments and Defense agencies concerning practices that they believed, if instituted, would assist in transitioning technology. In addition, in response to congressional concerns that the DoD had not been successful in transitioning technology, the Under Secretary of Defense for Acquisition, Technology, and Logistics issued a report to Congress identifying why technology was not transitioning.

Addressing Affordability in Defense Science and Technology (S&T): A Handbook for S&T Managers. In October 1999, the DoD S&T Affordability Task Force issued a Handbook that stresses the importance of early involvement of all candidate acquisition programs in advanced technology efforts. The Handbook states that early involvement of advanced technology candidate acquisition programs in research development, design, test planning, manufacture, training, logistics, finance, and contracts are essential to address key issues that lock in a majority of the life-cycle costs of programs. The Handbook states that management tools for ensuring effective technology transitioning include establishing integrated product teams (known as IPTs), creating IPT charters, identifying quantitative metrics and key exit criteria, and developing a formal transition plan that is officially signed by the "customer" (usually an acquisition community member) and the technology manager. Additional management tools include preparing an approved memorandum of agreement or understanding that includes a funding strategy, which commits the acquisition community to transition the technology.

Technology Transition for Affordability: A Guide for S&T Program Managers. In April 2001, the Deputy Under Secretary of Defense (Science and Technology) issued a Guide to provide S&T program managers with strategies to transition technology to the acquisition community. The Guide states that the transition of technology should be timely (get the technology in the hands of the warfighter as soon as possible) and cost-effective (provide the best technology at the lowest possible cost). The Guide states that a key strategy for transitioning technology is early coordination between the S&T project manager and the receiving acquisition manager to promote a mutual understanding between the two parties. Early coordination assists the S&T project manager's understanding of how to transition the technology with the time-phased requirements of the receiving acquisition manager. The receiving acquisition manager, in turn, is kept current on the maturity of the technology and is

better able to plan and schedule the technology introduction. A tool for fostering this coordination is to establish IPTs that involve the managers of the candidate acquisition programs. The Guide provides that IPTs should include the S&T project manager, the S&T contractor, the acquisition manager and the respective contractor(s), and test and evaluation representatives. An IPT should be formed early in the life cycle of a technology's development to address key issues that can greatly affect life-cycle cost and the eventual acceptance and implementation of the technology. Issues that the IPT should address include defining and agreeing upon quantifiable metrics, such as cost, performance, and schedule; exit criteria; and the maturity of the technology at transition identified as technology readiness levels (TRLs) (the TRLs are described in Appendix B). The Guide states that those issues and others should be agreed upon in formal documentation such as memorandums of agreement or understanding and technology transition plans.

Under Secretary of Defense for Acquisition, Technology, and Logistics Report to Congress. In June 2001, the Under Secretary of Defense for Acquisition, Technology, and Logistics provided a report to the congressional defense committees on technology transition from the Defense Advanced Research Projects Agency. The report provided Congress with the results of a review of the transition of research to the Military Departments from the Defense Advanced Research Projects Agency and addressed issues that were also applicable for the Army transition of research technology to acquisition program managers and, ultimately, to the warfighter. The report cited a key reason for difficult technology transition as being the need for collaboration among three diverse groups: the S&T researcher, the acquisition program manager, and the military user. Effective transition requires the groups to work together as a team, which is frequently a difficult issue. In addition, for a technology transition to be successful, the acquisition program manager's prime contractor must be supportive of the technology insertion, and the technology must demonstrate a greater return than the existing capability.

Army S&T Process. The Army Science and Technology Master Plan (the Plan) presents the S&T investments that are required to achieve the Army vision of transforming its force's capabilities to dominate the full spectrum of operations. The Army vision is to create an Objective Force capable of deploying a combat brigade anywhere in the world in 96 hours, a combat division in 120 hours, and five combat divisions anywhere in 30 days. The Army S&T projects were reshaped to speed development of technologies necessary to achieve the Army's transformation vision. The transformation path from today's force to the future Objective Force includes incorporating technologies into existing and developing systems. The Army had about 260 separately funded advance technology projects or tasks from FYs 1999 through 2001, with an average aggregate funding level of more than $700 million per year to develop capabilities for introduction to military applications.

Objectives

The audit objective was to determine whether the Army was successful in transitioning advanced technology projects to military applications. Specifically, we examined whether the Army had established a process to successfully transition technology. We also evaluated management controls in the Army as they relate to the audit objective. See Appendix A for a discussion of the audit scope and methodology and the review of the management control program.

A. Army Science and Technology Process

The Army S&T management created an extensive management process in 1999 to plan, review, and provide oversight of technology efforts that were proposed to transition to the warfighter. However, improvements are still needed because acquisition program officials were not adequately involved in fully facilitating and supporting the successful and timely transition to the warfighter for 18 science and technology projects that had expenditures of $405.2 million.[1] For example, none of the 18 projects had formally agreed to technology readiness levels, which are agreed-upon levels of technology maturity development that are required for transitioning to the receiving acquisition program manager. Also, five of the science and technology projects, which were advanced technology demonstrators, did not have the necessary acquisition program funding for transitioning. Finally, for the two science and technology projects that transitioned with expenditures of $36.3 million, one did not meet the exit criteria before it transitioned and the other required substantial additional development by the receiving acquisition program office. Acquisition program officials were not adequately involved in transitioning technologies because the Army S&T management process did not require the level of coordination between acquisition officials that was advocated in the Deputy Under Secretary of Defense (Science and Technology) guidance. Specifically, integrated product teams were not established or they did not include acquisition program managers, the S&T manager did not establish formal agreements with acquisition program managers that included technology readiness levels and exit criteria, and S&T projects were not budgeted by acquisition users to transition. As a result, unless measures are undertaken to effectively coordinate the 18 science and technology projects that have planned additional funding of $244.4 million, the Army cannot make fully informed and prudent decisions on whether continued investment is warranted.

Army Science and Technology Review Process

Army S&T Review Process. The S&T community has an extensive technology planning, review, and oversight process to assist the Army in achieving the future Objective Force. The Army Pamphlet 70-3, "Army Acquisition Procedures," July 15, 1999, (Army guidance) describes the S&T review process and provides discretionary guidance on S&T projects. At the beginning of each fiscal year, the Deputy Assistant Secretary for Research and Technology and the Director, Force Development Office of the Deputy Chief of Staff for Programs, issue guidance on new technology proposals and existing technology reviews.

[1]A total of 20 science and technology projects were reviewed with expenditures of $441.5 million.

New technology proposals are identified as S&T objectives (referred to in the Army as STOs) and are reviewed and approved during Army's annual S&T oversight process. The annual S&T oversight process also reviews ongoing technology projects[2] that have been in development for 3 years; that have been revised in terms of cost, schedule, or scope; and that have been completed.

The Army S&T Program received management direction and approval from three executive-level groups in developing the Plan. The first level of review is the Warfighter Technical Council, a one-star-level group that performs detailed reviews of all proposed and ongoing STOs, advanced technology demonstrations (ATDs) and advance concept technology demonstrations (ACTDs). The Warfighter Technical Council is co-chaired by the Director of Technology, Office of the Deputy Assistant Secretary for Research and Technology, and the Assistant Chief of Staff for Combat Development, Army Training and Doctrine Command. The Training and Doctrine Command represents the military user in identifying and supporting areas for S&T research. The second level of review is the Army S&T Working Group, co-chaired by the Deputy Assistant Secretary for Research and Technology and the Assistant Deputy Chief of Staff for Programs (Force Development). The Army S&T Working Group provides two-star-level resolution of issues and reviews and approves research efforts for STOs and ATDs. The Army's final approval level is the S&T Advisory Group, a four-star-level group that is co-chaired by the Assistant Secretary of the Army for Acquisition, Logistics, and Technology and the Army Vice Chief of Staff. Army acquisition representation is provided at all three reviews. Appendix C provides a flow chart depicting the Army S&T oversight process.

Technology Project Documentation. As part of the S&T review process, S&T project managers are required to submit documentation providing an overview of proposed and ongoing projects. The required documents include a project description chart, a product description chart, TRLs and a milestone chart, and the Ten-Question Quad Chart. Those four documents are used as a basis for determining whether or not a proposed effort becomes a STO, ATD, or ACTD. The project description chart provides the program objective and identifies intermediate milestones and final product applications (with metrics) to Army systems. The product description chart identifies the program's technologies and provides additional STO information such as affordability metrics and approval dates for the Mission Needs Statement or the Operational Requirements Document. The TRL milestone chart provides the TRLs for the technologies as well as the significant high-level metrics that will be achieved throughout the duration of the technology development. The Ten-Question Quad Chart identifies the purpose of the research, the technology barrier to be overcome, the quantitative metrics to be met, the TRLs to be achieved, the estimated timeframes for the technology to be available, and the office or acquisition program that endorsed the research effort.

[2]Other technology efforts include ATDs and ACTDs.

Ten-Question Quad Chart. The annual oversight process uses the Ten-Question Quad Chart as one of the key documents to evaluate proposed and ongoing S&T projects. The Ten-Question Quad Chart provides the data necessary to evaluate the merits of the technology and is divided into four discrete sections.

The first section describes the problem, the barriers to solving the problem, and the plan to overcome the barriers. The second section discusses how the S&T project fits into Army needs, ongoing and completed S&T capabilities, and lists TRLs. The third section provides the benefits of the S&T project in terms of increased capability and cost savings, the transition milestones, the candidate acquisition programs or S&T projects to receive the technology, and the office that endorsed the research. The final section provides the schedule and the cost of major tasks.

The Army requires that all S&T projects have a technology path or plan that identifies the candidate programs for the transitioning technology in the Ten-Question Quad Chart. Our review of the Ten-Question Quad Chart identified that it does not accurately portray the technology transition paths or plans. For example, the Aviation and Missile Command, Aviation Applied Technology Directorate, planned seven STOs or ATDs for aviation platforms. According to the Ten-Question Quad Chart, four of the STOs or ATDs identified five candidate aviation platforms for the developing technology, with plans for three of those platforms to transition from FYs 2002 through 2004. However, the receiving acquisition program managers stated that they had not planned, scheduled, or budgeted for the technology introduction. The acquisition program managers stated that they were monitoring the STO or ATD technologies and that when they believed the technologies were mature, they would consider introducing the technologies to the aviation platform during a scheduled platform upgrade. The introduction would occur if the funding was available and if the technology was a sufficient upgrade to warrant the expenditure. The following are two examples of ongoing technologies that lack formal acquisition program support.

Helicopter Active Control Technology STO. The Helicopter Active Control Technology STO was proposed to demonstrate a 60-percent improvement in weapon pointing accuracy, a 50-percent increase in agility and maneuverability, and a 30-percent reduction in flight test time. The STO Ten-Question Quad Chart showed that the S&T was scheduled to transition to the Chinook helicopter (CH-47) upgrade in FY 2003, the Blackhawk helicopter (UH-60) upgrade in FY 2006, and the Apache helicopter (AH-64) upgrade in FY 2007. Although the technology was planned to be demonstrated on the Apache helicopter, the acquisition program managers for the Chinook, Blackhawk, and Apache had not prepared detail plans or budgets for the technology to be added to their helicopter systems.

Advanced Rotorcraft Transmission II. The Advanced Rotorcraft Transmission II STO goals were to demonstrate a 25-percent increase in drive system power-to-weight ratio, a 10-percent reduction in drive system operating cost, and a 10-decibel reduction in transmission-generated noise. The Advanced

Rotorcraft Transmission II development effort was conducted on the Osprey tilt-rotorcraft (V-22), a non-Army helicopter. The Ten-Question Quad Chart for the Advanced Rotorcraft Transmission II identified the Blackhawk helicopter (UH-60X) in FY 2006, the Comanche helicopter (RAH-66) in FY 2006, the Apache helicopter (AH-64) in FY 2004, and the Osprey tilt-rotorcraft (V-22) in FY 2003 as candidate programs for the technology. However, none of the Army acquisition program managers had prepared detail plans or budgets for the technology to be added to their helicopter systems.

Although the S&T annual oversight process includes representatives from the user community (the Army Training and Doctrine Command) and the acquisition community (the Army Deputy for Systems Management and Horizontal Technology Integration), coordination with the specific receiving acquisition program managers is not required, and therefore makes the candidate acquisition systems identified in the Ten-Question Quad Chart questionable. To improve the merits of the Ten-Question Quad Chart and to enhance the likelihood of technology transition, the S&T project manager should be required to establish and maintain an up-to-date formal agreement with the candidate acquisition programs that are identified in the Ten-Question Quad Chart. The establishment of a formal agreement should be a condition for continued S&T funding.

Army Science and Technology Projects Reviewed

The audit examined 20 S&T projects funded with research, development, test, and evaluation funds; advanced technology development appropriations expenditures of $441.5 million and planned additional funding of $244.4 million at the two Army sites visited. The 20 S&T projects included 14 STOs and 6 ATDs at either the Tank-automotive and Armament Command, Armament Research, Development, Engineering Center; or the Aviation and Missile Command, Aviation Applied Technology Directorate.

The audit evaluated the 20 S&T projects and the extent of program coordination, using the Handbook and Guide, with the planned receiving acquisition program(s) or other technology effort. The Handbook and Guide cited best business practices include the creation of integrated product teams that are accompanied by an established charter. To be effective, the IPTs must include the acquisition program manager(s) and the prime contractor to facilitate the technology integration. The Handbook and Guide also provide for the formal establishment of memorandums of agreement or understanding with the acquisition program manager(s), including agreements on TRLs and exit criteria, and for coordination to provide acquisition programs with the necessary funding to continue the S&T integration. The following table summarizes the audit results by the STOs and the ATDs. See Appendix D for a summary of the advanced technology development projects that we reviewed.

Summary of Science and Technology Objectives (STOs) and Advanced Technology Demonstrations (ATDs) Examined
(ratio shows positive responses to total examined)

Action	Number of Occurrences 14 STOs	Number of Occurrences 6 ATDs	Percent of Occurrences 14 STOs	Percent of Occurrences 6 ATDs
Integrated Product Team				
Team established	7 of 14	6 of 6	50	100
Charter approved	3 of 7[3]	4 of 6[3]	43	67
Acquisition program manager included	9 of 16[4]	4 of 11[4]	56	36
Acquisition program prime contractor included	7 of 16[5]	5 of 11[5]	44	45
Acquisition Program Manager				
MOA/MOU	3 of 29[6]	2 of 11[6]	10	18
Exit TRLs formally agreed	0 of 26[7]	0 of 3[7]	0	0
Exit criteria formally agreed	1 of 29[6]	2 of 11[6]	3	18
Funding by acquisition user to transition	4 of 20[8]	0 of 6[9]	20	0

[3]Charters were established for projects that had IPTs.

[4]S&T projects that established IPTs applied to more than one existing acquisition program.

[5]S&T projects that established IPTs applied to more than one existing acquisition program prime contractor.

[6]The 14 STOs and 6 ATDs applied to 29 and 11 existing acquisition programs, respectively.

[7]Two STOs that applied to three acquisition programs and two ATDs that applied to eight existing acquisitions programs were completed before the requirement for TRLs.

[8]The number of STOs that should have had funding was 20 instead of 29 because for 9 STOs funding documentation was unavailable, the technology was a manufacturing improvement, or the user had not been defined.

[9]The number of receiving acquisition programs for ATDs that should have had funding was 6 instead of 11 because Aviation Applied Technology Directorate officials stated that, for five programs, only pieces of the Rotocraft Pilots Association technology were to transition.

Integrated Product Teams

DoD Instruction 5000.2, Operation of the Defense Acquisition System, (Including Change 1), January 4, 2001, requires that all S&T and acquisition programs establish IPTs. The DoD Instruction states that IPTs are a multifunctional team assembled around a product or services, and are responsible for advising the S&T project manager and acquisition program manager on cost, schedule, and performance of that product. Army acquisition procedures state that IPTs are a management technique that integrates all activities, from product concept through production and field support.

Integrated Product Teams Established. The establishment of IPTs was required for all the STOs and ATDs; however, despite guidance in the Handbook and the Guide, only 7 of 14 STOs established IPTs. All six ATDs that we reviewed had established IPTs. The Army S&T guidance does not require IPTs for STOs, but does require IPTs for ATDs.

Integrated Product Team Charters. In addition to the establishment of IPTs, the Handbook and Guide recommend that charters be established for the teams. The Handbook states that IPT charters provide the best way to minimize team misunderstanding. The Handbook and Guide provide that each charter should include:

- The mission and objectives of the team,
- The metrics to evaluate the team's progress,
- The scope of the team's responsibility,
- The relationship of the team with other teams,
- The authority and accountability of the team,
- The resources available for the team, and
- A team membership list.

For the seven STOs that established IPTs, three had approved charters, and four of the six ATDs had approved charters. The Army S&T guidance does not require the establishment of charters.

Acquisition Program Manager and Prime Contractor. One goal of the Army S&T Program is to transition technology to an acquisition program and, subsequently, to the warfighter. To transition technology faster, at reduced cost, and ensure interoperability with existing and future warfighting systems, the IPT should include the receiving S&T project manager and the receiving acquisition program manager's prime contractor, as appropriate. For the 7 STOs that established IPTs, 16 acquisition programs or S&T projects were identified as candidates to receive the technology. However, only 9 of the 16 acquisition programs or S&T project management offices and only 7 of the

16 prime contractors were members of IPTs. For the 6 ATDs that established IPTs, 11 acquisition programs or S&T projects were identified to receive the emerging technology. The 11 acquisition programs or S&T projects had 5 prime contractors participating (some programs had duplicate contractors). For the 6 ATDs, only 4 of 11 acquisition programs or S&T project management offices participated in the integrated teams. Also, only 5 prime contractors associated with the 11 acquisition programs were represented as members of the ATD integrated teams. The Army S&T guidance does not require the inclusion of acquisition program officials or their prime contractors in IPTs for STO or ATD efforts.

Role of Acquisition Program Managers

To improve the success of technology transitioning, acquisition program managers must make a firm commitment to transition the technology to their programs. The commitment should include a formal and up-to-date memorandum of agreement or understanding between the S&T project manager and the acquisition program manager(s). Each agreement or understanding should specify the relationship and the respective responsibilities of the S&T project manager and the receiving acquisition program manager. The agreement should address system requirements, funding, personnel support, exit criteria, and TRLs.

Memorandums of Agreement or Understanding. The 14 STOs identified 29 existing acquisition programs or S&T projects to which they could transition their technology. Formal memorandums of agreement or understanding between the STO managers and the receiving acquisition programs or S&T projects were available for only 3 of the 29 existing acquisition programs or S&T projects. The 6 ATDs identified 11 existing S&T projects or acquisition programs for technology transition; however, only 2 memorandums of agreements were established. Army guidance does not require memorandums of agreement or understanding.

Technology Readiness Levels. DoD adopted TRLs in response to a General Accounting Office Report, *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes*, issued in July 1999, and mandated within the Army S&T community in early 2000. The TRLs are an assessment of the technical maturity for an S&T project. The TRL ratings range from one through nine, with more mature S&T efforts having a higher TRL number and a lower risk for the acquisition program.

Although TRLs were established for all S&T projects, they were not negotiated and formally agreed upon with the acquisition program managers or other S&T project managers. For the 14 STOs, 26 candidate acquisition programs or S&T projects to receive the emerging technology were identified. For the six ATDs, three acquisition programs or S&T projects were identified as potential receiving candidates. However, none of the 14 STO projects or the 6 ATDs established formal agreements with the receiving candidates on the TRL that the technology would be developed to prior to transitioning. Army guidance does not require formal agreements on TRLs between the S&T project manager and

the receiving candidate. As part of the overall coordination process, the S&T project manager and the receiving candidate should be required to formally agree on the TRL to enhance technology transitioning.

Exit Criteria. The exit criteria establish goals for S&T projects and determine the entrance criteria for the technology that transitions. The S&T project manager and the acquisition program manager, in collaboration with the IPT, should develop exit criteria that are appropriate for transitioning the technology. Exit criteria are used to track progress in technical, schedule, and management-risk areas. The 14 STOs identified 29 candidate acquisition programs or S&T projects, and the 6 ATDs identified 11 candidate acquisition programs or S&T projects. However, only one STO and two ATDs formally coordinated the exit criteria with the acquisition program manager or S&T project managers.

Army guidance does not require S&T project managers to establish formal agreements with acquisition program managers or other recipient S&T efforts on TRLs or exit criteria. The Army should establish a requirement for formal agreements with all planned technology recipients for continued funding.

Funding By Acquisition User for Transition

The DoD and the Services' research, development, testing, and evaluation budget is divided into seven budget activities. The S&T community receives funding from only the first three budget activities: basic research, applied research, and advanced technology development. The acquisition community is funded with three of the last four budget activities: demonstration and validation, engineering and manufacturing development, and operational systems development. The last budget activity, management support, is directed toward support of installations or operations required for general research and development use. S&T projects are not funded from the budget activity fund appropriated for the acquisition community, and acquisition programs are not funded from the budget activity fund appropriated for the S&T community. The separation of research, development, testing, and evaluation funding between the S&T and acquisition communities and the shrinking of the research, development, testing, and evaluation budget makes coordination between the S&T project managers and acquisition program managers very critical. If STOs and ATDs are critical to future and existing weapon systems, and the technology is successfully demonstrated using coordinated exit criteria and TRLs, the acquisition community must set funds aside for transitioning.

This review identified that receiving acquisition program managers were not providing the funding necessary for technology to transition. The 14 STO and 6 ATD projects evaluated were all funded from the Advanced Technology Development budget, generally through the final demonstration of the technology. However, only 4 of the 20 candidate acquisition program managers for the 14 STOs and none of the 6 candidate acquisition program managers for the 5 ATDs that were scheduled to receive technology had set aside funding to continue development after the technology transitions (1 ATD had 2 acquisition program candidates).

Formal agreements between the S&T project manager and the acquisition program manager as a requirement for continued S&T funding may highlight projects that are not likely to transition because the acquisition program manager had not adequately budgeted for the technology transition. Without adequate funding for technology transitioning, the S&T community will not be able to determine whether continued investment in S&T project is beneficial.

Recent Initiatives and Changes

The DoD and the Army recognized that technology has not transitioned to the warfighter as desired. To enhance the prospects of technology transitioning, DoD proposed establishing formal technology transition agreements, and the Army established Director(s) positions within the program executive offices to enhance technology transitioning.

Technology Readiness (Transition) Agreements. The Deputy Under Secretary of Defense (Science and Technology) issued interim guidance on July 5, 2001, that proposed the use of a Technology Readiness (Transition) Agreement. The Agreement would represent agreements between the S&T project managers and the candidate acquisition program managers for the emerging technology. The S&T project manager would provide a description of the technology or capability, the status of the technology, the technology development strategy, key technical measures of the readiness to transition, and the project plan, including milestones in the Agreement. The Agreement would also require the acquisition program manager to provide a description of the acquisition program, the program technology needs, and an integration strategy for the new technology. The S&T project manager and the acquisition manager would sign the Agreement and review it periodically. The Deputy Under Secretary of Defense (Science and Technology) did not require the establishment of an Agreement, and its use is advisory.

Army Reorganization. On October 26, 2001, the Army Chief of Staff reorganized the program executive officer and the program manager structure. The action abolished the positions of the Deputies for System Acquisition, Aviation and Missile Command, the Tank-automotive and Armaments Command, and the Communications Electronics Command and realigned their functions and assigned projects and acquisition program managers to existing, reorganized, or newly created program executive offices. The reorganization established a Director for Science and Technology (Director) in each program executive office. The Directors will be responsible for transitioning projects to the acquisition community from the Army S&T community. The details of the reorganization had not been determined; however, the Directors will be responsible for management and oversight of selected advanced technology development funding allocated for S&T activities. The Assistant Secretary will determine the amount of S&T funding that the Directors for Research and Technology will receive.

Management General Comments to the Report and Audit Response

Management Comments. The Deputy Assistant Secretary (Research and Technology) (the Assistant Secretary) stated that the role of the S&T community is to provide near-term capability and far-term focus for the future. It is the responsibility of the S&T community to bring technology options to the table. Once the technology has shown an appropriate level of maturity, the S&T managers negotiate with acquisition program managers to identify appropriate transition points. When the acquisition program manager determines that the technology is needed and can meet the program schedule, the acquisition manager will seek transition funding.

The report does not address the primary role of all of S&T efforts, which is to deliver options to the warfighters so that they can choose the best approach available at the time needed. It is critical that the S&T community be allowed to do exploration prior to discovery . . . to look at problems with an open solution set, vice a pre-determined path. The ability to keep the options open is the main reason for not requiring transition funding for all S&T efforts. The Army has implemented recommendations from the General Accounting Office Report "Better Management of Technology Development can Improve Weapon Systems Outcomes." The General Accounting Office recognized that the S&T organization has the responsibility to mature technology to high TRLs, hence adoption of TRLs as a key indicator of maturity. The General Accounting Office report indicated that the DoD S&T community is responsible for producing generic rather than weapon-specific technologies. Its goal is to conduct research, develop technology, and farm those efforts for potential military applications. The S&T role is to show that the technology is feasible; however, transition is not the sole purpose. The purpose of STOs and ATDs is to focus on technologies needed by the warfighter. The S&T community will transition technology if the Army decides that it needs this capability and has funds for its acquisition.

The management comments also provided information on some technology transitions and coordination actions that have taken place since the audit. Management comments included actions taken to establish TTAs with acquisition program managers (Blackhawk, Chinook, Apache, and the Comanche program offices) receiving research from the Aviation and Missile Research, Development, and Engineering Center and represent roadmaps for technology consideration.

Audit Response. Both new and ongoing S&T efforts are spending limited advanced technology demonstration resources. Technologies should have a more defined path for transitioning with formal transitioning agreements with the acquisition community if the Army's goal of achieving the future Objective Force is to be met. DoD adopted TRLs in response to a General Accounting Office report and with the desire that the establishment of TRLs would represent an agreement between the S&T and acquisition communities. By establishing

coordination between the two communities, evolving technology in the S&T community would do more than provide options to the warfighter; it would provide the technology capabilities to the warfighter.

Recommendations, Management Comments, and Audit Response

A. We recommend that the Assistant Secretary of the Army for Acquisition, Logistics, and Technology, for advanced technology development efforts:

1. Require the establishment of integrated product teams that include representatives from the candidate acquisition program office(s) and the acquisition program office prime contractor(s), where appropriate.

Management Comments. The Assistant Secretary concurred and stated that the Army currently requires IPTs that involve acquisition and S&T managers for ATDs, but that it would be neither appropriate nor practical for each STO to have an IPT. STOs are programs of lesser maturity than ATDs and, even when successful, require further development before creation of an IPT and transition to acquisition would be appropriate.

Audit Response. Although management concurred, the comments are nonresponsive to the recommendation and conflict with the data in this report. As identified in the table in this report "Summary of Science and Technology Objectives (STOs) and Advanced Technology Demonstrations (ATDs) Examined," (page 8), all the ATDs had IPTs; however, only 4 of 11 acquisition managers were included in the IPTs for the ATDs. To enhance the involvement of the acquisition community in evolving technologies, the S&T managers should be required to establish IPTs that include the candidate acquisition program office(s) and their prime contractor(s). The Department of the Army Pamphlet 70-3, "Army Acquisition Procedures – Research, Development, and Acquisition," July 15, 1999, provides guidance in the management of S&T programs and the establishment of IPTs; however, the guidance is advisory and, as such, does not require the establishment of IPTs. The pamphlet states, "this pamphlet provides discretionary guidance on materiel acquisition management," and continues the advisory theme by stating, "the fundamental purpose of this version of Department of the Army Pamphlet 70-3 remains the same; provides advisory guidance on the materiel acquisition life cycle."

The Assistant Secretary stated that establishing IPTs for every STO would be neither appropriate nor practical. The Army makes a distinction between STOs and ATDs even though STOs and ATDs are both S&T projects using advanced technology development funds under the Research, Development, Test, and Evaluation appropriation. Additionally, STOs comprise 46 percent of the Army's advanced technology development budget for FY 2002 and have specific, measurable, major technological advancements to be achieved. Those advancements focus and stabilize advanced technology development efforts. Projects under this category have a direct relevance to identified military needs, and their development is used to demonstrate the general military use. As such,

early coordination with the potential recipient acquisition program is necessary to enhance the transition of the STO technology. The Army's review process requires the identification of weapon programs that STO technology would transition to as a requirement for STO approval and funding. Early coordination with potential acquisition recipients is emphasized not only in the Handbook and Guide, but also in the Defense Systems Management College course, "Technology Insertion in Defense Systems Acquisitions." The Handbook, the Guide, and the technology insertion course do not advocate lesser coordination for S&T efforts that use advanced technology development funds. The audit identified that half of the STOs examined had established IPTs, and that half of those IPTs included representatives from the acquisition community.

Accordingly, STOs should be consistently held to the same level of development coordination as the ATDs. We request that the Assistant Secretary of the Army for Acquisition, Logistics, and Technology reconsider his position on requiring the establishment of IPTs for ATDs and STOs and provide additional comments to the final report.

2. Require the establishment of formal agreements between the science and technology manager and the candidate acquisition program manager(s) for emerging technologies. The formal agreements should coordinate exit criteria, technology readiness levels, availability of transitioning funds, and estimated transitioning timeframes.

Management Comments. The Assistant Secretary concurred and stated that ATD management plans are approved for all ATDs and document exit criteria, TRLs, and estimated transition time frames. The signed ATD management plans serve as the MOA or MOU between the S&T community and the acquisition manager.

Audit Response. Although management concurred, the comments are nonresponsive and conflict with the data in this report. The audit examined ATD management plans and considered them in developing the audit results. The audit results for ATDs (page 8) contradict management's comments that formal agreements have been appropriately established. Management comments also exclude applicability to STOs. As presented in the audit response to Recommendation 1., formal agreements are needed for STOs as well as ATDs.

Further, the DoD has been placing greater emphasis on coordinating advanced technology demonstration-funded efforts to improve technology transitioning. The Deputy Under Secretary of Defense for Science and Technology, in a July 5, 2001, memorandum to the Military Departments and Defense agencies, recommended the development of TRLs and, unlike the Army, made no distinction between emerging technologies. Accordingly, we request that the Assistant Secretary of the Army for Acquisition, Logistics, and Technology reconsider his position and provide comments to the final report on the deficiencies identified in the report and on requiring formal agreements for all ongoing STOs as well as ATD efforts.

3. Require the establishment of formal memorandums of agreement or understanding and technology transition agreements between the science and technology manager and candidate acquisition program manager(s). The establishment of the formal agreements should be a requirement for continued research, development, test and evaluation funding.

Management Comments. The Assistant Secretary concurred and stated that Army's ATD management plans serve as formal MOAs/MOUs and as TTAs.

Audit Response. Although management comments concurred, the comments were not fully responsive to the recommendation. The comments excluded applicability to STOs. Therefore, we request the Assistant Secretary of the Army for Acquisition, Logistics, and Technology to provide comments to the final report that address applicability to STOs.

4. Require the participation of the program executive officer and the acquisition program manager in the Army science and technology annual review process. The program executive officer and acquisition program manager should review and formally comment on the feasibility of science and technology projects that are integrating and transitioning into acquisition programs.

Management Comments. The Assistant Secretary concurred and stated that action is underway to include the program executive officer in the Army Science and Technology Working Group that approves all STOs and ATDs.

Audit Response. Management comments were responsive to the recommendation.

5. Review the technology paths or plans for the 18 science and technology projects identified in this audit and discontinue any project that does not have formal acquisition program support.

Management Comments. The Assistant Secretary nonconcurred and stated that S&T examines the feasibility of technology to solve warfighter problems, and that only the most technically mature efforts in the advanced technology development program should be considered and planned for transitioning. The General Accounting Office criticized the Services for attempting transitions when technology was immature.

The Assistant Secretary stated that the nature of S&T in relation to acquisition has three phases; basic, applied, and advanced technology development. Basic research is discovery and understanding, trying to expand the knowledge. Basic research does not directly transition to acquisition. Applied research can be repeated, shows military utility, and can be further evaluated in the most mature technology environment-- advanced technology development. Advanced technology development has the highest probability of providing transitionable products. Within advanced technology development, the Army has three broad categories of activity; ATDs, STOs, and other advanced technology efforts (referred to by the Army as non-STOs). ATDs are the most complex efforts and have the closest link to acquisition programs. STOs are typically less

complex and their ability to transition is based upon Army funding priorities and warfighting requirements. Whether STOs transition or not, they remain valuable "proof" of technology concepts and capabilities. The remaining advanced technology efforts (non-STOs) are used to pursue higher risk technology and have a lower probability of transitioning.

Audit Response. Management comments were nonresponsive and do not address the intent of the recommendation. We understand the distinction between basic and applied research and we did not include S&T efforts in those early stages in this audit. We agree that immature technology should not transition and believe that strengthening coordination between the S&T and acquisition community, including formally agreeing to TRLs and exit criteria, would significantly reduce problems in this area.

The report of the Under Secretary of Defense for Acquisition, Technology, and Logistics to Congress, in June 2001, cited a key reason for difficult technology transitions was the need for collaboration among three diverse groups: the S&T researcher, the acquisition program manager, and the military user. The Under Secretary's report stated that effective transitions require the groups to work together as a team, which is frequently a difficult issue. Management comments ignore the results of this review summarized in "Summary of Science and Technology Objectives (STOs) and Advanced Technology Demonstrations (ATDs) Examined," (page 8) that improvements are needed for two members of this diverse group.

The Army requires advanced technology development efforts, ATDs, and STOs to identify transitioning plans or paths as described in the Army Science and Technology Review Process (page 4). The process requires technology project documentation including the Ten-Question Quad Chart that identifies the planned acquisition program for the emerging technology. This audit examined the coordination efforts from Army's Ten-Question Quad Chart between the S&T community and the identified acquisition program offices. With limited S&T financial resources, it would be prudent for management to align S&T efforts in areas that are more likely to result in a successful transitioning of the technology to the warfighter. The intent of the recommendation, based on the lack of coordination among two of the diverse groups, was to examine those efforts that do not have adequate coordination as recommended in the Handbook, the Guide, and Defense Systems Management College training. We believe that continued expenditure of advanced technology demonstration funds without the proper coordination for technology efforts is inappropriate and ignores lessons learned. Therefore, we request that the Assistant Secretary of the Army for Acquisition, Logistics, and Technology reconsider his position and provide additional comments to the final report.

B. Performance Assessments

The performance appraisal process was not effectively used as a management tool to assist in achieving DoD performance goals and the Army Materiel Command's corporate objective of transitioning technology quickly to the warfighter. This condition exists because the Centers did not incorporate performance goals necessary for successful technology transitioning into the S&T project managers' performance plans. As a result, the Army Materiel Command's Research, Development and Engineering Centers (Centers) were not fully applying the Deputy Under Secretary of Defense (Science and Technology) best practices and Army guidance on managing and coordinating the transition of technology.

Background

Deputy Under Secretary of Defense (Science and Technology). The Deputy Under Secretary of Defense (Science and Technology) issued a Handbook followed by a Guide to the Military Departments and Defense agencies concerning practices that he believes, if instituted, would assist in achieving the DoD goal for transitioning technology.

Addressing Affordability in Defense Science and Technology (S&T): A Handbook for S&T Managers. In October 1999, the DoD S&T Affordability Task Force issued a Handbook that stressed the importance of involving all candidate acquisition programs; that is, the acquisition program managers, in developing research. The Handbook emphasized that effective transitioning of technology should include establishing IPT groups, creating an IPT charter, identifying and agreeing to quantitative metrics and key exit criteria, developing formal transition plans, and developing memorandums of agreement or understanding. The Handbook stressed that, through the establishment of working groups and agreements with all candidate acquisition programs such as the receiving program office and the user, evolving technology has a better chance of transitioning.

The Handbook also stated that one of the keys to successful transitioning is implementing an S&T personnel assessment process that is based on transitioning and affordability, in addition to technical personal achievement and papers.

Technology Transition for Affordability: A Guide for S&T Program Managers. In April of 2001, the Deputy Under Secretary of Defense (Science & Technology) issued a Guide to provide S&T project managers with strategies for achieving technology transitioning. The Guide emphasized the importance of teaming with the customer; that is, the acquisition program manager. The Guide stated that, although S&T projects are viewed as pre-acquisition, S&T inclusion in the new acquisition policy (DoD Instruction 5000 and DoD 5000.2-R) should serve to focus resources on improving transitioning. The implementation of the new acquisition policy that includes S&T in the

acquisition process will yield increased connectivity, visibility, and communication among the S&T community, the acquisition community, and the user, all of which are important for effective transitioning.

Army Materiel Command's Strategic Plan. The Army Materiel Command (AMC) issued its strategic plan in July 2001. The AMC Strategic Plan identifies eight strategic goals as instrumental to the AMC and the Army's successful transformation outlined in the Army vision. To accomplish the 8 strategic goals, the AMC promulgated 14 objectives. Three of the AMC objectives include developing and implementing an AMC corporate S&T capability to integrate all organizations and disciplines in support of the Army transformation; developing and implementing processes to rapidly acquire and field the best technology to transform the force and enhance survivability, lethality, deployability and affordability; and developing and implementing a process to transition technology to materiel developers (acquisition program managers) in a timely manner. The AMC Strategic Plan provides a framework to build the AMC of the future and stresses that its success requires a total commitment from every leader, manager, and associate. The AMC Strategic Plan also requires each AMC element to develop a corresponding plan with goals, objectives, and metrics that are closely aligned to the framework of the AMC Strategic Plan.

Project Manager Performance Plans

Major Subordinate Commands and Personal Performance Objectives. On September 12, 2001, the Commander, AMC, issued a memorandum reiterating that major subordinate commands are required to prepare their Strategic Plans and Command Objectives in consonance with the AMC Strategic Plan. The AMC memorandum also required that major subordinate commands link every senior leader's performance plan, down to the division level, to the objectives of the major subordinate commands.

The personal performance plans obtained for S&T project managers at the Armament Research, Development, and Engineering Center of the Army Tank-automotive and Armament Command; and the Aviation Applied Technology Directorate of the Army Aviation and Missile Command, did not include adequate S&T performance requirements necessary to enhance technology transitioning.

Armament Research, Development and Engineering Center. Examination of performance plans for S&T project managers identified that the managers are responsible for technical program management, engineering design and support, financial management, and training and security.

Technical program management responsibilities include planning, scheduling, and coordinating all major activities related to the S&T project; conducting

briefings on S&T tasks; attending and participating in meetings and conferences; overseeing test plan preparation; coordinating and witnessing tests; and conducting special projects or tasks involving planning, control, analysis, and execution.

Engineering design and support responsibilities include providing engineering support; providing guidance on follow-on design efforts; and preparing requirements to software contractors.

Financial management responsibilities include developing funding requirements and expenditure plans; reviewing funding performance; and maintaining expenditures within financial guidelines.

Training and security focused on obtaining training and being aware of and complying with security procedures.

None of the plans discussed performance requirements in relation to transitioning S&T projects to acquisition programs. The incorporation of this performance element in S&T project managers' performance appraisals would emphasize the importance of transitioning technology.

Aviation Applied Technology Directorate. The review of S&T project managers' performance plans at the Aviation Applied Technology Directorate showed that the technical personnel were responsible for project planning, project execution, professional development, and team leadership.

Project planning functions include planning realistic and executable schedules within budget constraints; identifying mission needs and deficiencies; coordinating efforts vertically and horizontally with other organizations; developing project plans, including need, technology feasibility, cost estimates; developing, evaluating, and negotiating contract work efforts, engineering specifications; and developing contract data requirements.

Project execution responsibilities include maintaining cognizance and responsibility for execution of assigned S&T projects so that technical cost and schedules are quantifiable and commensurate with project plans; identifying project perturbations and taking timely corrective actions; ensuring proper expenditure of funds; and satisfying customers (internal and external).

Professional development and team leadership include maintaining technical competence and cultivating professional and personal growth of team personnel.

The inclusion of project planning, project execution, professional development, and team leadership are all important performance elements for the S&T project managers. The inclusion of a performance element concerning technology transition would help highlight that proven technology must transition to the warfighter.

Performance Assessments. Although the S&T project managers' performance attributes identified at the Center and the Directorate are valuable in executing S&T projects, the S&T project managers are not required to establish and

maintain the necessary attributes for coordination and technology transitioning identified in the Deputy Under Secretary of Defense (Science and Technology) Handbook and Guide.

As identified, S&T project managers were not held accountable for establishing a process to enhance technology transitioning. The inclusion of the requirement in S&T project managers' performance plans to establish and maintain formal coordination with all candidate acquisition programs through establishing IPT groups, creating IPT charters, formalizing and maintaining up-to-date agreements with all candidate acquisition programs of quantitative metrics and key exit criteria, establishing formal transition plans, and developing memorandums of agreement or understanding would significantly assist technology transitioning.

The inclusion of those requirements would hold S&T project managers accountable for establishing a process to enhance transition and serve as a basis for assessing performance as required by Army Pamphlet 70-3. In addition, the performance assessment process would be a management tool at the S&T project manager level (as opposed to only at the division level) to assist in achieving the AMC Strategic Plan and the requirement of the AMC memorandum of September 12, 2001, by providing a link between performance assessments and technology transitioning.

Conclusion

The Department of the Army Pamphlet 70-3, "Army Acquisition Procedures," July 15, 1999, provides discretionary guidance on materiel acquisition management. The Pamphlet is relevant to research, development, and acquisition efforts. The Pamphlet defines technology transition after a validated need is approved and after the technologies critical to performance have been proved. The Pamphlet states that technology transitioning requires early coordination among the S&T project manager, the acquisition program manager, and the user. The Pamphlet provides that, prior to transitioning, the technology must be demonstrated, tested, and shown to be predictable; that there must be a clear military need for the capability; and that the technology introduction must be cost-effective. The Pamphlet states that an S&T project manager will be assigned to each technology project and that the timely accomplishment of the technology should be a basis for assessing the performance of the S&T project manager. Examination of S&T project managers performance plans showed that they do not adequately satisfy the intent of Army Pamphlet 70-3, and performance plans should explicitly require actions related to technology transitioning as a performance element.

Recommendation, Management Comments, and Audit Response

B. We recommend that the Commander, Army Materiel Command require that the personnel performance plans for managers responsible for advanced technology development-funded programs at its Research, Development and Engineering Centers explicitly require an assessment of managers' performance with planned technology users. The performance plans should include performance assessments for the establishment of integrated product teams with all planned technology users, creation of integrated product team charters, coordination and acceptance of quantitative metrics and key exit criteria with all planned users, development of transition plans that are formally agreed to by all planned users, and the development and maintenance of up-to-date memorandums of agreement or understanding with all planned users.

Management Comments. The Commander, Army Materiel Command did not provide comments to the draft report; however, the Assistant Secretary concurred with comment. The Assistant Secretary stated that the Department of the Army concurs with the philosophy of linking personnel performance to program performance. However, only the ATD managers should be held accountable for transition since the predominance of S&T is trying to demonstrate what is possible, and STO technology is too immature for transition. The Assistant Secretary stated that the Commander, Army Materiel Command is reviewing the recommended approach to require an assessment for ATD managers with other performance metrics, such as achieving TRLs.

Audit Response. We considered the Assistant Secretary's comments in preparing the final report. We clarified the recommendation to address the need to include technology transitioning in performance plans for managers who are responsible for advanced technology development programs as opposed to basic and applied technologies.

The Assistant Secretary's comments were partially responsive. We believe that the policy of linking personnel performance to program performance should apply to STO managers as well as ATD managers. We see no distinction between ATD and the STO managers' responsibility in that the programs being managed are supported with advanced technology development funds. Linking technology transitioning to S&T managers' performance would assist in establishing a tone that the DoD is serious about enhancing the likelihood of providing advanced technologies to the warfighter. We request that the Commander, Army Materiel Command provide comments to this recommendation in the final report.

Appendix A. Scope and Methodology

Scope

We examined 20 S&T projects at the Army Tank-automotive and Armament Command, Armament Research, Development and Engineering Center and the Army Aviation and Missile Command, Aviation Applied Technology Directorate to evaluate the management process for transitioning successful technologies to the warfighter. The S&T projects examined at the two Army sites visited were funded with research, development, test, and evaluation appropriations for advanced technology development and had expenditures of $441.5 million and planned additional funding of $244.4 million.

We did not evaluate the technical merits of the S&T projects. We did not review the management control programs at the Army Tank-automotive and Armament Command, Armament Research, Development and Engineering Center or the Army Aviation and Missile Command, Aviation Applied Technology Directorate. We limited our management control review to the management procedures of transitioning technology from S&T projects to the acquisition program managers.

General Accounting Office High-Risk Area. The General Accounting Office has identified several high-risk areas in the DoD. This report provides coverage of the Weapon System Acquisition (DoD WEP SYS ACQ) high-risk area.

Methodology

We conducted interviews with S&T and acquisition program officials, and examined applicable key documentation. Key documentation reviewed included guidance advocated by the Deputy Under Secretary of Defense (Science and Technology); the Army Science and Technology Master Plan for 2001; the Ten-Question Quad Chart; integrated product team charters and meeting minutes; memorandums of understanding or agreement; acquisition program funding profiles; S&T management plans; technology transition paths or plans; the AMC Strategic Plan; the research, development, test, and evaluation budget item justification sheet (R-2 Exhibit); and performance plans for S&T project managers. We reviewed key documentation dated from April 1993 through October 2001. We also conducted interviews with S&T management officials at the Office of the Secretary of Defense and the Army.

We relied on computer-processed data without performing tests of general and application system controls to confirm the reliability of the database. We obtained a computerized listing of Army research, development, test, and evaluation appropriations for advanced technology development from the Office

of the Deputy Assistant Secretary of the Army for Research and Technology. We relied on the computerized listing to represent the known universe of S&T projects in our review of the management process. We validated the total funding on the computerized listing to the total funding of the Army research, development, test, and evaluation appropriations for advanced technology development. The S&T projects reviewed at the two sites visited were active S&T projects and correlated to the data in the computerized listing. Validating the computerized listing to the appropriations was deemed appropriate for this audit because the audit's objective was to examine the management process for transitioning technology, not the individual S&T projects, and further validation of the computerized listing would not change the conclusions in this report.

Audit Dates and Standards. We performed this program results audit from April 2001 through January 2002 in accordance with generally accepted government auditing standards.

Contacts During the Audit. We visited or contacted individuals and organizations within DoD. Further details are available on request.

Management Control Program Review

DoD Directive 5010.38 "Management Control (MC) Program," August 26, 1996, and DoD Instruction 5010.40, "Management Control (MC) Program Procedures," August 28, 1996, require DoD organizations to implement a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and evaluate the adequacy of the controls.

Scope of the Review of the Management Control Program. We evaluated the management control process to determine whether effective management procedures were established to transition successful S&T projects to acquisition program managers and, ultimately, to the warfighter.

Adequacy of Management Controls. The audit identified that the Army leadership created a comprehensive high-level management oversight process to approve and review proposed and ongoing technologies. However, the Army S&T oversight process does not require the involvement of program executive officers or individual acquisition program managers. The Army S&T oversight process also does not require the establishment of formal coordination documents with acquisition officials as a condition for approval of continued funding. The absence of acquisition officials and formal coordination documents in the oversight process is considered a material management control weakness, as discussed in the Finding section of this report. The recommendations for both findings, if implemented, will improve the transitioning of technology to the acquisition program manager and to the warfighter. A copy of the report will be provided to the senior Army official responsible for management controls.

Prior Coverage

During the last 5 years, the General Accounting Office issued two reports discussing the benefits of adequately managing the challenges of transitioning technologies to warfighters.

General Accounting Office

Report No. GAO-1-311, Defense Acquisition: Army Transformation Faces Weapon Systems Challenges, May 21, 2001

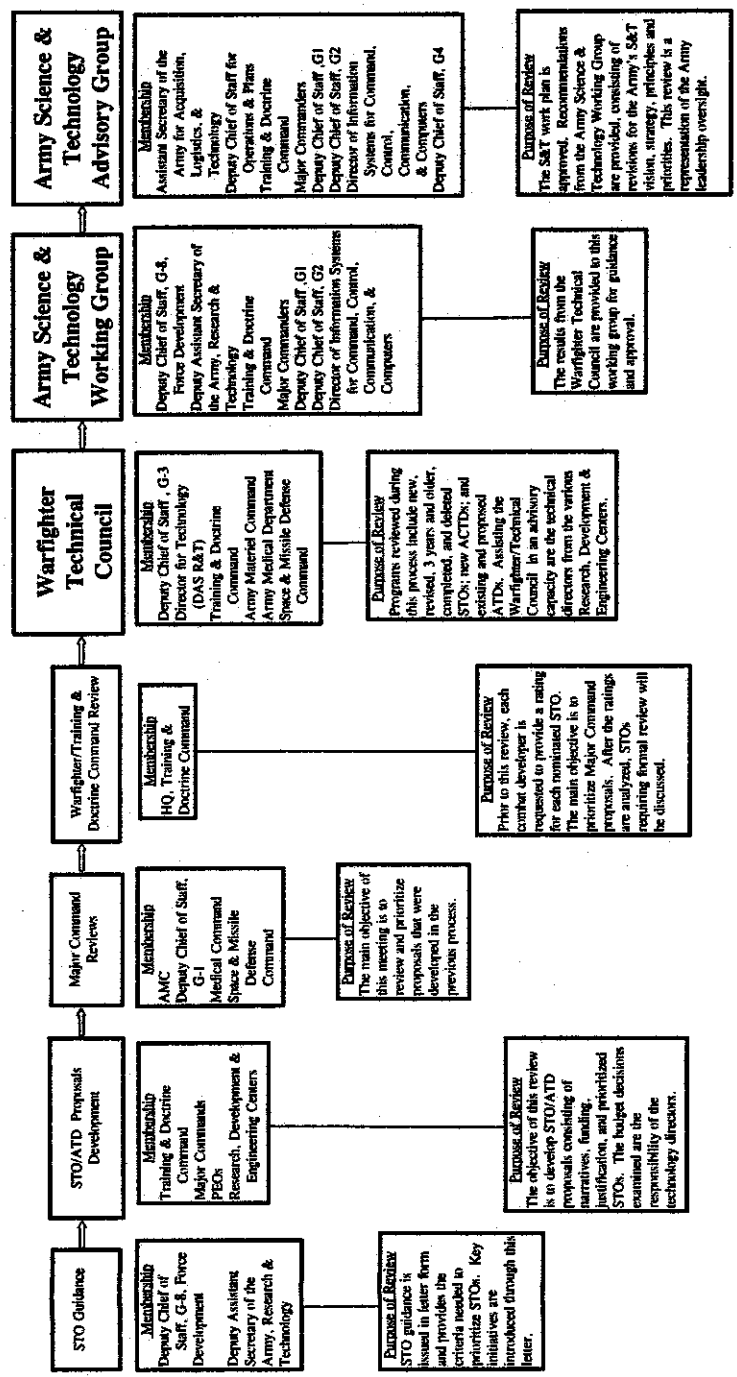
Report No. NSIAD-99-162, Best Practices: Better Management of Technology Development Can Improve System Outcomes, July 30, 1999

Appendix B. Technology Readiness Levels and Their Definitions

The following matrix lists the various technology readiness levels and provides a description of each as listed in Appendix 6 of DoD 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs," 10 June 2001.

Technology Readiness Level	Description
1. Basic principles observed and reported.	Lowest level of technology readiness. Scientific research begins to be translated into technology's basic properties.
2. Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
3. Analytical and experimental critical function and/or characteristic proof of concept.	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Component and/or breadboard validation in laboratory environment.	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.
5. Component and/or breadboard validation in relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in simulated environment. Examples include "high fidelity" laboratory integration of components.
6. System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond the breadboard tested for level 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in a simulated operational environment.
7. System prototype demonstration in an operational environment.	Prototype near or at planned operational system. Represents a major step up from level 6, requiring the demonstration of an actual system prototype in an operational environment. Examples include testing the prototype in a test bed aircraft.
8. Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this level represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine whether it meets design specifications.
9. Actual system proven through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.

Appendix C. Army Science and Technology Approval Process



Appendix D. Summary of Advanced Technology Development Projects Reviewed

Science and Technology Objectives

System	Receiving User	MOA/MOU[1] With User	Established an IPT[2]	IPT[2] Charter	IPT[2] Includes User	IPT[2] Includes Prime Contractor	Funding By Acquisition User to Transition	Receiving User Agreed to Exit Level TRL	Receiving User Agreed to Exit Criteria
Advanced-Light Armament for Combat Vehicles	Future Combat System	-[3]	Yes	No	-[3]	-[3]	-[4]	-[3]	-[3]
	Advanced Amphibious Assault Vehicle	No	Yes	Yes	Yes	No	-[5]	No	No
	PM-Tank and Medium-caliber Armanents System	No	Yes	Yes	Yes	No	-[5]	No	No
Advanced Rotocraft Transmission	PM-Blackhawk	No	Yes	No	No	No	No	No	No
	PM-Comanche	No	Yes	No	No	No	No	No	No
	PM-Apache	No	Yes	No	No	No	No	No	No
	Osprey	No	Yes	No	Yes	Yes	-[5]	No	No
	Rotorcraft Drive Systems for the 21st century	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]
Airborne Manned/ Unmanned System Technology	PM-Apache	No	No	No	No	No	No	No	No

Note: See footnotes at the end of the appendix.

System	Receiving User	MOA/MOU[1] With User	Established an IPT[2]	IPT[2] Charter	IPT[2] Includes User	IPT[2] Includes Prime Contractor	Funding By Acquisition User to Transition	Receiving User Agreed to Exit Level TRL	Receiving User Agreed to Exit Criteria
Area Denial System	Future Combat System	-[3]	Yes	No	-[3]	-[3]	-[4]	-[3]	-[3]
	RAPTOR	No	Yes	No	Yes	No	-[5]	No	No
	PM-Mines, Countermines, and Demolition	No	Yes	No	Yes	No	-[5]	No	No
Electro-Rheological Fluids	Multi-Role Armament and Ammunition System	No	No	No	-[4]	-[4]	-[4]	No	No
Extended Range Munition	PM-Tank and Medium-caliber Armaments System	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Helicopter Active Controls Technology	Variable Geometry Advanced Rotor Demo	-[3]	Yes	Yes[6]	-[3]	-[3]	-[3]	-[3]	-[3]
	PM-Chinook	No	Yes	Yes[6]	No	Yes	No	No	No
	PM-Blackhawk	No	Yes	Yes[6]	No	No	No	No	No
	PM-Longbow Apache	No	Yes	Yes[6]	No	Yes	No	No	No
Joint Turbine Advanced Gas Generator Phase III	Common Engine Program	Yes	Yes	No	Yes	Yes	Yes	No	No

Note: See footnotes at the end of the appendix.

System	Receiving User	MOA/MOU[1] With User	Established an IPT[2]	IPT[2] Charter	IPT[2] Includes User	IPT[2] Includes Prime Contractor	Funding By Acquisition User to Transition	Receiving User Agreed to Exit Level TRL	Receiving User Agreed to Exit Criteria
Light Weight Auto Howitzer TD[7]	PM-Towed Artilery Digitization	No	No	No	No	No	No	-[8]	No
Munition Survivability	Federal Supply System	No	No	No	No	No	No[9]	-[8]	No
	Munitions Survivability Software	No	No	No	No	No	No[10]	-[8]	No
Objective Individual Combat Weapon System Enhancements	PM Small Arms	No	No	No	No	No	Yes	No	No
	Objective Individual Combat Weapon	No	No	No	No	No	Yes	No	No
Rotorcraft Drive Systems for the 21st Century	PM-Blackhawk	No	No	No	No	No	No	No	No
	PM-Comanche	No	No	No	No	No	No	No	No
	Osprey	No	No	No	No	No	No	No	No
	Future Drives (Phase III)	-[3]	-[3]	-[3]	-[3]	-[3]	-[5]	-[3]	-[3]
	PM-Apache	No	-[3]	-[3]	No	No	No	No	No
Responsive Accurate Mission Module	Robotic Follower	No	No	No	No	No	No	No	No
	Forward Deployed Robotic Unit	No	No	No	No	No	No	No	No

Note: See footnotes at the end of the appendix.

System	Receiving User	MOA/MOU[1] With User	Established an IPT[2]	IPT[2] Charter	IPT[2] Includes User	IPT[2] Includes Prime Contractor	Funding By Acquisition User to Transition	Receiving User Agreed to Exit Level TRL	Receiving User Agreed to Exit Criteria
Rotary Wing Structures Technology	PM-Comanche	Yes	Yes	No	Yes	Yes	-[3]	No	No
	PM-Blackhawk	No	Yes	No	No	No	-[3]	No	No
	PM-Apache	No	Yes	No	Yes	Yes	-[3]	No	No

Note: See footnotes at the end of the appendix.

Advanced Technology Demonstrations

System	Receiving User	MOA/MOU[1] With User	Established an IPT[2]	IPT[2] Charter	IPT[2] Includes User	IPT[2] Includes Prime Contractor	Funding By Acquisition User to Transition	Receiving User Agreed to Exit Level TRL	Receiving User Agreed to Exit Criteria
Direct Fire Lethality	Future Combat Systems	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]
	Potential PM-Tank Medium-caliber Armament Systems	No	Yes	Yes	Yes	Yes	No	No	Yes
Multi-Role Armament and Ammunition System	Future Combat Systems	-[3]	Yes[11]	No[12]	-[3]	-[3]	-[4]	-[3]	-[3]
Objective Crew Served Weapon	PM Small Arms	Yes	Yes	Yes	Yes	Yes	No	No	Yes
	Future Combat Systems	-[3]	Yes	Yes	-[3]	-[3]	-[3]	-[3]	-[3]
Objective Individual Combat Weapon[7]	PM Small Arms	Yes	Yes	Yes	Yes	Yes	No	-[8]	No
Precision Guided Mortar Munition	PM Mortar	No	Yes	Yes	Yes	Yes	No	No	No

Note: See footnotes at the end of the appendix.

System	Receiving User	MOA/MOU[1] With User	Established an IPT[2]	IPT[2] Charter	IPT[2] Includes User	IPT[2] Includes Prime Contractor	Funding By Acquisition User to Transition	Receiving User Agreed to Exit Level TRL	Receiving User Agreed to Exit Criteria
Rotorcraft Pilot's Associate	Unmanned Combat Air Vehicle	No	Yes	No	No	No	-[13]	-[8]	No
	RAH-66 (Comanche)	No	Yes	No	No	No	No	-[8]	No
	AH-64D (Longbow Apache)	No	Yes	No	No	Yes	No	-[8]	No
	Army Airborne Command and Control System	No	Yes	No	No	No	-[13]	-[8]	No
	Virtual Cockpit Optimization Program	No	Yes	No	No	No	-[13]	-[8]	No
	Future Scout Cavalry System	No	Yes	No	No	No	-[13]	-[8]	No
	Airborne Manned Unmanned System Technology Demonstration ATD	No	Yes	No	No	No	-[13]	-[8]	No

[1] Memorandum of Agreement; Memorandum of Understanding
[2] Integrated Product Team
[3] Deemed not applicable because the system is transitioning to a receiver who has yet to be clearly defined or the technology is a manufacturing improvement process
[4] Adequate funding has yet to be established because this program is scheduled to transition to the Future Combat System.
[5] No documents were provided to verify this information.
[6] Contract Performance Plan.
[7] System was determined to transition to an acquisition customer.
[8] TRLs were not required prior to FY 2001 STO/ATD cycle.
[9] The fire-blocking blankets and water-filled barricades do not have funding to transition.
[10] STO management team transferred software algorithms that they developed to themselves as part of MSS 1.
[11] IPT establishment is between one STO manager to another STO manager.
[12] Document was outdated and/or not signed by the appropriate officials.
[13] Aviation Applied Technology Directorate officials stated that only pieces of the Rotorcraft Pilot's Associate technology transitioned; therefore, we did not determine whether acquisition programs had funding for the Rotorcraft Pilot's Associate.

Appendix E. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition, Technology, and Logistics
  Deputy Under Secretary of Defense for Science and Technology
Under Secretary of Defense (Comptroller/Chief Financial Officer)
  Deputy Chief Financial Officer
  Deputy Comptroller (Program/Budget)

Department of the Army

Assistant Secretary of the Army for Acquisition, Logistics, and Technology
Assistant Secretary of the Army (Financial Management and Comptroller)
Commander, Training and Doctrine Command
Deputy Chief of Staff for Programs
Commander, Army Materiel Command
  Commander, Tank-automotive and Armaments Command
    Armament Research and Development Engineering Center
  Commander, Aviation and Missile Command
    Director, Aviation Applied Technology Directorate
Project Executive Officer for Aviation
Project Executive Officer for Ground Combat and Support Systems
Auditor General, Department of the Army

Non-Defense Federal Organization

Office of Management and Budget

Congressional Committees and Subcommittees, Chairman and Ranking Minority Member

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Committee on Government Reform
House Subcommittee on Government Efficiency, Financial Management, and Intergovernmental Relations, Committee on Government Reform
House Subcommittee on National Security, Veterans Affairs, and International Relations, Committee on Government Reform
House Subcommittee on Technology and Procurement Policy, Committee on Government Reform

Department of the Army Comments

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
ACQUISITION LOGISTICS AND TECHNOLOGY
103 ARMY PENTAGON
WASHINGTON DC 20310-0103

REPLY TO
ATTENTION OF

23 MAY 2002

SAAL-ZT

MEMORANDUM FOR OFFICE OF THE INSPECTOR GENERAL, DOD

SUBJECT: Audit AB-0105 (Project No. D2001-AB-0105) Transition of Advanced Technology Programs to Military Applications

The Army appreciates the opportunity to provide comments on the Department of Defense Inspector General's (IG's) report on the transition of advanced technology programs to military applications. The Army uses Army Regulation 70-1 (Research, Development and Acquisition, Army Acquisition and Policy) and the Army Pamphlet 70-3 (Research, Development and Acquisition, Army Acquisition Procedures) to establish science and technology program management procedures. These policies and procedures are consistent with OSD policy and guidance.

Recommendations:
A(1). Require the establishment of integrated product teams (IPTs) that include representatives from the candidate acquisition program office(s) and the acquisition prime contractors(s), where appropriate.
Concur. The Army already requires the creation of IPTs that involve both the acquisition and science and technology program managers for all Advanced Technology Demonstration (ATD) programs (16 in FY02). It is neither appropriate nor practical for each Science and Technology Objective (STO) (155 in FY02) to have an IPT. STO programs are of lesser maturity than ATDs and even when successful, require further development before the creation of an IPT and transition to acquisition would be appropriate.

A(2). Require the establishment of formal agreements between the science and technology managers and the candidate acquisition program manager(s) for emerging technologies. The formal agreements should coordinate exit criteria, technology readiness levels, and estimated transitioning timelines.
Concur. ATD management plans, which are approved by the Deputy Assistant Secretary for Research and Technology for all ATDs, document program exit criteria, Technology Readiness Levels (TRLs) and estimated technology transition time frames. The signed ATD management plans serve as Memoranda of Agreement (MOA) or Memoranda of Understanding (MOU) between the science and technology managers and the candidate acquisition program managers.

A(3). Require the establishment of formal memorandums of agreement or understanding and technology transition agreements between the science and

technology manager and candidate acquisition program manager(s). The establishment of the formal agreements should be a requirement for continued research, development, test and evaluation funding.
Concur. . The Army's ATD management plans serve as formal MOAs/MOUs and as Technology Transition Agreements.

A(4). Require the participation of the program executive officer and the acquisition program manager in the Army science and technology annual review process. The program executive officer and acquisition program manager should review and formally comment on the feasibility of science and technology projects that are integrating and transitioning into acquisition programs.
Concur. Action is underway this year to include PEOs in the Army Science and Technology Working Group (ASTWG), the 2-star body that approves all STOs and ATDs.

A(5). Review the technology paths or plans for the 18 science and technology projects identified in this audit and discontinue any projects that does not have formal acquisition program support.
Nonconcur. S&T by its nature examines the feasibility of technology to solve warfighter problems and as such not all efforts will be successful to have established transition paths to acquisition. Only the most technically mature efforts in the advanced technology development program – the Advanced Technology Demonstrations – should be considered and planned for transition to acquisition. There are numerous GAO reports that correctly criticize the Services for attempting transitions when technology is immature.

One needs to understand that the nature and role of science and technology in relation to acquisition. Science and technology examines potential technologies to fulfill warfighter needs, which may or may not have successful paths to acquisition but these investments produce gains through increased technology understanding. For FY03 approximately 15% of the budget requested program is for Basic Research. The nature of this work is discovery and understanding - trying to expand our knowledge base. Basic research does not directly transition to acquisition. Knowledge gained here can result in understanding of science to develop practical application approaches. As these approaches become feasible they are worked in the Applied Research Program, which encompasses another 40% of the annual science and technology budget. When laboratory applications of applied research can be repeated and show military utility to our warfighting customers, it can be further evaluated in the most mature technology environment, the Advanced Technology Development Program. Advanced technology development funding provides the remaining 45% of the annual science and technology budget. It is this investment in advanced technology development that has the highest probability of providing transitionable "products." Within these efforts there are three broad categories of activity: 1) advanced technology demonstrations, 2) science and technology objectives and 3) other advanced technology efforts. The ATDs are the most complex and mature S&T efforts with the closest linkage to acquisition

programs. The Army requires that ATD managers obtain a transition endorsement from the appropriate Title 10 Program Manager and the Army coordinates programming for needed transition funding within resource constraints. ATD managers are already held accountable to achieve their program's exit criteria, which include transition to acquisition. The STOs are typically less complex S&T efforts, and their ability to transition into acquisition is based upon Army funding priorities and warfighting requirements that would require fielding of these technologies. Whether transitioned into PM programs or not, these efforts remain valuable as "proofs" of technology and operational concepts that can provide advanced warfighting capabilities. The remaining advanced technology efforts are used to pursue higher risk technology. These technologies have a lower probability of success than ATD or STO efforts and therefore should not be programmed for transition to PMs. However, successful work in this area can lead to future ATD or STO programs that can provide an advance in technology to the PM.

B(1). We recommend that the Commander, Army Materiel Command, require that the personnel performance plans of science and technology project managers at its Research, Development and Engineering Centers explicitly require an assessment of managers' performance with planned technology users. The performance plans should include performance coordination assessments for the establishment of integrated product teams with all planned technology users, creation of integrated product team charters, coordination and acceptance of quantitative metrics and key exit criteria with all planned users, development of a formal transition plans that are formally agreed to by all planned users, and the development and maintenance of up-to-date memorandums of agreements or understanding with all planned users. **Concur with Comment.** Headquarters DA concurs with the philosophy of linking personnel performance to program performance. However, only the ATD Program Managers should be accountable for transition since the predominance of S&T is trying to demonstrate the art of the possible and is too immature for transition into acquisition. The Commander of the Army Materiel Command is reviewing the recommended approach to require an assessment of ATD program managers' performance with planned technology users. Other performance metrics, such as progress in achieving scheduled technology readiness levels as specified in the GAO Report entitled, "Better Management of Technology Development Can Improve Weapon Systems Outcomes," are being used to evaluate S&T personnel.

General Comments:

The role of the Science and Technology (S&T) community within the Army is to provide both a near term capability and a far-term focus for the future. It is the responsibility of the S&T community to "bring technology options to the table". Once the technology has shown an appropriate level of maturity, such as a proof-of-concept demonstration, S&T Program Managers (PMs) negotiate with acquisition Program Managers to identify appropriate transition points. When the acquisition Program Manager determines that a technology is needed to satisfy required capability and can meet the acquisition program schedule, then the acquisition

Program Manager will seek System Development and Demonstration transition funding (6.4).

The report does not mention or address the primary role of all of S&T efforts. This role is to deliver options to the warfighter so that they can choose the best approach available at the time that it is needed. It is critical that the S&T community be allowed to do exploration prior to discovery... to look at problems with an open solution set, vice a pre-determined path. The ability to keep the options open for as long as possible is a main reason for not requiring a 6.4 funding tail for all of the S&T efforts. The acquisition community does not have the resources to pursue all of the proposed options and a requirement for a funding tail for all S&T efforts would force a down-selection of technology too early in the development cycle. The Army has implemented recommendations from the GAO Report, "Better Management of Technology Development Can Improve Weapon Systems Outcomes," GAO/NSIAD-99-162, dated July 1999. In this report, the GAO recognized that a key factor to the successful management of technology was to make the S&T organization, rather than the program or product development manager, responsible to maturing technology to a high Technology Readiness Level (TRL), hence our adoption of TRLs as a key indicator of maturity. The GAO report also provides a good description of the role of S&T in general. The report indicates, "DOD's science and technology community is responsible for basic research, applied research, and advanced technology development to produce generic, rather than weapons-specific, technologies. Its goal is to conduct research, develop technology, and farm these efforts for potential military application; such as a weapons system...the S&T officials stated role is to show that technology is feasible through laboratory experiments and demonstration." It is understood that not all S&T programs will transition into an Army system. However, transition is not the sole purpose of the Service S&T programs. The purpose of STOs and ATDs are to focus on work needed by the warfighter. The S&T community will ultimately transition the technology when the Army decides that it needs the capability and has funds for its acquisition.

Actions Reported Subsequent to the IG Review:

Advanced Rotorcraft Transmission (ART): The Split Torque design developed under ART I has transitioned into the Comanche. ART II technologies are being transitioned into the RDS21 Tech Demo.

Airborne Manned/Unmanned Systems Technology (AMUST): AMUST Technology along with Rotorcraft Pilot's Associate are the two key technologies that will be demonstrated in the Hunter Stand-off Killer Team (HSKT) ACTD. The AMUST Baseline capability has been demonstrated on the AH-64 and is planned for integration into Lot #7 Apache Longbow (FY04-FY10). In addition, this technology will meet the Comanche timeline to transition to RAH-66 Block I upgrades (UAV Level 4 Control). The Comanche PM has endorsed this technology in the RAH-66 Technology Transition Agreement. Furthermore the AMUST technology has been identified by the PM for a Product improvement for the Army Airborne Command and Control System (A2C2S) Blackhawk.

Rotorcraft Pilot's Associate (RPA): RPA Technology has transitioned into the AMUST STO and the HSKT ACTD that will transition to the fleet as noted above. In addition, the RPA Technology has transitioned to the DARPA/Air Force Unmanned Combat Air Vehicle (UCAV) and the Army Airborne Command and Control System (A2C2S) Blackhawk.

Helicopter Active Controls Technology (HACT): PM Comanche has endorsed HACT and the timeline for transition to RAH-66 Block I upgrades in the RAH-66 Technology Transition Agreement.

Rotary Wing Structures Technology (RWST): The technology has transitioned directly into the Comanche. The Comanche PM is currently using the RWST demonstration component design as the baseline structural design for the lower forward fuselage of the Comanche. Furthermore the design methodologies and processes that are developed as a part of RWST will continue to be used by the prime manufacturer in all future product designs. The contractor is in the process of institutionalizing the design process and methodologies throughout the company, which will benefit both their military and commercial customers.

Rotor Drive System for the 21st Century (RDS-21): PM Comanche has endorsed RDS-21 in the RAH-66 Technology Transition Agreement. In addition, the technology will feed the development of the DARPA/ARMY Unmanned Combat Armed Rotorcraft (UCAR).

Precision Guided Mortar Munition (PGMM): PM Mortars has received FY02 Congressional funding for the Component Advanced Development program as part of PGMM and there is funding for SDD in the POM starting in FY04. PM Mortars has agreed to the ATD exit level TRLs.

Objective Individual Combat Weapon (OICW) System: PM Objective Individual Combat Weapon has endorsed the OICW Systems Enhancement STO and has concurred that the TRLs and the metrics as stated in the STO charts are the agreed upon program exit criteria.

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RISK MANAGEMENT GUIDE FOR DOD ACQUISITION

Fifth Edition

June 2002

Department of Defense
Defense Acquisition University

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RISK MANAGEMENT GUIDE

Acquisition reform has changed the way the Department of Defense (DoD) designs, develops, manufactures, and supports systems. Our technical, business, and management approach for acquiring and operating systems has, and continues to, evolve. For example, we no longer can rely on military specifications and standards to define and control how our developers design, build, and support our new systems. Today we use commercial hardware and software, promote open systems architecture, and encourage streamlining processes, just to name a few of the initiatives that affect the way we do business. At the same time, the Office of the Secretary of Defense (OSD) has reduced the level of oversight and review of programs and manufacturers' plants.

While the new acquisition model gives government program managers and their contractors broader control and more options than they have enjoyed in the past, it also exposes them to new risks. OSD recognizes that risk is inherent in any acquisition program and considers it essential that program managers take appropriate steps to manage and control risks.

This document is a product of a joint effort by the Under Secretary of Defense (Acquisition, Technology and Logistics (USD (AT&L)) staff and the Defense Acquisition University. It is based on the material developed by the DoD Risk Management Working Group. Material in this Guide is also reflected in the Risk Management Focus Area of the Program Management Community of Practice (PMCOP) (**http://www.pmcop.dau.mil**), and in the *Defense Acquisition Deskbook*, which can be accessed via the Acquisition Support Center Website (**http://center.dau.mil**).

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PREFACE

In 1996, the USD (AT&L) established a Risk Management Working Group composed of members of the Office of the Secretary of Defense (OSD) staff, representatives of the Military Services, and members of other DoD agencies involved in systems acquisition. This group reviewed pertinent DoD directives (DoDD) and regulations, examined how the Services managed risk, studied various examples of risk management by industry, and looked at DoD training and education activity in risk management. Other sources of information were the Software Engineering Institute Risk Initiative, the Open Systems Initiative, and the safety and cost estimating communities. The findings and results of the Working Group investigation were presented to the USD (AT&L) and are summarized below:

Following that guidance, Working Group members wrote the risk management portions of the *Defense Acquisition Deskbook*. The *Defense Acquisition Deskbook* is accessible from the DAU Acquisition Support Center (**http://center.dau.mil**).

Industries
• Focus of efforts is to get a product to market at a competitive price. • Industry has have either a structured or informal Risk Management process. • Evolutionary approaches help avoid or minimize risk. • Most approaches employ risk avoidance, early planning, continuous assessment, and problem-solving techniques. • Structured approaches, when they exist, are similar to DoD's approach to Risk Management. The Working Group concluded that industry has no magic formula for Risk Management.
The Military Services
• The Services differ in their approaches to Risk Management. • Each approach has its strengths but no one approach is comprehensive. • Consolidation of the strengths of each approach could foster better Risk Management in DoD. The Working Group recommended that the *Defense Acquisition Deskbook* contain a set of guidelines for sound risk management practices, and further, that it contain a set of risk management definitions that are comprehensive and useful by all the Components.
DoD Policy*
• The risk management policy contained in DoDD 5000.1 is not comprehensive. The Working Group recommended that DoDD 5000.1 be amended to include a more comprehensive set of risk management policies that focuses on: • The relationship between the Cost As an Independent Variable (CAIV) concept and Risk Management. • Requirement that risk management be prospective (forward looking). • Establishment of risk management as a primary management technique to be used by Program Managers (PMs).

***Note:** The DoD 5000 policy documents referred to in the 1996 Report have since been superseded by a new set of DoD 5000 policy documents issued in 2000–2002 time frame.

DoD Procedures
• Risk Management procedures in DoD 5000.2-R are inadequate to fully implement the risk management policy contained in DoDD 5000.1. Procedures are lacking regarding: – Scope of Risk Management – Purpose of Risk Management – Role of Milestone Decision Authorities – Risk Management's support of CAIV – Risk assessment during early acquisition phases. • Some key procedures may have been lost in transition from DoD 5000.2M to DoD 5000.2-R. The Working Group recommended that procedures in DoD 5000.2-R be expanded, using the *Defense Acquisition Deskbook* as the expansion means, in order to provide comprehensive guidance for the implementation of risk management policy.
DoD Risk Management Training
• Risk management training for the DoD Acquisition Corps needs to be updated and expanded, and Integrated Product Team (IPT) and Overarching IPT (OIPT) personnel need to be educated on the new and expanding role of risk management in DoD systems acquisition. • Risk Management knowledge level needs improvement. • Education is a key to obtaining the support of OIPTs and PMs. The Working Group recommended that the Defense Acquisition University (DAU) include training for Risk Management in all functional courses and develop a dedicated risk management course for acquisition corps personnel.

The Risk Management part of the *Defense Acquisition Deskbook* forms the basis for this *Guide*. The goal of the *Risk Management Guide* is to provide acquisition professionals and program management offices with a practical reference for dealing with system acquisition risks. It has also been designed to be used as an aid in DAU course offerings.

This *Guide* reflects the efforts of many people. Mr. Mark Schaeffer, former Deputy Director, Systems Engineering, who chaired the Risk Management Working Group, and Mr. Mike Zsak and Mr. Tom Parry, formerly from the AT&L Systems Engineering Support Office, were the original driving force behind the risk management initiative. Mr. Paul McMahon and Mr. Bill Bahnmaier from the DAU/DSMC faculty and Mr. Greg Caruth, Ms. Debbie Gonzalez, Ms. Frances Battle from the DAU Press; Ms. Patricia Bartlett from Bartlett Communications, and Mr. Norman Bull guided the composition of the *Guide*. Assistance was also provided by Mr. Jeff Turner of the DAU Publications Distribution Center. Special recognition goes to the Institute for Defense Analyses team composed of Mr. Louis Simpleman, Mr. Ken Evans, Mr. Jim Lloyd, Mr. Gerald Pike, and Mr. Richard Roemer, who compiled the data and wrote major portions of the text. Also special thanks to Ms. Margaret Adcock of the Navy Acquisition Reform Office for her detailed comments and support.

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1

INTRODUCTION

Risk has always been a concern in the acquisition of Department of Defense (DoD) systems. The acquisition process itself is designed, to a large degree, to allow risks to be controlled from conception to delivery of a system. Unfortunately, in the past, some Program Managers (PMs) and decision makers have viewed risk as something to be avoided. Any program that had risk was subject to intense review and oversight. This attitude has changed. DoD managers recognize that risk is inherent in any program and that it is necessary to analyze future program events to identify potential risks and take measures to handle them.

Risk management is concerned with the outcome of future events, whose exact outcome is unknown, and with how to deal with these uncertainties, i.e., a range of possible outcomes. In general, outcomes are categorized as favorable or unfavorable, and risk management is the art and science of planning, assessing, and handling future events to ensure favorable outcomes. The alternative to risk management is crisis management, a resource-intensive process that is normally constrained by a restricted set of available options.

1.1 PURPOSE AND SCOPE

This *Risk Management Guide* is designed to provide acquisition professionals and program management offices (PMOs) with a reference book for dealing with system acquisition risks. It is intended to be useful as an aid in classroom instruction and as a reference book for practical applications. Most of the material in this *Guide* is derived from the *Defense Acquisition Deskbook*. Readers should refer to Paragraph 2.5.2 of the *Defense Acquisition Deskbook* for any new risk management information that is disseminated between publishing of updated *Guide* editions.

1.2 ORGANIZATION OF THE GUIDE

The *Risk Management Guide* discusses risk and risk management, defines terms, and introduces basic risk management concepts (Chapter 2).

Chapter 3 examines risk management concepts relative to the DoD acquisition process. It illustrates how risk management is an integral part of program management, describes interaction with other acquisition processes, and identifies and discusses the various types of acquisition risks.

Chapter 4 discusses the implementation of a risk management program from the perspective of a PMO. This chapter focuses on practical application issues such as risk management program design options, PMO risk management organizations, and criteria for a risk management information system (MIS).

Chapter 5, the final chapter, describes a number of techniques that address the aspects (phases) of risk management, i.e., planning, assessment, handling, and monitoring.

This *Guide* is a source of background information and provides a starting point for a risk management program. None of the material is mandatory. PMs should tailor the approaches and techniques to fit their programs.

The *Risk Management Guide* also contains appendices that are intended to serve as reference material and examples, and provide backup detail for some of the concepts presented in the main portion of the *Guide*.

1.3 APPROACH TO RISK MANAGEMENT

Based on the DoD model contained in the *Defense Acquisition Deskbook* (described in Chapter 2), this *Guide* emphasizes a risk management approach that is disciplined, forward looking, and continuous.

In 1986, the Government Accounting Office (GAO), as part of an evaluation of DoD policies and procedures for technical risk assessments, developed a set of criteria as an approach to good risk assessments. These criteria, with slight modification, apply to all aspects of risk management and are encompassed in the *Guide's* approach. They are:

(1) **Planned Procedures.** Risk management is planned and systematic.

(2) **Prospective Assessment.** Potential future problems are considered, not just current problems.

(3) **Attention to Technical Risk.** There is explicit attention to technical risk.

(4) **Documentation.** All aspects of the risk management program are recorded and data maintained.

(5) **Continual Process.** Risk assessments are made throughout the acquisition process; handling activities are continually evaluated and changed if necessary; and critical risk areas are always monitored.

While these criteria are not solely sufficient to determine the "health" of a program, they are important indicators of how well a risk management process is being implemented. A proactive risk management process is a good start toward a successful program.

1.4 DOD RISK MANAGEMENT POLICIES AND PROCEDURES

DoD policies and procedures that address risk management for acquisition programs are contained in five key DoD documents. DoD Directive (DoDD) 5000.1 (*The Defense Acquisition System*) contains overall acquisition policy—with a strong basis in risk management. The policy on risk management is amplified further by the information in DoD Instruction (DoDI) 5000.2 (*Operation of the Defense Acquisition System*) and DoD 5000.2-R (*Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and the Major Automated Information System (MAIS) Acquisition Programs*). These documents integrate risk management into the acquisition process, describe the relationship between risk and various acquisition functions, and establish some reporting requirements. DoDD 5000.4 and DoD 5000.4-M address risk and cost analysis guidance as they apply to the Office of the Secretary of Defense. Appendix A is an extract of existing risk management policies and procedures from all of these documents.

The DoD 5000 series contains strong statements on risk management but requires elaboration to

help the PM establish an effective risk management program. The information furnished in the Risk Management section of the *Defense Acquisition Deskbook* supports and expands the contents of the DoD 5000 series.

The DoD risk management policies and procedures provide the basis for this *Guide*, which complements the *Defense Acquisition Deskbook* by elaborating on risk management concepts and by providing greater detail for applying techniques.

2

RISK AND RISK MANAGEMENT

2.1 INTRODUCTION

This Chapter introduces the concepts of risk and risk management by explaining the DoD risk-related definitions and by identifying the characteristics of acquisition risks. It also presents and discusses a structured concept for risk management and its five subordinate processes.

2.2 OVERVIEW

The DoD risk management concept is based on the principles that risk management must be forward-looking, structured, informative, and continuous. The key to successful risk management is early planning and aggressive execution. Good planning enables an organized, comprehensive, and iterative approach for identifying and assessing the risk and handling options necessary to refine a program acquisition strategy. To support these efforts, assessments should be performed as early as possible in the life cycle to ensure that critical technical, schedule, and cost risks are addressed with mitigation actions incorporated into program planning and budget projections.

PMs should update program risk assessments and tailor their management strategies accordingly. Early information gives them data that helps when writing a Request for Proposal and assists in Source Selection planning. As a program progresses, new information improves insight into risk areas, thereby allowing the development of effective handling strategies. The net result promotes executable programs.

Effective risk management requires involvement of the entire program team and also requires help from outside experts knowledgeable in critical risk areas (e.g., threat, technology, design, manufacturing, logistics, schedule, and cost). In addition, the risk management process should cover hardware, software, the human element, and integration issues. Outside experts may include representatives from the user, laboratories, contract management, test, logistics, and sustainment communities, and industry. Users, essential participants in program trade analyses, should be part of the assessment process so that an acceptable balance among cost, schedule, performance, and risk can be reached. A close relationship between the Government and industry, and later with the selected contractor(s), promotes an understanding of program risks and assists in developing and executing the management efforts.

Successful risk management programs generally have the following characteristics:

€ Feasible, stable, and well-understood user requirements and threat;

- A close relationship with user, industry, and other appropriate participants;

- A planned and structured risk management process, integral to the acquisition process;
- An acquisition strategy consistent with risk level and risk-handling strategies;
- Continual reassessment of program and associated risks;
- A defined set of success criteria for all cost, schedule, and performance elements, e.g., Acquisition Program Baseline (APB) thresholds;
- Metrics to monitor effectiveness of risk-handling strategies;
- Effective Test and Evaluation Program; and
- Formal documentation.

PMs should follow the guidelines below to ensure that a management program possesses the above characteristics.

- Assess program risks, using a structured process, and develop strategies to manage these risks throughout each acquisition phase.
- Identify early and intensively manage those design parameters that critically affect cost, capability, or readiness.
- Use technology demonstrations/modeling/simulation and aggressive prototyping to reduce risks.
- Use test and evaluation as a means of quantifying the results of the risk-handling process.
- Include industry and user participation in risk management.
- Use Developmental Test and Evaluation (DT&E) and early operational assessments when appropriate.
- Establish a series of "risk assessment reviews" to evaluate the effectiveness of risk handling against clearly defined success criteria.
- Establish the means and format to communicate risk information and to train participants in risk management.
- Prepare an assessment training package for members of the program office and others, as needed.
- Acquire approval of accepted risks at the appropriate decision level.

In general, management of software risk is the same as management of other types of risk and techniques that apply to hardware programs are equally applicable to software intensive programs. However, some characteristics of software make this type of risk management different, primarily because it is difficult to:

- Identify software risk.
- Estimate the time and resources required to develop new software, resulting in potential risks in cost and schedule.
- Test software completely because of the number of paths that can be followed in the logic of the software.
- Develop new programs because of the rapid changes in information technology and an ever-increasing demand for quality software personnel.

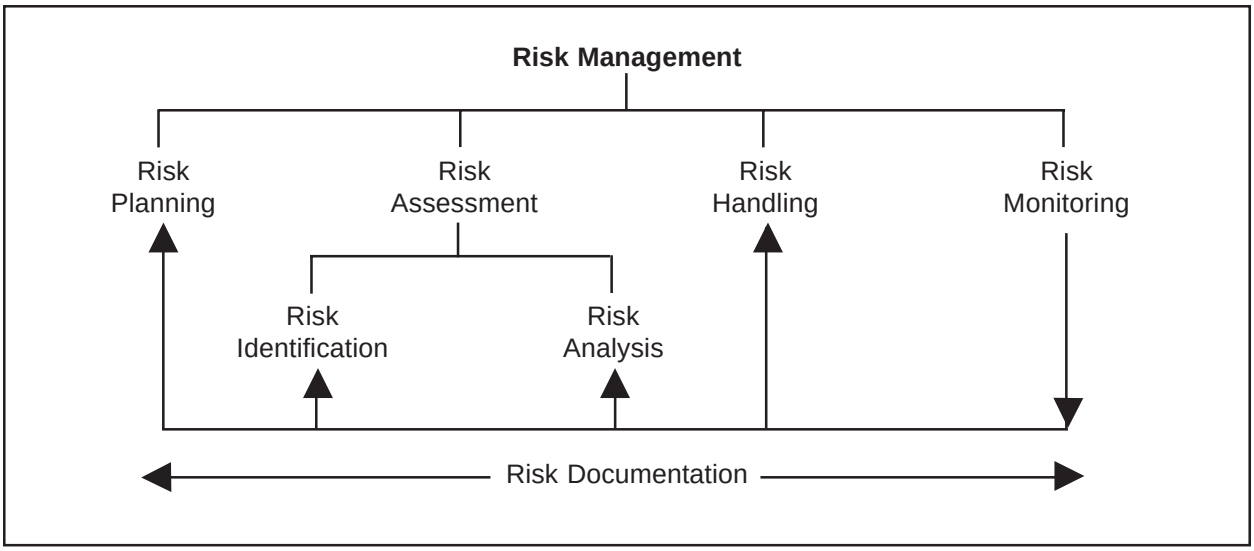

Figure 2-1. Risk Management Structure

2.3 RISK MANAGEMENT STRUCTURE AND DEFINITIONS

Although each risk management strategy depends upon the nature of the system being developed, research reveals that good strategies contain the same basic processes and structure shown in Figure 2-1. This structure is sometimes also referred to as the Risk Management Process Model. The application of these processes vary with acquisition phases and the degree of system definition; all should be integrated into the program management function. The elements of the structure are discussed in the following paragraphs of this Chapter; however, in order to form a basis for discussion, the *Defense Acquisition Deskbook* definitions for the processes and elements of risk management include:

Risk is a measure of the potential inability to achieve overall program objectives within defined cost, schedule, and technical constraints and has two components: (1) the *probability/likelihood* of failing to achieve a particular outcome, and (2) the *consequences/impacts* of failing to achieve that outcome.

Risk events, i.e., things that could go wrong for a program or system, are elements of an acquisition program that should be assessed to determine the level of risk. The events should be defined to a level that an individual can comprehend the potential impact and its causes. For example, a potential risk event for a turbine engine could be turbine blade vibration. There could be a series of potential risk events that should be selected, examined, and assessed by subject-matter experts.

The relationship between the two components of risk—probability and consequence/impact—is complex. To avoid obscuring the results of an assessment, the risk associated with an event should be characterized in terms of its two components. As part of the assessment there is also a need for backup documentation containing the supporting data and assessment rationale.

Risk management is the act or practice of dealing with risk. It includes planning for risk, assessing (identifying and analyzing) risk areas, developing risk-handling options, monitoring risks to determine how risks have changed, and documenting the overall risk management program.

Risk planning is the process of developing and documenting an organized, comprehensive, and interactive strategy and methods for identifying and tracking risk areas, developing risk-handling plans, performing continuous risk assessments to determine how risks have changed, and assigning adequate resources.

Risk assessment is the process of identifying and analyzing program areas and critical technical process risks to increase the probability/likelihood of meeting cost, schedule, and performance objectives. *Risk identification* is the process of examining the program areas and each critical technical process to identify and document the associated risk. *Risk analysis* is the process of examining each identified risk area or process to refine the description of the risk, isolating the cause, and determining the effects. It includes risk rating and prioritization in which risk events are defined in terms of their probability of occurrence, severity of consequence/impact, and relationship to other risk areas or processes.

Risk handling is the process that identifies, evaluates, selects, and implements options in order to set risk at acceptable levels given program constraints and objectives. This includes the specifics on what should be done, when it should be accomplished, who is responsible, and associated cost and schedule. The most appropriate strategy is selected from these handling options. For purposes of the *Guide*, risk handling is an all-encompassing term whereas risk mitigation is one subset of risk handling.

Risk monitoring is the process that systematically tracks and evaluates the performance of risk-handling actions against established metrics throughout the acquisition process and develops further risk-handling options, as appropriate. It feeds information back into the other risk management activities of planning, assessment, and handling as shown in Figure 2-1. This feedback mechanism was first suggested by Dr. Edmund Conrow in his book *Effective Risk Management: Some Keys to Success.*

Risk documentation is recording, maintaining, and reporting assessments, handling analysis and plans, and monitoring results. It includes all plans, reports for the PM and decision authorities, and reporting forms that may be internal to the PMO.

2.4 RISK DISCUSSION

Implicit in the definition of risk is the concept that risks are future events , i.e., potential problems, and that there is uncertainty associated with the program if these risk events occur. Therefore, there is a need to determine, as much as possible, the probability of a risk event occurring and to estimate the consequence/impact if it occurs. The combination of these two factors determines the level of risk. For example, an event with a low probability of occurring, yet with severe consequences/impacts, may be a candidate for handling. Conversely, an event with a high probability of happening, but the consequences/impacts of which do not affect a program, may be acceptable and require no handling.

To reduce uncertainty and apply the definition of risk to acquisition programs, PMs must be familiar with the types of acquisition risks, understand risk terminology, and know how to measure risk. These topics are addressed in the next several sections.

2.4.1 Characteristics of Acquisition Risk

Acquisition programs tend to have numerous, often interrelated, risks. They are not always obvious; relationships may be obscure; and they may exist at all program levels throughout the life of a program. Risks are in the PMO (program

plans, etc.); in support provided by other Government agencies; in threat assessment; and in prime contractor processes, engineering and manufacturing processes, and technology. The interrelationship among risk events may cause an increase in one because of the occurrence of another. For example, a slip in schedule for an early test event may adversely impact subsequent tests, assuming a fixed period of test time is available.

Another important risk characteristic is the time period before a risk future event occurs; because time is critical in determining risk-handling options. If an event is imminent, the PMO must resort to crisis management. An event that is far enough in the future to allow management actions may be controllable. The goal is to avoid the need to revert to crisis management and problem solving by managing risk up front.

An event's probability of occurrence and consequences/impacts may change as the development process proceeds and information becomes available. Therefore, throughout the development phase, PMOs should reevaluate known risks on a periodic basis and examine the program for new risks.

2.4.2 Program Products, Processes, Risk Areas, and Risk Events

Program risk includes all risk events and their relationships to each other. It is a top-level assessment of impact to the program when all risk events at the lower levels of the program are considered. Program risk may be a roll-up of all low-level events; however, most likely, it is a subjective evaluation of the known risks by the PMO, based on the judgment and experience of experts. Any roll-up of program risks must be carefully done to prevent key risk issues from "slipping through the cracks." Identifying program risk is essential because it forces the PMO to consider relationships among all risks and may identify potential areas of concern that would have otherwise been overlooked. One of the greatest strengths of a formal, continuous risk management process is the proactive quest to identify risk events for handling and the reduction of uncertainty that results from handling actions.

A program office has continuous demands on its time and resources. It is, at best, difficult, and probably impossible, to assess every potential area and process. To manage risk, the PMOs should focus on the critical areas that could affect the outcome of their programs. Work Breakdown Structure (WBS) product and process elements and industrial engineering and manufacturing processes contain most of the significant risk events. Risk events are determined by examining each WBS element and process in terms of sources or areas of risk. Broadly speaking, these sources generally can be grouped as cost, schedule, and performance, with the latter including technical risk. Following are some typical risk areas:

- **Threat**. The sensitivity of the program to uncertainty in the threat description, the degree to which the system design would have to change if the threat's parameters change, or the vulnerability of the program to foreign intelligence collection efforts (sensitivity to threat countermeasure).

- **Requirements**. The sensitivity of the program to uncertainty in the system description and requirements except for those caused by threat uncertainty.

- **Design**. The ability of the system configuration to achieve the program's engineering objectives based on the available technology, design tools, design maturity, etc.

- **Test and Evaluation (T&E)**. The adequacy and capability of the T&E program to assess

attainment of significant performance specifications and determine whether the systems are operationally effective and suitable.

- **Modeling and Simulation (M&S)**. The adequacy and capability of M&S to support all phases of a program using verified, valid, and accredited M&S tools.

- **Technology**. The degree to which the technology proposed for the program has been demonstrated as capable of meeting all of the program's objectives.

- **Logistics**. The ability of the system configuration to achieve the program's logistics objectives based on the system design, maintenance concept, support system design, and availability of support resources.

- **Production**. The ability of the system configuration to achieve the program's production objectives based on the system design, manufacturing processes chosen, and availability of manufacturing resources such as facilities and personnel.

- **Concurrency**. The sensitivity of the program to uncertainty resulting from the combining or overlapping of life-cycle phases or activities.

- **Capability of Developer**. The ability of the developer to design, develop, and manufacture the system. The contractor should have the experience, resources, and knowledge to produce the system.

- **Cost/Funding**. The ability of the system to achieve the program's life-cycle cost objectives. This includes the effects of budget and affordability decisions and the effects of inherent errors in the cost estimating technique(s) used (given that the technical requirements were properly defined).

- **Management**. The degree in which program plans and strategies exist and are realistic and consistent. The Government's acquisition team should be qualified and sufficiently staffed to manage the program.

- **Schedule**. The adequacy of the time allocated for performing the defined tasks, e.g., developmental, production, etc. This factor includes the effects of programmatic schedule decisions, the inherent errors in the schedule estimating technique used, and external physical constraints.

Critical risk processes are the developer's engineering and production processes which, historically, have caused the most difficulty during the development and/or production phases of acquisition programs. These processes include, but are not limited to, **design, test, production, facilities, logistics, and management**. These processes are included in the critical risk areas and are addressed separately to emphasize that they focus on processes. DoD 4245.7-M, *Transition from Development to Production*, describes them using templates. See Figure 2-2 for an example of the template for product development. The templates are the result of a Defense Science Board task force, composed of Government and industry experts, who identified engineering processes and control methods to minimize risk in both Government and industry. The task force defined these critical events in terms of the templates, which are briefly discussed later. A copy of DoD 4245.7-M may be obtained at the Defense Technical Information Center (DTIC) Website: **http://www.dtic.mil/whs/directives**.

Additional areas, such as manpower, environmental impact, systems safety and health, and systems engineering, that are analyzed during program plan development provide indicators for additional risk. The PMO should consider these areas for early assessment since failure

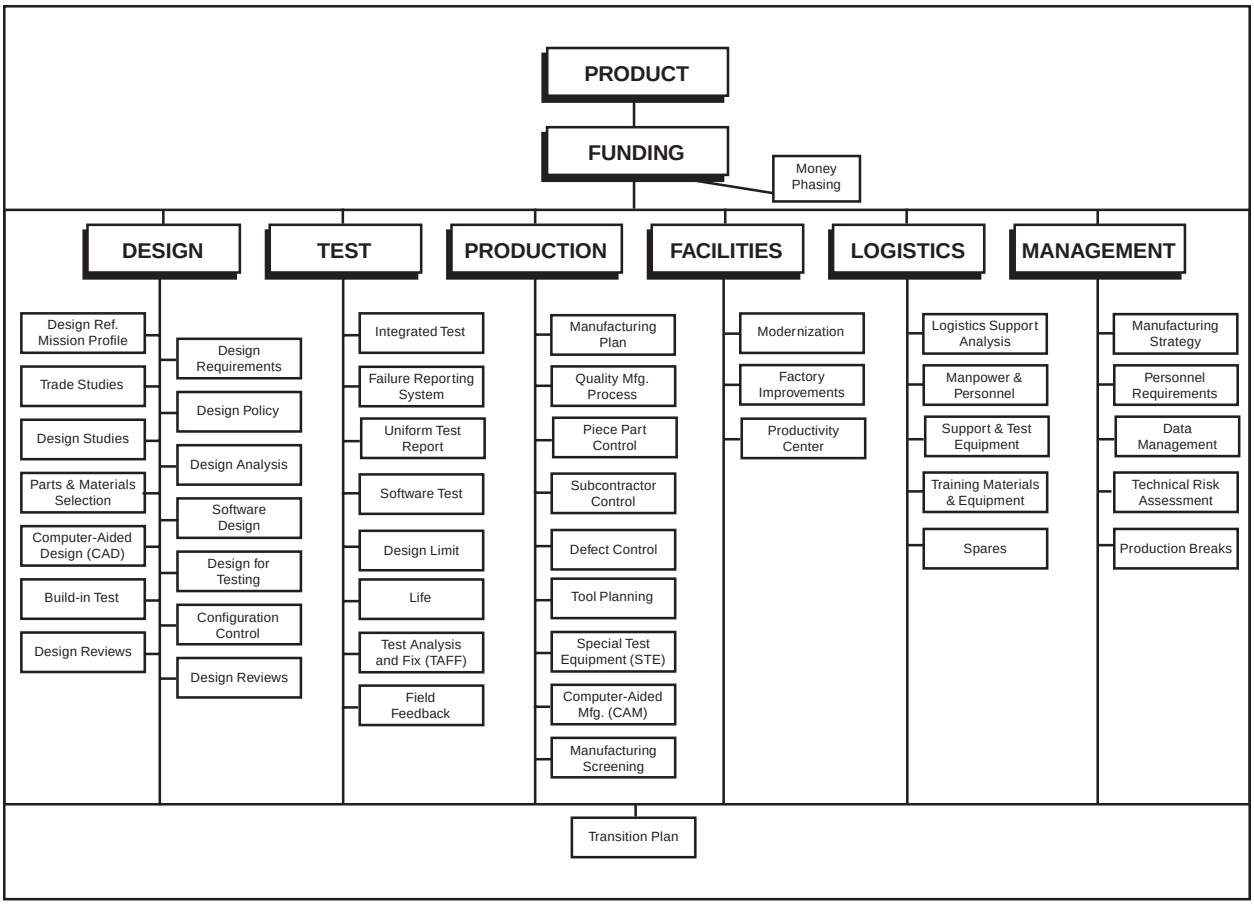

Figure 2-2. Critical Process Areas and Templates

to do so could cause dire consequences/impacts in the program's latter phases.

In addition, PMs should address the uncertainty associated with security—an area sometimes overlooked by developers but addressed in the Acquisition System Protection (ASP) section of the *Defense Acquisition Deskbook* and Air Force Pamphlet ASPWG PH-1, *Acquisition System Protection Program Work Book*, September 1994. However, in addition to the guidance given there, PMs must recognize that, in the past, classified programs have experienced difficulty in access, facilities, clearances, and visitor control. Failure to manage these aspects of a classified program could adversely affect cost and schedule.

2.5 RISK PLANNING

2.5.1 Purpose of Risk Plans

Risk planning is the detailed formulation of a program of action for the management of risk. It is the process to:

- Develop and document an organized, comprehensive, and interactive risk management strategy.
- Determine the methods to be used to execute a PM's risk management strategy.
- Plan for adequate resources.

Risk planning is iterative and includes describing and scheduling the activities and process to

assess (identify and analyze), handle, monitor, and document the risk associated with a program. The result is the Risk Management Plan (RMP).

2.5.2 Risk Planning Process

The PMO should periodically review the plan and revise it, if necessary. Some events such as: (1) a change in acquisition strategy, (2) preparation for a major decision point, (3) technical audits and reviews, (4) an update of other program plans, and (5) preparation for a Program Objective Memorandum (POM) submission may drive the need to update an existing plan.

Planning begins by developing and documenting a risk management strategy. Early efforts establish the purpose and objective, assign responsibilities for specific areas, identify additional technical expertise needed, describe the assessment process and areas to consider, delineate procedures for consideration of handling options, define a risk rating scheme, dictate the reporting and documentation needs, and establish report requirements and monitoring metrics. This planning should also address evaluation of the capabilities of potential sources as well as early industry involvement and program.

The PM's strategy to manage risk provides the program team with direction and basis for planning. Initially formalized during a program's Concept Exploration Phase and updated for each subsequent program phase, the strategy should be reflected in the program's acquisition strategy, which with requirement and threat documents, known risks, and system and program characteristics are sources of information for PMO use to devise a strategy and begin developing a Risk Management Plan. Since the program's risks are affected by the Government and contractor team's ability to develop and manufacture the system, industry can provide valuable insight into this area of consideration.

The plan is the road map that tells the Government and contractor team how to get from where the program is today to where the PM wants it to be in the future. The key to writing a good plan is to provide the necessary information so the program team knows the objectives, goals, and the PMO's risk management process. Since it is a map, it may be specific in some areas, such as the assignment of responsibilities for Government and contractor participants and

Introduction
Program Summary
Definitions
Risk Management Strategy and Approach
Organization
Risk Management Process and Procedures
Risk Planning
Risk Assessment
Risk Handling
Risk Monitoring
Risk Management Information System, Documentation and Reports

Figure 2-3. A Risk Management Plan Outline/Format

definitions, and general in other areas to allow users to choose the most efficient way to proceed. For example, a description of techniques that suggests several methods for evaluators to use to assess risk is appropriate, since every technique has advantages and disadvantages depending on the situation.

Appendix B contains two examples of a risk plan and a summary of the format is shown in Figure 2-3.

In a decentralized PMO risk management organization, the program's risk management coordinator may be responsible for risk management planning. See Sections 4.4, Risk Management Organization in the PMO, and 5.3, Risk Planning Techniques.

2.6 RISK ASSESSMENT

2.6.1 Purpose of Risk Assessments

The primary objective of assessments is to identify and analyze program risks so that the most critical among them may be controlled. Assessments are factors that managers should consider in setting cost, schedule, and performance objectives because they provide an indication of the probability/likelihood of achieving the desired outcomes.

2.6.2 Risk Assessment Process

Risk assessment is the *problem definition* stage of management that identifies and analyzes (quantifies) prospective program events in terms of probability and consequences/impacts. The results form the basis for most risk management actions. It is probably the most difficult and time-consuming part of the management process. There are no quick answers or shortcuts. Tools are available to assist evaluators in assessing risk, but none are totally suitable for any program and may be highly misleading if the user does not understand how to apply them or interpret the results. Despite its complexity, risk assessment is one of the most important phases of the risk process because the caliber and quality of assessments determine the effectiveness of a management program.

The components of assessment, identification and analysis, are performed sequentially with identification being the first step.

Risk identification begins by compiling the program's risk events. PMOs should examine and identify program events by reducing them to a level of detail that permits an evaluator to understand the significance of any risk and identify its causes, i.e., risk drivers. This is a practical way of addressing the large and diverse number of potential risks that often occur in acquisition programs. For example, a WBS level 4 or 5 element may generate several risk events associated with a specification or function, e.g., failure to meet turbine blade vibration requirements for an engine turbine design.

Risk events are best identified by examining each WBS product and process element in terms of the sources or areas of risk, as previously described in Paragraph 2.4.2.

Risks are those events that evaluators (after examining scenarios, WBS, or processes) determine would adversely affect the program. Evaluators may initially rank events by probability and consequence/impact of occurrence before beginning analysis to focus on those most critical.

Risk analysis is a technical and systematic process to examine identified risks, isolate causes, determine the relationship to other risks, and express the impact in terms of probability and consequences/impacts.

In practice, the distinction between risk identification and risk analysis is often blurred because there is some risk analysis that occurs during the identification process. For example, if, in the process of interviewing an expert, a risk is identified, it is logical to pursue information on the probability of it occurring, the consequences/impacts, the time associated with the risk (i.e., when it might occur), and possible ways of dealing with it. The latter actions are part of risk analysis and risk handling, but often begin during risk identification.

Prioritization is the ranking of risk events to determine the order of importance. It serves as the basis for risk-handling actions. Prioritization is part of risk analysis.

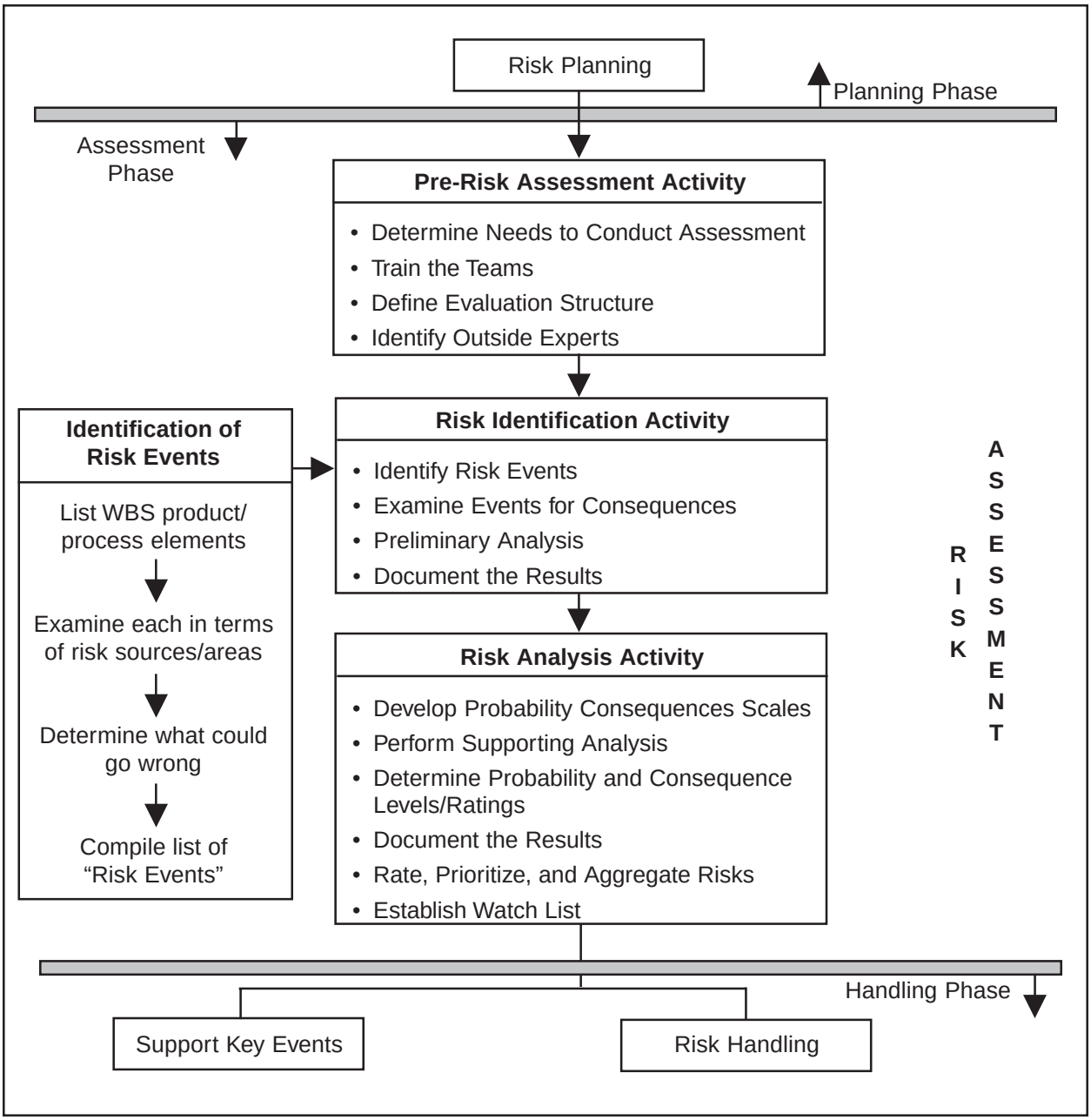

Figure 2-4. Risk Assessment

Integrated Product Teams (IPTs) typically perform risk assessments in a decentralized risk management organization as described in Paragraph 4.4. If necessary, the team may be augmented by people from other program areas or outside experts. Paragraph 5.4, Risk Assessment Techniques, elaborates on this for each of the described assessment techniques.

2.6.3 Timing of Risk Assessments

The assessment process begins during the last half of the Concept and Technology Development (CTD) Phase and continues throughout the subsequent acquisition phases. The PMO should continually reassess the program at increasing levels of detail as the program pro-gresses through the acquisition phases and more information becomes available. There are, however, times when events may require new assessments, i.e., a major change in the acquisition strategy. Paragraph 2.5.2 lists other events that could cause risk assessments to be performed.

2.6.4 Conducting Risk Assessments

There is no standard approach to assessing risk because methods vary according to the technique employed, the phase of the program, and the nature of the program itself; however, some top-level actions are typically common to all methods. They are grouped in Figure 2-4 into pre-risk assessment activities, risk identification activities, and risk analysis activities. Each risk category or area, e.g., cost, schedule, and performance, includes a core set of assessment tasks and is related to the other two categories. This relationship requires supportive analysis among areas to ensure the integration of the assessment process. For example, a technical assessment probably should include a cost and schedule analysis in determining the technical risk impact. The results of the assessments, normally conducted by IPTs follow:

Performance/Technical Assessment (Includes technical areas of risk shown in Paragraph 2.4.2.)

- Provides technical foundation,
- Identifies and describes program risks, i.e., threat, technology, design, manufacturing, etc.,
- Prioritizes risks with relative or quantified weight for program impact,
- Analyzes risks and relates them to other internal and external risks,
- Quantifies associated program activities with both time duration and resources,
- Quantifies inputs for schedule assessment and cost estimate,
- Documents technical basis and risk definition for the risk assessment.

Schedule Assessment

- Evaluates baseline schedule inputs,
- Incorporates technical assessment and schedule uncertainty inputs to program schedule model,
- Evaluates impacts to program schedule based on technical team assessment,
- Performs schedule analysis on program integrated master schedule,
- Quantifies schedule excursions reflecting effects of cost risks, including resource constraints,
- Provides Government schedule assessment for cost analysis and fiscal year planning,

- Reflects technical foundation, activity definition, and inputs from technical and cost areas,

- Documents schedule basis and risk impacts for the risk assessment.

Cost Estimate and Assessment

- Builds on technical and schedule assessment results,

- Translates technical and schedule risks into cost,

- Derives cost estimate by integrating technical risk and schedule risk impacts with resources,

- Establishes budgetary requirements consistent with fiscal year planning,

- Determines if the phasing of funds supports technical and acquisition approach,

- Provides program cost excursions from:
  – Near-term budget execution impacts,
  – External budget changes and constraints.

- Documents cost basis and risk impacts.

2.6.4.1 Pre-Risk Assessment Activities. The Risk Management Plan may describe the actions that compose this activity. Typically, a program-level IPT may conduct a quick-look assessment of the program to identify the need for technical experts (who are not part of the team) and to examine areas that appear most likely to contain risk. The program's risk coordinator, or an outside expert, may train the IPTs, focusing on the program's risk strategy, definitions, suggested techniques, documentation, and reporting requirements. Paragraph 4.9, Risk Management Training, provides some suggestions for training.

2.6.4.2 Risk Identification Activity. To identify risk events, IPTs should break down program elements to a level where they, or subject-matter experts, can perform valid assessments. The information necessary to do this varies according to the phase of the program. During the early phases, requirement, threat documents, and acquisition plans may be the only program-specific data available. They should be analyzed to identify events that may have adverse consequences/impacts. A useful

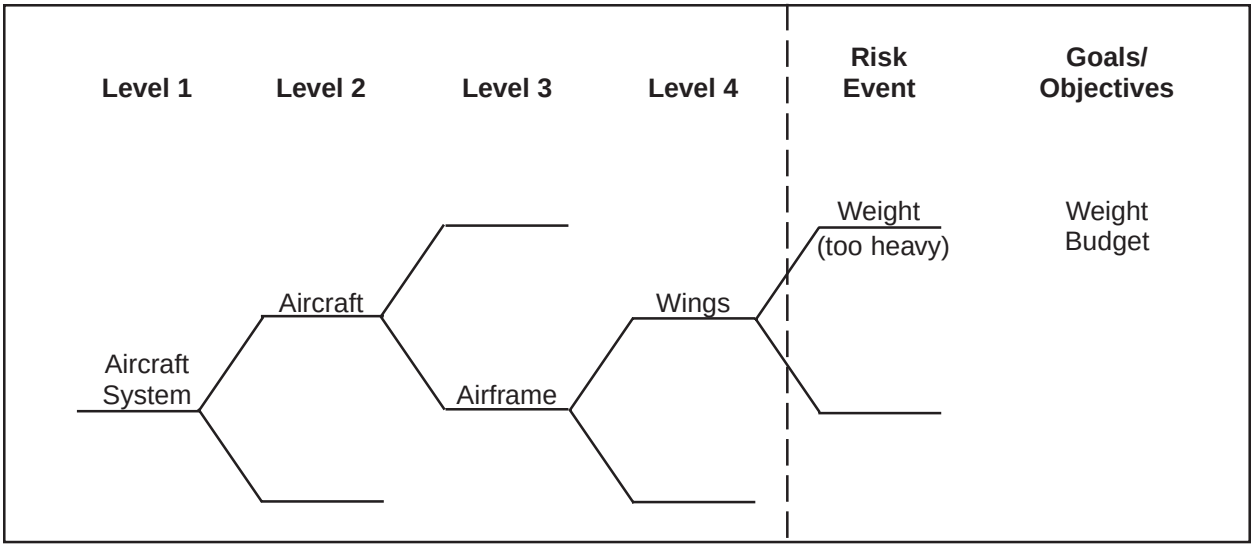

Figure 2-5. Example of a WBS Dependent Evaluation Structure

initial identification exercise is to perform a mission profile for the system as suggested in DoD 4245.7-M, *Transition from Development to Production.* Using this methodology, the developer creates a functional and environmental profile for the system and examines the low-level requirements that the system must meet to satisfy its mission requirements. The IPTs may then study these requirements to determine which are critical. For example, in an aircraft profile, it may be apparent that high speed is critical. If the speed requirement is close to that achieved by existing aircraft, this may not be a concern. However, if the speed is greater than that achieved by today's aircraft, it may be a critical risk area. Since aircraft speed depends, among other things, on weight and engine thrust, it would be desirable to enlist the help of a materials expert to address weight and an engine expert to assess engine-associated risk.

Another method of decomposition is to create a WBS as early as possible in a program. Figure 2-5 is a simple example of a decomposition based on the WBS for an aircraft. The figure shows an important requirement of the decomposition process, the establishment of goals (e.g., don't exceed the weight budget or objective). Risk events are determined by matching each WBS element and process to sources or areas of risk. Risk areas/sources are described in Paragraph 2.4.2 and Table 4-2.

During decomposition, risk events are identified from experience, brainstorming, lessons learned from similar programs, and guidance contained in the risk management plan. A structured approach previously discussed matches each WBS element and process in terms of sources or areas of risk. The examination of each element against each risk area is an exploratory exercise to identify the critical risks. The investigation may show that risks are interrelated. For example, the weight of an aircraft affects its speed, but also impacts the payload, range, and fuel requirements. These have design and logistics consequences/impacts and may even affect the number of aircraft that must be procured to meet objectives.

Critical risks need to be documented as specified in the Risk Management Plan and may include the scenario that causes the risk, planned management controls and actions, etc. It may also contain an initial assessment of the consequences/impacts to focus the risk assessment effort. A risk watch list should be initiated as part of risk identification. It is refined during handling, and monitored/updated during the monitoring phase. Watch lists provide a convenient and necessary form to track and document activities and actions resulting from risk analysis. Watch lists frequently evolve from the input of each "expert" functional manager on a program. (See paragraph 5.7.5.)

2.6.4.3 Risk Analysis Activity. Analysis begins with a detailed study of the critical risk events that have been identified. The objective is to gather enough information about the risks to judge the probability of occurrence and the impact on cost, schedule, and performance if the risk occurs.

Impact assessments are normally subjective and based on detailed information that may come from:

- Comparisons with similar systems,
- Relevant lessons-learned studies,
- Experience,
- Results from tests and prototype development,
- Data from engineering or other models,
- Specialist and expert judgments,

- Analysis of plans and related documents,
- Modeling and simulation,
- Sensitivity analysis of alternatives.

Depending on the particular technique and the risk being analyzed, some supporting analysis may be necessary, i.e., analysis of contractor processes, such as design, engineering, fault tree analysis, engineering models, simulation, etc. Analyses provide the basis for subjective assessments.

A critical aspect of risk analysis is data collection. Two primary sources of data are

Risk Assessment Technique	Applicable Acquisition Phases	Applicable Risk Areas & Processes
Plan Evaluation/Risk Identification	All phases	Program Plans and critical communications with the developer
Product (WBS) Risk Assessment	All phases starting with the completion of the Contract WBS	All critical risk areas except threat, requirements, cost, and schedule
Process (DoD 4265.7-M) Risk Assessment	All phases, but mainly late SDD	All critical risk processes
Cost Risk Assessment	All phases	Cost critical risk areas
Schedule Risk Assessment	All phases	Schedule critical risk areas

Table 2-1. Risk Assessment Approaches

Level	What is the Likelihood the Risk Event Will Happen?
a	Remote
b	Unlikely
c	Likely
d	Highly Likely
e	Near Certainty

Table 2-2. Probability/Likelihood Criteria (Example)

Level	Given the Risk Is Realized, What Is the Magnitude of the Impact?		
	Performance	Schedule	Cost
a	Minimal or no impact	Minimal or no impact	Minimal or no impact
b	Acceptable with some reduction in margin	Additional resources required; able to meet need dates	<5%
c	Acceptable with significant reduction in margin	Minor slip in key milestones; not able to meet need date	5-7%
d	Acceptable; no remaining margin	Major slip in key milestone or critical path impacted	7-10%
e	Unacceptable	Can't achieve key team or major program milestone	>10%

Table 2-3. Consequences/Impacts Criteria (Example)

Risk Rating	Description
High	Major disruption likely
Moderate	Some disruption
Low	Minimum disruption

Table 2-4. Overall Risk Rating Criteria (Example)

Priority	Area/Source Process	Location	Risk Event	Proba-bility	Conse-quence	Risk Rating
1	Design	WBS 3.1	Design not completed on time	Highly Likely	Can't achieve key milestone	High
2						
3						

Table 2-5. Risk Ratings (Example)

interviews of subject-matter experts and analogy comparisons with similar systems. Paragraph 5.4 contains a procedure for collecting both types of data for use in support of the techniques listed in Table 2-1. Periodically, sets of risks need to be prioritized in preparation for risk handling, and aggregated to support program management reviews. Paragraph 5.5, Risk Prioritization, describes methods for accomplishing this.

2.6.4.3.1 Risk Rating and Prioritization/ Ranking

Risk ratings are an indication of the potential impact of risks on a program; they are a measure of the probability/likelihood of an event occurring and the consequences/impacts of the event. They are often expressed as high, moderate, and low. Risk rating and prioritization/ ranking are considered integral parts of risk analysis.

A group of experts, who are familiar with each risk source/area (e.g., design, logistics, production, etc.) and product WBS element, are best qualified to determine risk ratings. They should identify rating criteria for review by the PMO, who includes them in the Risk Management Plan. In most cases, the criteria will be based on the experience of the experts, as opposed to mathematically derived, and should establish levels of probability/likelihood and consequences/ impacts that will provide a range of possibilities large enough to distinguish differences in risk ratings. At the program level, consequences/impacts should be expressed in terms of impact on cost, schedule and performance. Tables 2-2 and 2-3 are examples of probability/ likelihood and consequence/impact criteria, and Table 2-4 contains an example of overall risk rating criteria, which considers both probability/likelihood and consequences/ impacts. Table 2-5 provides a sample format for presenting risk ratings.

Using these risk ratings, PMs can identify events requiring priority management (high or moderate risk probability/likelihood or consequences/impacts). The document prioritizing the risk events is called a Watch List. Risk ratings also help to identify the areas that should be reported within and outside the PMO, e.g., milestone decision reviews. Thus, it is important that the ratings be portrayed as accurately as possible.

A simple method of representing the risk rating for risk events, i.e., a risk matrix, is shown in Figure 2-6. In this matrix, the PM has defined high, moderate, and low levels for the various combinations of probability/likelihood and consequences/impacts.

There is a common tendency to attempt to develop a single number to portray the risk associated with a particular event. This approach may be suitable if both probability/likelihood (probability) and consequences/impacts have been quantified using compatible cardinal scales or calibrated ordinal scales whose scale levels have been determined using accepted procedures (e.g., Analytical Hierarchy Process). In such a case, mathematical manipulation of the values may be meaningful and provide some quantitative basis for the ranking of risks.

In most cases, however, risk scales are actually just raw (uncalibrated) ordinal scales, reflecting only relative standing between scale levels and not actual numerical differences. Any mathematical operations performed on results from uncalibrated ordinal scales, or a combination of uncalibrated ordinal and cardinal scales, can provide information that will at best be misleading, if not completely meaningless, resulting in erroneous risk ratings. *Hence, mathematical operations should generally not be performed on scores derived from uncalibrated* ordinal *scales.* (Note: risk scales that are expressed as decimal values (e.g., a 5 level scale with values 0.2, 0.4, 0.6, 0.8 and 1.0) still retain the ordinal scale limitations discussed above.) For a more detailed discussion of risk scales, see Appendix G of the reference *Effective Risk Management: Some Keys to Success*.

One way to avoid this situation is to simply show each risk event's probability/likelihood and consequences/impacts separately, with no attempt to mathematically combine them. Other factors that may significantly contribute to the risk rating, such as time sensitivity or resource availability, can also be shown. The prioritization or ranking—done after the rating—should also be performed using a structured risk rating approach (e.g., Figure 2-6) coupled with expert opinion and experience. Prioritization or ranking is achieved through integration of risk events from lower to higher WBS levels. This means that the effect of risk at lower WBS elements needs to be reflected cumulatively at the top or system level.

2.7 RISK HANDLING

2.7.1 Purpose of Risk Handling

Risk handling includes specific methods and techniques to deal with known risks and a schedule for accomplishing tasks, identifies

Likelihood	a	b	c	d	e
e	L	M	H	H	H
d	L	M	M	H	H
c	L	M	M	M	H
b	L	L	L	M	M
a	L	L	L	L	M

Consequence

Figure 2-6. Overall Risk Rating (Example)

who is responsible for the risk area, and provides an estimate of the cost and schedule associated with handling the risk, if any. It involves planning and execution with the objective of handling risks at an acceptable level. The IPTs that assess risk should begin the process to identify and evaluate handling approaches to propose to the PM, who selects the appropriate ones for implementation.

2.7.2 Risk-Handling Process

The risk-handling phase must be compatible with the risk management plan and any additional guidance the PM provides. Paragraph 5.3 describes a technique that concentrates on planning. A critical part of planning involves refining and selecting of the most appropriate handling options.

The IPTs that evaluate the handling options may use the following criteria as a starting point for assessment:

- Can the option be feasibly implemented and still meet the user's needs?
- What is the expected effectiveness of the handling option in reducing program risk to an acceptable level?
- Is the option affordable in terms of dollars and other resources (e.g., use of critical materials, test facilities, etc.)?
- Is time available to develop and implement the option, and what effect does that have on the overall program schedule?
- What effect does the option have on the system's technical performance?

Risk-handling options can include risk control, risk avoidance, risk assumption, and risk transfer. An acronym used to identify these options is "CAAT". Although the control risk-handling option is commonly used in defense programs, it should not automatically be chosen. All four options should be evaluated and the best one chosen for a given risk issue.

Risk Control does not attempt to eliminate the source of the risk but seeks to reduce or mitigate the risks. It monitors and manages the risk in a manner that reduces the probability/likelihood and/or consequence/impact of its occurrence or minimizes the risk's effect on the program. This option may add to the cost of a program; however, the selected approach should provide an optional risk among the candidate approaches of risk reduction, cost effectiveness, and schedule impact. A sampling is listed below of the types of risk control actions available to the PMO. Paragraph 5.6.2 discusses them in more detail.

- **Multiple Development Efforts**. Create competing systems in parallel that meet the same performance requirements.
- **Alternative Design**. Create a backup design option that uses a lower risk approach.
- **Trade Studies.** Arrive at a balance of engineering requirements in the design of a system.
- **Early Prototyping**. Build and test prototypes early in the system development.
- **Incremental Development**. Design with the intent of upgrading system parts in the future.
- **Technology Maturation Efforts**. Normally, technology maturation is used when the desired technology will replace an existing technology which is available for use in the system.

- **Robust Design**. This approach, while it could be more costly, uses advanced design and manufacturing techniques that promote quality through design.

- **Reviews, Walk-throughs, and Inspections.** These three actions can be used to reduce the probability/likelihood and potential consequences/impacts of risks through timely assessment of actual or planned events.

- **Design of Experiments**. This engineering tool identifies critical design factors that are sensitive, therefore potentially high risk, to achieve a particular user requirement.

- **Open Systems.** Carefully selected commercial specifications and standards whose use can result in lower risks.

- **Use of Standard Items/Software Reuse.** Use of existing and proven hardware and software, where applicable, can substantially reduce risks.

- **Two-Phase Development.** Incorporation of formal risk reduction into System Development and Demonstration (SDD). The first part of SDD is System Integration (SI), where prototypes are developed and tested. In the second part, System Demonstration (SD), Engineering Development Models (EDMs) are developed and tested.

- **Use of Mock-ups**. The use of mock-ups, especially man-machine interface mock-ups, can be used to conduct early exploration of design options.

- **Modeling/Simulation**. Modeling and simulation can be used to investigate various design options and system requirement levels.

- **Key Parameter Control Boards**. The practice of establishing a control board for a parameter may be appropriate when a particular feature (such as system weight) is crucial to achieving the overall program requirements.

- **Manufacturing Screening**. For programs in SDD, various manufacturing screens (including environmental stress screening (ESS)) can be incorporated into test article production and low rate initial production (LRIP) to identify deficient manufacturing processes. ESS is a manufacturing process for stimulating parts and workmanship defects in electronic assemblies and units.

- **Test, Analyze, and Fix (TAAF)**. TAAF is the use of a period of dedicated testing to identify and correct deficiencies in a design.

- **Demonstration Events**. Demonstration events are points in the program (normally tests) that determine if risks are being successfully abated.

- **Process Proofing**. Similar to Program Metrics, but aimed at manufacturing and support processes which are critical to achieving system requirements. Proofing simulates actual production environments and conditions to insure repeatedly conforming hardware and software.

As you can see, there are numerous means that can be used to actively control risks.

Risk Avoidance involves a change in the concept, requirements, specifications, and/or practices that reduce risk to an acceptable level. Simply stated, it eliminates the sources of high or possibly medium risk and replaces them with a lower risk solution and may be supported by a cost/benefit analysis. Generally, this method may be done in parallel with the up-front requirements analysis, supported by

cost/requirement trade studies, which can include Cost As an Independent Variable (CAIV) trades.

Risk Assumption. Risk assumption is an acknowledgment of the existence of a particular risk situation and a conscious decision to accept the associated level of risk, without engaging in any special efforts to control it. However, a general cost and schedule reserve may be set aside to deal with any problems that may occur as a result of various risk assumption decisions. This method recognizes that not all identified program risks warrant special handling; as such, it is most suited for those situations that have been classified as low risk. The key to successful risk assumption is twofold:

- Identify the resources (time, money, people, etc.) needed to overcome a risk if it materializes. This includes identifying the specific management actions (such as retesting, additional time for further design activities) that may occur.

- Ensure that necessary administrative actions are taken to identify a management reserve to accomplish those management actions.

Risk-handling options have broad cost implications. The magnitude of these costs are circumstance-dependent. The approval and funding of handling options should be part of the process that establishes the program cost and performance goals. This should normally be done by the Program-Level Risk Management IPT or Risk Management Board. The selected handling option should be included in the program's acquisition strategy.

Once the acquisition strategy includes risk-handling approaches, the PMO can derive the schedule and identify cost, schedule, and performance, impacts to the basic program.

Risk Transfer. This action may reallocate risk during the concept development and design processes from one part of the system to another, thereby reducing the overall system risk, or redistributing risks between the Government and the prime contractor or within Government agencies; or between members of the contractor team. It is an integral part of the functional analysis process. Risk transfer is a form of risk sharing and not risk abrogation on the part of the Government, and it may influence cost objectives. An example is the transfer of a function from hardware implementation to software implementation or vice versa. The effectiveness of risk transfer depends on the use of successful system design techniques. Modularity and functional partitioning are two design techniques that support risk transfer. In some cases, risk transfer may concentrate risk areas in one area of the design. This allows management to focus attention and resources on that area.

2.8 RISK MONITORING

The monitoring process systematically tracks and evaluates the effectiveness of risk-handling actions against established metrics. Monitoring results may also provide a basis for developing additional handling options and identifying new risks. The key to the monitoring process is to establish a cost, schedule, and performance management indicator system over the entire program that the PM uses to evaluate the status of the program. The indicator system should be designed to provide early warning of potential problems to allow management actions. Risk monitoring is not a problem-solving technique, but rather, a proactive technique to observe the results of risk handling and identify new risks. Some monitoring techniques can be adapted to become part of a risk indicator system:

- **Test and Evaluation (T&E)**. A well-defined (T&E) program is a key element in monitoring

the performance of selected risk-handling options and developing new risk assessments.

- **Earned Value (EV)**. This uses standard DoD cost/schedule data to evaluate a program's cost and schedule performance in an integrated fashion. As such, it provides a basis to determine if risk-handling actions are achieving their forecasted results.

- **Technical Performance Measurement (TPM)**. TPM is a product design assessment which estimates, through engineering analysis and tests, the values of essential performance parameters of the current design as effected by risk-handling actions.

- **Program Metrics**. These are used for formal, periodic performance assessments of the various development processes, evaluating how well the system development process is achieving its objective. This technique can be used to monitor corrective actions that emerged from an assessment of the critical risk processes.

- **Schedule Performance Monitoring**. This is the use of program schedule data to evaluate how well the program is progressing to completion.

Paragraph 5.7 describes several monitoring techniques, e.g., earned value.

The indicator system and periodic reassessments of program risk should provide the PMO with the means to incorporate risk management into the overall program management structure.

2.9 RISK DOCUMENTATION

A primary criteria for successful management is formally documenting the ongoing risk management process. This is important because:

- It provides the basis for program assessments and updates as the program progresses.

- Formal documentation tends to ensure more comprehensive risk assessments than if it is not documented.

- It provides a basis for monitoring risk-handling actions and verifying the results.

- It provides program background material for new personnel.

- It is a management tool for the execution of the program.

- It provides the rationale for program decisions.

The documentation should be done by those responsible for planning, collecting, and analyzing data, i.e., IPT level in most cases.

Risk management reports vary depending on the size, nature, and phase of the program. Examples of some risk management documents and reports that may be useful to a PM are:

- Risk management plan,

- Risk information form,

- Risk assessment report,

- Prioritized list of risks,

- Risk handling plan,

- Aggregated risk list,

- Risk monitoring documentation:
  - Program metrics,
  - Technical reports,
  - Earned value reports,

– Watch list,
– Schedule performance report,
– Critical risk processes reports.

Most PMOs can devise a list of standard reports that will satisfy their needs most of the time; however, since there will always be a need for *ad hoc* reports, briefings, and assessments, it is advisable to store risk information in a management information system (MIS). This allows the creation of both standard and *ad hoc* reports, as needed. Paragraphs 4.8 and 5.8 discuss an MIS to support a risk management program.

Acquisition reform discourages Government oversight; therefore, formal contractor-produced risk documentation may not be available for most programs. However, program insight is encouraged, and PMOs can obtain information about program risk from contractor internal documentation such as:

- **Risk Management Policy and Procedures**. This is a description of the contractor's corporate policy for the management of risk. The procedures describe the methods for risk identification, analysis, handling, monitoring, and documentation. It should provide the baseline planning document for the contractor's approach to risk management.

- **Corporate Policy and Procedures Documents**. Corporations have policy and procedures documents that address the functional areas that are critical to the design, engineering, manufacture, test and evaluation, quality, configuration control, manufacture, etc., of a system. These documents are based on what the company perceives as best practices, and although they may not specifically address risk, deviation from these policies represents risk to a program. Internal company reports that address how well programs comply with policy may be required and will provide valuable information.

- **Risk Monitoring Report**. Contractors should have internal tracking metrics and reports for each moderate- or high-risk item. These metrics may be used to determine the status of risk reduction programs.

3

RISK MANAGEMENT AND THE DOD ACQUISITION PROCESS

3.1 INTRODUCTION

This Chapter discusses the relationship between risk and the acquisition process, describes how risk is considered in design of the Acquisition Plan, and expresses the need to consider risk as early in the program as possible. Appendix A is a summary of the risk management requirements that are contained in DoDD 5000.1, DoDI 5000.2, DoD 5000.2-R, DoD 5000.4, and DoD 5000.4-M.

3.2 OVERVIEW

The DoD acquisition process for the management of programs consists of a series of phases designed to reduce risk, ensure affordability, and provide adequate information for decision making. Acquisition officials are encouraged to tailor programs to eliminate phases or activities that result in little payoff in fielding time or cost savings. To effectively tailor a program, one needs to understand the risks present in the program and to develop a plan for managing these risks. DoD policy calls for the continual assessment of program risks, beginning with the initial phase of an acquisition program, and the development of management approaches before any decision is made to enter all subsequent phases.

The application of risk management processes (planning, assessment, identification, analysis, handling, and monitoring) is particularly important during Concept and Technology Development (CTD) Phase of any program, when alternatives are evaluated, program objectives are established, and the acquisition strategy is developed. All of these activities require acceptance of some level of risk and development of plans to manage the risk.

As a program evolves into subsequent phases, the nature of the risk management effort will change. New assessments will be built on previous ones. Risk areas will become more specific as the system is defined.

Risk management should also be an integral part of any Source Selection process, from request for proposal (RFP) preparation, through proposal evaluation, and after contract award. Throughout the program life, IPTs will play a key role in risk management activities.

3.3 DOD ACQUISITION PROCESS

The phases and milestones of the acquisition process provide a streamlined structure that emphasizes risk management and affordability. The phases are a logical means of progressively translating broadly-stated mission needs into well-defined system-specific requirements, and ultimately into operationally effective, suitable, and survivable systems. It is important to remember that the term “system” includes

hardware, software, and the human element. Each phase is designed, among other things, to manage risks. Milestones are points in time that allow decision makers to evaluate the program status and determine if the program should proceed to the next phase. The Milestone Decision Authority (MDA) and PM tailor milestones and phases so that each milestone decision point allows assessment of program status and the opportunity to review plans for the next phase and beyond. The MDA should explicitly address program risks and the adequacy of risk management planning during the milestone reviews and establish exit criteria for progression to the next phase.

The contract schedule normally allows time for milestone decisions before spending begins in subsequent phases and should also permit demonstration of the exit criteria in time to support the milestone review. There are exceptions to this—driven by funding availability and option award dates. However, the objective is to provide proper fiscal control without delaying the acquisition decisions or contracts while adequately considering risk.

The acquisition strategy defines the business and technical management approach to meet objectives within program constraints with a primary goal to minimize the time and cost of satisfying a valid need, consistent with common sense and sound business practices. A PM prepares a preliminary acquisition strategy at Milestone A (that includes CTD Phase activities that focus on identifying risk and handling options). Later, the PM updates the strategy to support each milestone decision by describing activities and events planned for the upcoming phase and relating the accomplishments of that phase to the program's overall, long-term objectives. The risk associated with a program will significantly influence the acquisition strategy.

3.4 CHARACTERISTICS OF THE ACQUISITION PROCESS

The acquisition process that has evolved can be characterized in terms of the following concepts that are particularly relevant to the management of risk in programs.

3.4.1 Integrated Product and Process Development (IPPD)

IPPD integrates all acquisition activities in order to optimize system development, production, and deployment. Key to the success of the IPPD concept are the IPTs, which are composed of qualified and empowered representatives from all appropriate functional disciplines who work together to identify and resolve issues. As such, IPTs are the foundation for organizing for risk management.

3.4.2 Continuous Risk Management

PMs should focus on risk management throughout the life of the program, not just in preparation for program and milestone reviews. Program risks should be continuously assessed, and the risk-handling approaches developed, executed, and monitored throughout the acquisition process. Both the Government and contractors must understand risks as a program progresses through the various phases and milestone decision points, and must modify the management strategy and plan accordingly. While specific government and contractors risk management processes may likely be different, it is important that each party have a common and complete set of process steps (regardless of their names), and be able to exchange and clearly understand the other party's risk management documentation.

3.4.3 Program Stability

Once a program is initiated, program stability is a top priority. Keys to creating program stability are realistic investment planning and affordability assessments. They must reflect an accurate and comprehensive understanding of existing or expected program risks. A risk management strategy must be developed early in the process, before actually initiating the program to ensure it is a stable one, recognizing that key issues affecting program stability may be external.

3.4.4 Reduction of Life-Cycle Costs

DoD considers the reduction of total cost to acquire and operate systems while maintaining a high level of performance for the user to be of highest priority. This is reflected, in part, through the introduction of the "Cost As an Independent Variable" (CAIV) concept. CAIV entails setting aggressive, realistic cost objectives early in an acquisition program and then managing all aspects of the program to achieve those objectives, while still meeting the user's performance and schedule needs. Inherent in the CAIV concept is the realization that risks must be understood, taken, and managed in order to achieve cost, schedule, and performance objectives. An understanding of risk is essential to setting realistic cost objectives. The PM and user representatives should identify risk and cost driving requirements during the generation of the Operational Requirement Document (ORD) in order to know where tradeoffs may be necessary.

3.4.5 Event-Oriented Management

Event-oriented management requires that decision makers base their decisions on significant events in the acquisition life cycle, rather than on arbitrary calendar dates. This management process emphasizes effective acquisition planning and embodies sound risk management. Decisions to proceed with a program should be based on demonstration of performance, through test and evaluation, and on verification that program risks are well-understood and are being managed effectively. Attainment of agreed-upon exit criteria is an indication that the PMO is managing risk effectively.

3.4.6 Modeling and Simulation

Properly used, models and simulations can reduce time, resources, and acquisition risk and may increase the quality of the systems being developed. Users of these models and simulations must have a good understanding of their capabilities and limitations and their applicability to the issues being addressed.

From a risk perspective, modeling and simulation may be used to develop alternative concepts during system design; predict performance in support of trade-off studies; evaluate system design and support preliminary design reviews during design development; predict system performance and supplement live tests during testing; examine the military value of the system; determine the impact of design changes; hone requirements; and develop life-cycle support requirements and assessments.

However, a key limitation through models and simulations is that the results are only as accurate and certain as the quality of the underlying relationships and input data. Blindly believing and using the output from models and simulations should never be done.

3.5 RISK MANAGEMENT ACTIVITIES DURING ACQUISITION PHASES

Risk management activities should be applied continuously throughout all acquisition process phases and in the technology opportunities and requirements activities that feed into the process.

However, because of the difference in available information, the level of application and detail will vary for technology opportunity activities and for each phase. For technological opportunity activities, DoD used three mechanisms to transition concepts and technology to user and acquisition customers: Advanced Technology Demonstrations (ATDs), Advanced Concept Technology Demonstrations (ACTDs), and Experiments. When assessing the risk of these mechanisms, descriptors called Technology Readiness Levels (TRLs) are used. TRLs provide consistent, uniform descriptions of technical maturity—across different types of technologies. Appendix 6 of DoD 5000.2-R (also see Appendix A, page A-11 of this *Guide*) contains guidance on use of TRLs.

In the CTD Phase, management focuses on assessing the risks in the alternative concepts available to satisfy users needs and on planning a strategy to address those risks. For each of the subsequent phases, all four risk management activities may be applied with increasing focus on risk handling and monitoring.

The PM identifies objectives, alternatives, and constraints at the beginning of each phase of a program and then evaluates alternatives, identifies sources of project risk, and selects a strategy for resolving the risks. The PMO updates the acquisition strategy, risk assessments, and other aspects of program planning, based on analyses, for the phase of the acquisition.

Developers should become involved in the risk management process at the beginning, when users define performance requirements, and continue during the acquisition process until the system is delivered. The early identification and assessment of critical risks allow PMs to formulate handling approaches and to streamline the program definition and the RFP around critical product and process risks.

The following paragraphs address risk management in the different phases in more detail.

3.5.1 Concept and Technology Development (CTD) Phase

DoDI 5000.2 describes the CTD Phase as normally consisting of studies that define and evaluate the feasibility of alternative concepts and provide the basis for the assessment of these alternatives in terms of their advantages, disadvantages, and risk levels at the Milestone (MS) B decision point. In addition to providing input to the Analysis of Alternatives, the PM develops a proposed acquisition program baseline (APB) and exit criteria for the System Integration (SI) part of the System Development and Demonstration (SDD) Phase.

The APB documents the most important performance, cost, and schedule objectives and thresholds for the selected concepts. The parameters selected are such that a re-evaluation of alternative concepts is appropriate if thresholds are not met. Exit criteria are events or accomplishments that allow managers to track progress in critical technical, cost, or schedule risk areas. They must be demonstrated to show that a program is on track.

In defining alternative concepts, PMs should pay particular attention to the threat and the user's requirements, which are normally stated in broad terms at this time. Risks can be introduced if the requirements are not stable, or if they are overly restrictive and contain specific technical solutions. Requirements can also be significant cost and schedule risk drivers if they require a level of performance that is difficult to achieve within the program budget and time constraints. Such drivers need to be identified as early in the program as possible.

The acquisition strategy should address the known risks for each alternative concept, and

the plans to handle them, including specific events intended to control the risks. Similarly, the T&E strategy should reflect how T&E, with the use of M&S, will be used to assess risk levels and identify new or suspected risk areas.

A risk management strategy, derived in concert with the acquisition strategy, should be developed during this phase and revised and updated continually throughout the program. This strategy should include risk management planning that clearly defines roles, responsibilities, authority, and documentation for program reviews, risk assessments, and risk monitoring.

3.5.2 Subsequent Phases

During subsequent phases, concepts, technological approaches, and/or design approaches (selected at the previous milestone decisions) are pursued to define the program and program risks. Selected alternative concepts continue to be analyzed, and the acquisition strategy, and the various strategies and plans derived from it, continue to be refined.

Risk management efforts in these phases focus on: understanding critical technology, manufacturing, and support risks, along with cost, schedule, and performance risks; and demonstrating that they are being controlled before moving to the next milestone. Note that the accuracy of cost, schedule, performance risk assessments should improve with each succeeding program phase (e.g., more info, better design documentation, etc.). Thus, particular attention should be placed on handling and monitoring activities. Planning and assessment should continue as new information becomes available and new risk events are identified.

During these phases, the risk management program should be carried out in an integrated Government-contractor framework to the extent possible, that allows the Government to manage program risks, with the contractor responsible to the PM for product and process risks and for maintaining design accountability. Both the Government and contractors need to understand the risks clearly, and jointly plan management efforts. In any event, risk management needs to be tailored to each program and contract type.

3.6 RISK MANAGEMENT AND MILESTONE DECISIONS

Before a milestone review, the PM should update risk assessments, explicitly addressing the risks in the critical areas, such as threat, requirements, technology, etc., and identify areas of moderate or high risk.

Each critical technical assessment should be supported by subsystems' risk assessments, which should be supported by design reviews, test results, and specific analyses.

The PM should present planned risk-handling actions for moderate- or high-risk areas at the milestone review to determine their adequacy and to ensure the efficient allocation of resources.

3.7 RISK MANAGEMENT AND THE ACQUISITION STRATEGY

In addition to providing the framework for program planning and execution, the acquisition strategy serves several purposes that are important to risk management:

- Provides a master schedule for research, development, test, production, deployment, and critical events in the acquisition cycle.

- Gives a master checklist of the important issues and alternatives that must be addressed.

- Assists in prioritizing and integrating functional requirements, evaluating alternatives, and providing a coordinated approach to

integrate diverse functional issues, leading to the accomplishment of program objectives.

- Documents the assumptions and guidelines that led to the initiation and direction of the program.

- Provides the basis for the development and execution of the various subordinate functional strategies and plans.

The strategy structure should ensure a sound program through the management of cost, schedule, and performance risk. A good acquisition strategy acknowledges and identifies program risks and forms the basis for implementing a forward-looking, rather than reactive, effective risk management effort.

Acquisition strategy should describe how risk is to be handled and identify which risks are to be shared with the contractor and which are to be retained by Government. The key concept here is that the Government shares the risk with the contractor, but does not transfer risk to the contractor. The PMO always has a responsibility to the system user to develop a capable system and can never absolve itself of that responsibility. Therefore, all program risks, whether primarily managed by the PMO or by the contractor, must be assessed and managed by the PMO.

Once the program office has determined how much of each risk is to be shared with the contractor, it should assess the total risk assumed by the developing contractor (including subcontractors). The Government should not require contractors to accept financial risks that are inconsistent with their ability to handle them. Financial risks are driven, in large measure, by the underlying technical and programmatic risks inherent in a program. The Government contracting officer should, therefore, select the proper type of contract based on an appropriate risk assessment, to ensure a clear relationship between the selected contract type and program risk. An example would be the use of cost-reimbursable-type contracts for development projects.

3.8 RISK MANAGEMENT AND CAIV

The intention of CAIV is to establish balance between cost, schedule, performance, and risk early in the acquisition process and to manage to a cost objective. CAIV requires that PMs establish aggressive cost objectives, defined to some degree by the maximum level of acceptable risk. Risks in achieving both performance and aggressive cost goals must be clearly recognized and actively managed through:

(1) continuing iteration of cost/performance/schedule/risk tradeoffs,

(2) identifying key performance and manufacturing process uncertainties, and

(3) demonstrating solutions before production.

Whereas DoD has traditionally managed performance risk, equal emphasis must be placed on managing cost and schedule risks. An underlying premise of CAIV is that if costs are too great, and there are ways to reduce them, then the user and developer may reduce performance requirements to meet cost objections. Cost control and effective risk management involve planning and scheduling events and demonstrations to verify solutions to cost, schedule, and performance risk issues.

User participation in the trade-off analysis is essential to attain a favorable balance between cost, schedule, performance, and risk. The PM and user representatives should identify risk and cost driving requirements during the generation of the ORD to know where tradeoffs may be

possible. Risk assessments are critical to the CAIV process since they provide users and developers with essential data to assist in the cost, schedule, performance, and risk trade decisions.

Cost for risk management is directly related to the level of risk and affects a program in two ways. First, costs are associated with specific handling activities, for example, a parallel development. Second, funds are needed to cover the known risks of the selected system approach (i.e., funds to cover cost uncertainty). PMs must include the anticipated expense of managing risk in their estimates of program costs. Decision makers must weigh these costs against the level of risk in reaching program funding decisions. CAIV requires that program funds support the level of accepted program risk and that risk management costs are included in setting cost objectives.

4

RISK MANAGEMENT AND PROGRAM MANAGEMENT

4.1 INTRODUCTION

Risk management as a program management responsibility can be a comprehensive and responsive management tool if it is properly organized and monitored at the PM level. A formalized risk management program should be well-planned and forward-looking by identifying, analyzing, and resolving potential problem areas before they occur, and by incorporating monitoring techniques that accurately portray the status of risks and the efforts to mitigate them. Introduction of risk management early in a program emphasizes its importance and encourages contractors and members of the Government team to consider risk in the daily management functions.

This Chapter addresses the relationship between risk management and program management and suggests methods of introducing risk management in a program, organizing for risk, and training.

4.2 OVERVIEW

A PMO should organize for risk management, using existing IPTs. The PM may also want to use contractors to support management efforts or have experts not involved with the program perform independent assessments.

To use risk management as a program management tool, the information resulting from each of the risk processes should be documented in a usable form and available to members of the Government/industry program team. This information will provide the basis for reporting risk and overall program information, both internally and externally. Managing collection and dissemination of risk information can be enhanced through the use of a Management Information System (MIS).

4.3 PROGRAM MANAGER AND RISK MANAGEMENT

All PMs are responsible for establishing and executing a risk management program that satisfies the policies contained in DoDD 5000.1. A PM must balance program-unique requirements or circumstances (e.g., size of the PMO staff) against the demands of proven risk management principles and practices. This section addresses these principles and practices and provides a basis for establishing a PMO's risk management organization and related procedures. The following guidelines define an approach to risk management.

4.3.1 Risk Management Is a Program Management Tool

Risk management should be integral to a program's overall management. PMs must take an active role in the process to ensure that their approach leads to a balanced use of program resources, reflects their overall management philosophy, and includes Government and contractors. Past DoD practices have generally treated risk management solely as a system engineering function, cost-estimating technique or possibly as an independent function distinct from other program functions. Today, risk management is recognized as a vital integrated program management tool that cuts across the entire acquisition program, addressing and interrelating cost, schedule, and performance risks. The goal is to make everyone involved in a program aware that risk should be a consideration in the design, development, and fielding of a system. It should not be treated as someone else's responsibility. Specific functional areas—such as system engineering—could be charged with implementing risk management, as long as they take the program management view towards it.

4.3.2 Risk Management Is a Formal Process

Formal risk management refers to a structured process whereby risks are *systematically* identified, analyzed, handled, and monitored. (A recommended structure is described in Section 2 of this *Guide*.) A structured risk management process, which is applied early, continuously, and rigorously, provides a disciplined environment for decision making and for the efficient use of program resources. Through a disciplined process PMs can uncover obscure and lower-level risks that collectively could pose a major risk.

The need for a formal risk management process arises from the nature of risk and the complexity of acquisition programs. The numerous risks in an acquisition program are often interrelated and obscure and change in the course of the development process. A formal approach is the only effective method to sort through numerous risk events, to identify the risks and their interrelationships, to pinpoint the truly critical ones, and to identify cost-effective ways to reduce those risks, consistent with overall program objectives.

A structured process can reduce the complexity of an acquisition program by defining an approach to assess, handle, monitor, and communicate program risk. The systematic identification, analysis, and mitigation of risks also offers a reliable way to ensure objectivity, that is, minimize unwarranted optimism, prejudice, ignorance, or self-interest. Further, structure reduces the impact of personnel turnover and provides a basis for training and consistency among all the functional areas of a program. A structured risk program may also promote teamwork and understanding and improves the quality of the risk products.

4.3.3 Risk Management Is Forward-Looking

Effective risk management is based on the premise that PMs must identify potential problems, referred to as risk events, long before they can occur and develop strategies that increase the probability/likelihood of a favorable outcome to these problems. Application of this philosophy occurs primarily by using analytical techniques that give forward-looking assessments.

Typically, the early identification of potential problems is concerned with two types of events. The first are relevant to the current or imminent acquisition phase of a program (intermediate-term), such as satisfying a technical exit criteria in time for the next milestone review.

The second are concerned with the future phase(s) of a program (long-term) such as potential risk events related to transitioning a system from development to production.

By analyzing critical events, certain risks can be determined. To do this, one should consider the range of potential outcomes and the factors that determine those outcomes. Through risk handling, a PM then develops approaches that minimize risk factors. Paragraph 5.6 of this *Guide* describes some handling approaches.

Choosing the proper risk-handling options requires that a balance be struck between the resources required to implement those options and their payoffs (both intermediate and long-term) and the resources realistically available.

4.3.4 Risk Management Is Integral to Integrated Product and Process Development (IPPD)

One of the tenets of IPPD is multidisciplinary teamwork through IPTs, which are an integral part of the defense acquisition oversight and review process. The Integrating IPT (IIPT) is a valuable resource to assist in developing a risk management plan and should be used accordingly. The PM should ensure that the requirements of the Overarching IPT (OIPT) are reflected in the plan.

Working with the OIPT, the PM can establish the type and frequency of risk management information that an OIPT requires, and refine management organization and procedures. This should be done during the initial OIPT meetings. OIPTs will most likely require information concerning:

- Known risks and their characteristics, e.g., probability of occurrence and consequences/ impacts,
- Planned risk-handling actions, funded and unfunded,
- Achievements in controlling risks at acceptable levels.

IIPTs and OIPTs may also require details on the PM's risk management program, access to the risk management plan, and the results of specific risk assessments. In addition, PMs may want to present selected information to IIPTs and OIPTs to help substantiate a position or recommendation, e.g., help support a budget request.

4.4 RISK MANAGEMENT ORGANIZATION IN THE PMO

The PM, after determining a preferred management approach, must organize the program office and establish outside relationships in order to manage risk. No particular organizational structure is superior; however, experience provides some insights into the development of effective risk management organizations. PMs should consider the following discussion in the context of their unique requirements and circumstances and apply those that are suitable to their specific needs.

4.4.1 Risk Management Organizational Structure

A major choice for each PM is whether to have a centralized or decentralized risk management organization. The PM may choose a centralized organizational structure until team members become familiar with both the program and the risk management process. In a centralized approach, the PM establishes a team that is responsible for all aspects of risk management. The team would write a plan, conduct assessments, evaluate risk-handling options, and monitor progress. Although this approach may be necessary early in a program, it tends to

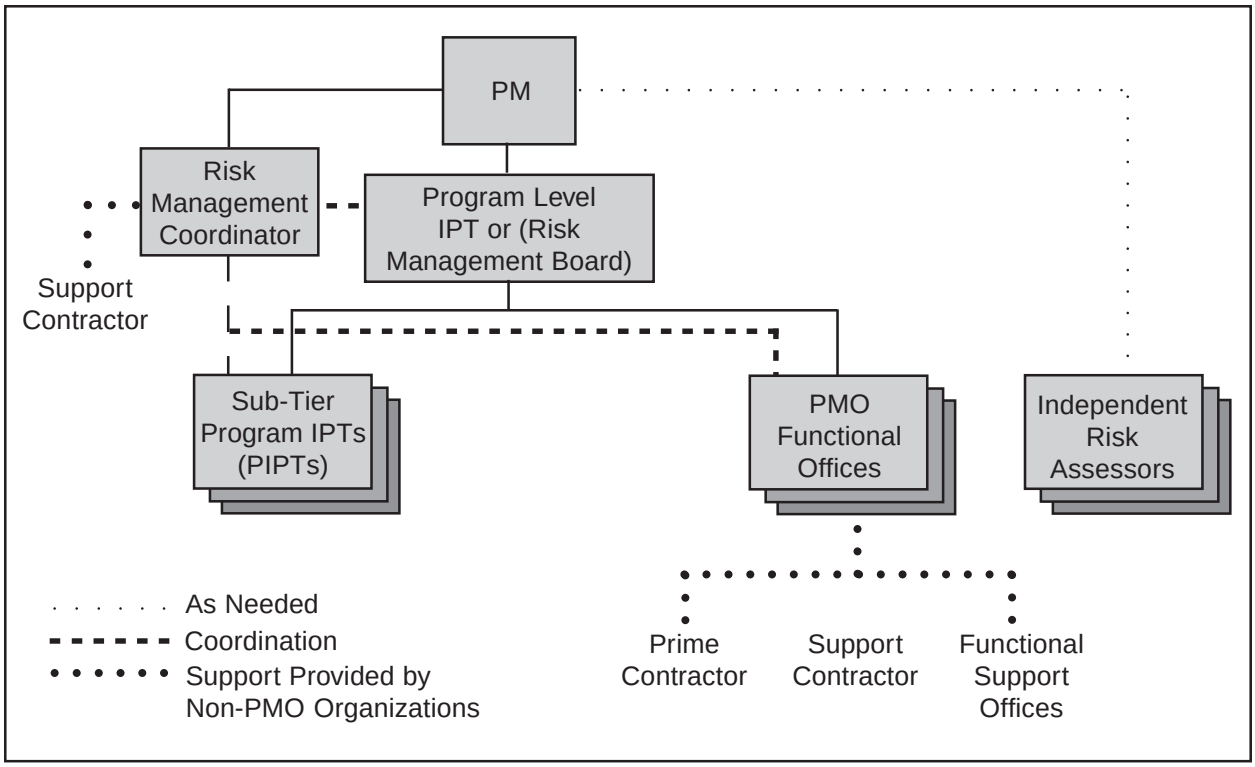

Figure 4-1. Decentralized Risk Management Organization

minimize the concept that risk management is a responsibility shared by all members of the acquisition team, whether Government or contractor.

The PM may also choose to decentralize. The degree of decentralization depends on the assignment of responsibilities. Some level of centralization is almost always essential for prioritizing risk across the program. A program level IPT (see Figure 4-1) or a Risk Management Board (RMB) may be appropriate for this integrating function.

The decentralized risk management organization is the most widely used approach, which is compatible with the DoD's IPPD policy and generally results in an efficient use of personnel resources. In this approach, risk management is delegated to Program IPTs (PIPTs).

The following guidelines apply to all risk management organizations:

- The PM is ultimately responsible for planning, allocating resources, and executing risk management. This requires the PM to oversee and participate in the risk management process.

- The PM must make optimal use of available resources, i.e., personnel, organizations, and funds. Personnel and organizational resources include the PMO, functional support offices of the host command, the prime contractor, independent risk assessors, and support contractors.

- Risk management is a team function. This stems from the pervasive nature of risk and the impact that risk-handling plans may have on other program plans and actions. In the aggregate, risk planning, risk assessment,

risk handling, and risk monitoring affect all program activities and organizations. Any attempt to implement an aggressive forward-looking risk management program without the involvement of all PMO subordinate organizations could result in confusion, misdirection, and wasted resources. The only way to avoid this is through teamwork among the PMO organizations and the prime contractor. The management organizational structure can promote teamwork by requiring strong connectivity between that structure, the various PMO organizations, and the prime contractor. The teams may use independent assessments to assist them, when required.

Figure 4-1 portrays a decentralized risk management organization. This example includes the entire PMO and selected non-PMO organizations, e.g., the prime contractor, who are members of the IPTs. The figure shows that risk management is an integral part of program management and not an additional or separate function to perform. Hence, separate personnel are not designated to manage risk, but rather all individuals are required to consider risk management as a routine part of their jobs. In the figure, the risk coordinator reports to the PM, but works in coordination with the PIPT, functional offices, and the Program Level IPT. As shown, this organizational structure is suited to Acquisition Category (ACAT) I programs, but PMs can tailor it to satisfy their specific requirements. The details are dependant upon the contract, type, statement of work, and other variables.

The organizational structure shows that the PM is ultimately responsible for risk management. There is a coordinator to assist with this responsibility and act as an "operations" officer. This may be a full-time position or an additional duty as the PM deems appropriate. The coordinator should have specific training and experience in risk management to increase the chance of successful implementation and to avoid common problems. A support contractor may assist the coordinator by performing administrative tasks associated with that office.

The Program Level IPT, composed of individuals from the PMO and prime contractor, ensures that the PM's risk management program is implemented and program results are synthesized into a form suitable for decision making by the PM and OIPT.

The inclusion of both Sub-Tier IPTs and PMO functional offices simply reflects that not all program management functions will be assigned to Sub-Tier IPTs for execution.

Independent risk assessors are typically hired when the PM has specific cost, schedule, performance concerns with a hardware or software product or engineering process and wants an independent assessment from an expert in a particular field. The duration of their services is normally short, and tailored to each program.

4.4.2 Risk Management Responsibilities

This section identifies the primary responsibilities that could be associated with a decentralized risk management organization. In assigning the responsibilities to the various organizational elements, the PM should strike a balance between a concentration of responsibilities at the higher levels and pushing them too far down the organizational structure.

The development of these responsibilities, in part, is based on the premise that risk management activities must be specific—and assigned to individuals, not groups. The responsibilities listed below are assigned to the leader of each organizational element, recognizing that the composition of each element will be program unique, i.e., number of assigned PMO personnel, prime contractor personnel, etc. The task of further

assigning these responsibilities, along with tailoring them to satisfy the needs and requirements of each program, remains for PMs and their staffs to accomplish.

Table 4-1 provides a description of the responsibilities associated with the decentralized risk management structure, sorted by notional organizational elements that may make up the risk management structure.

4.5 CONTRACTOR RISK MANAGEMENT

Experience has shown that managing a program's risks requires a close partnership between the PMO and the prime contractor(s). PMs must determine the type of support they need from their prime contractor, communicate these needs through the Request for Proposal (RFP) for each acquisition phase, and then provide for them in the contract. Preparation of the RFP and source selection are discussed in subsequent sections.

4.5.1 Contractor View of Risk

Contractors treat risk differently from the Government because each views risk from a different perspective. The PM, in executing his risk management program, needs to understand the contractor viewpoint.

Contractors typically divide risks into two basic types: business risks and program risks. Business risk, in the broadest sense, involves the inherent chance of making a profit or incurring a loss on any given contract. Program risk involves, among other things, technical, requirement, and design uncertainties. A contractor's efforts to minimize business risks may conflict with a Government PM's efforts to lower program risk.

While the government and contractors may have different views on specific cost, schedule, and performance risk levels/ratings, they generally have (or should have) similar views of the risk management process. One exception may be the requirements placed by corporate management—that could conflict with the Government view of program risk. The similarity, however, does not necessarily lead to the contractor having a competent internal risk management program. As a Project Management Institute (PMI) handbook points out, "On most (contractor) projects, responsibility for *Project Risk* is so pervasive that it is rarely given sufficient central attention." As a minimum, it is important that the PMO writes the RFP asking the contractor to describe its risk management process, including its approach to managing any specific areas.

4.5.2 Government/Contractor Relationship

The prime contractor's support and assistance is required even though the ultimate responsibility for risk management rests with the Government PM. Often, the contractor is better equipped to understand the program technical risks than the Government program office is. Both the Government and contractor need to share information, understand the risks, and develop and execute management efforts. The Government must involve the contractor early in program development, so that effective risk assessment and reduction can occur.

Therefore, risk management must be a key part of the contractor's management scheme. Although the Government does not dictate how the contractor should manage risk, some characteristics of a good Government/contractor relationship include:

- Clear definition of risks and their assignment.

Personnel	Job Responsibility
Program Manager	• Plan, organize, direct, and control risk management. • Comply with DoDD 5000.1, DoDI 5000.2, DoD 5000.2-R, DoDD 5000.4, and DoD 5000.4-M risk management guidance. • Ensure that funds are available to support approved risk-handling plans. • Inform and advise MDA, Cost Analysis Improvement Group (CAIG) and OIPT on program risk and its mitigation.
Risk Management Coordinator	• Develop and maintain risk management plans. • Provide risk management training. • Define the risk reporting scales to be used by the program. • Develop and maintain a risk management information system. • Prepare risk management reports. • Monitor compliance with DoDD risk management requirements. • Ensure that risk management functions and tasks performed by the Sub-Tier IPTs and the PMO functional offices are fully integrated and in compliance with assigned tasks. • Advise the PM and Program Level IPT on the use of risk management sources, i.e., host command functional support offices, etc. • Evaluate risk assessments, risk-handling plans, and risk monitoring results as directed and recommend appropriate actions. • Advise the PM on the use of independent risk assessors.
Program Level IPT (some PMOs use a Risk Management Board (RMB) for this responsibility)	• Ensure that the risk management program is implemented, risk reduction is accomplished in conformance with the PM's strategy, and the risk management efforts of the Sub-Tier IPTs are integrated. • Report risk events to the risk management coordinator. • Evaluate whether Sub-Tier IPTs and PMO functional offices have identified critical risks and proposed risk-handling plans. • Ensure that cost, schedule, and performance risks are compatible. • Ensure that cost, schedule, and performance risks are combined in a manner consistent with the plan.
PMO Sub-Tier PIPTs & Functional Offices (Process) and System Elements (Products)	• Assess risks, recommending appropriate risk-handling strategies for each identified moderate and high risk, and implementing and documenting all risk management analyses and findings within the team's product area. • Coordinate all risk management findings and decisions with other Sub-Tier IPTs, PMO functional offices, the Program Level IPT, and the risk-management coordination office. • Identify funding requirements to implement risk-handling plans. • Identify the need for risk management training. • Report risk events to the Program Level IPT and risk coordinator.
Independent Risk Assessors	• Perform independent risk assessment on critical risk areas or contractor engineering processes that the PM has specified. • Report the results of those assessments to the PM. • Work with the risk management coordinator.

Table 4-1. Notional Description of Risk Management Responsibilities

- Flexibility for assignment of risks and risk management responsibilities among the teams.

- Strong emphasis on best management and technical practices which, if followed, avoid unnecessary risks.

Regarding RFP development, discussed later in this section, information is provided on how these characteristics should be addressed.

The Government/contractor partnership can be forged in at least two ways. First, the PMO should include the prime contractor(s) in the top-level risk planning and assessment activities. This includes understanding and factoring in such issues as user requirements, affordability constraints, and schedule limitations. Second, the PMO should include in advance specific risk assessment and handling tasks as key contractual efforts during the concept exploration and program definition and risk reduction phases.

Forming a joint Government/contractor evaluation team is a good way of fostering an effective partnership. This is especially true in a program's early stages when uncertainty is high and both parties must frequently assess risks. These assessments, properly handled, involve multidisciplinary efforts requiring subject-matter experts from both the prime contractor and Government. This joint team should evaluate the proposed program in detail and explore the inherent program risks, the proposed handling strategies, the detailed development schedule, and the contractor's developmental resources (people, facilities, processes, tools, etc.).

A management approach using multiple teams is the best approach to use, e.g., Sub-Tier IPTs. Joint team(s) should be established at the beginning of each development phase to assess the risks to be overcome in that phase and to determine the handling technique(s) to be used. Requirements for contractor participation on the team(s) should be identified in the RFP and subsequent contract.

4.6 RISK MANAGEMENT AND THE CONTRACTUAL PROCESS

4.6.1 Risk Management: Pre-Contract Award

The contractor's developmental and manufacturing processes and tools, the availability and skill of personnel, and the previous experience of the Government and contractor team all influence their ability to handle the proposed system development and production. Therefore, an effective risk management process includes an evaluation of the capabilities of the potential contractors.

4.6.2 Early Industry Involvement: Industrial Capabilities Review

An Industrial Capabilities Review is a powerful tool available to PMs for determining *general* industrial capabilities. To avoid potential problems in the subsequent competitive process and to ensure that a "level playing field" is maintained, an announcement in the *Commerce Business Daily* should be made to inform all potential offerors that the Government plans to conduct an Industrial Capabilities Review and to request responses from all interested parties. Below is a general approach that PMOs may find readily adaptable to any type of capability review. The basic steps in the process are to:

- Obtain the Source Selection Authority's approval to conduct the review.

- Establish the criteria for the capability.

- Identify the potential contractors who will participate in the review.

- Provide an advance copy of the review material to those contractors.

- Select the review team, ensuring that it has the necessary mix of talent.

- Train the team on the purpose of the review and review criteria.

- Conduct the review and evaluate the results.

- Provide feedback to each contractor on the results of their review and assessment.

- Provide the results to the PM.

This review is an appraisal of general industrial capabilities and supports identifying potential program risks and best practices rather than evaluating specific contractors.

Regardless of the approach, the PMO should determine what specific information is needed. DoD 4245.7-M is a good guide to help tailor a set of questions for the contractors. The questions generally focus on two areas consistent with protection of contractor proprietary information.

- What is the state-of-the-art of the technology proposed for use in the system?

- What are the general developmental/manufacturing capabilities of the potential contractors (including experience, tools, processes, etc.) as compared to industry best practices?

Table 4-2 shows some of the specific areas or sources for risk identification. It includes a number of areas (threat, requirements, design, etc.) that have been shown through experience to contain risk events that tend to be more critical than others, and which ones should receive the most management attention. Risk events are determined by examining WBS element product and processes in terms of risk areas. Process areas are specifically addressed in DoD 4245.7M. They are general in that areas of risk could be present in any program from either source (WBS or process). They are intended as a list of "top-level" risk sources that will focus attention on a specific area. The PMO and contractor(s) will have to examine lower levels to understand the actual risks that are present in their program and to develop an effective management plan. The risks shown are not intended to serve as a simple checklist that one should apply directly, then consider the program risk-free if none of the listed risks are present.

An examination of the program in these areas can help to develop the final program acquisition strategy and the risk-sharing structure between the Government and industry. The PMO can also use the results to adjust the RFP for the next phase of the program.

4.6.3 Developing the Request for Proposal

The RFP should communicate to all offerors the concept that risk management is an essential part of the Government's acquisition strategy.

Before the draft RFP is developed using the results of the Industrial Capabilities Review, the PMO should conduct a risk assessment to ensure that the program described in the RFP is executable within the technical, schedule, and budget constraints. Based on this assessment, a program plan, an integrated master schedule, and life-cycle cost (LCC) estimate may be prepared. The technical, schedule, and cost issues should be discussed in the pre-proposal conference(s) before the draft RFP is released. In this way, critical risks inherent in the program can be identified and addressed in the RFP. In addition, this helps to establish key risk-management contractual conditions. The RFP

Risk Area	Significant Risks
Threat	• Uncertainty in threat accuracy. • Sensitivity of design and technology to threat. • Vulnerability of system to threat and threat countermeasures. • Vulnerability of program to intelligence penetration.
Requirements	• Operational requirements not properly established or vaguely stated. • Requirements are not stable. • Required operating environment not described. • Requirements do not address logistics and suitability. • Requirements are too constrictive—identify specific solutions that force high cost.
Design	• Design implications not sufficiently considered in concept exploration. • System will not satisfy user requirements. • Mismatch of user manpower or skill profiles with system design solution or human-machine interface problems. • Increased skills or more training requirements identified late in the acquisition process. • Design not cost effective. • Design relies on immature technologies or “exotic” materials to achieve performance objectives. • Software design, coding, and testing.
Test and Evaluation	• Test planning not initiated early in program (CTD Phase). • Testing does not address the ultimate operating environment. • Test procedures do not address all major performance and suitability specifications. • Test facilities not available to accomplish specific tests, especially system-level tests. • Insufficient time to test thoroughly.
Simulation	• Same risks as contained in the Significant Risks for Test and Evaluation. • M&S are not verified, validated, or accredited for the intended purpose. • Program lacks proper tools and modeling and simulation capability to assess alternatives.
Technology	• Program depends on unproved technology for success—there are no alternatives. • Program success depends on achieving advances in state-of-the-art technology. • Potential advances in technology will result in less than optimal cost-effective system or make system components obsolete. • Technology has not been demonstrated in required operating environment. • Technology relies on complex hardware, software, or integration design.
Logistics	• Inadequate supportability late in development or after fielding, resulting in need for engineering changes, increased costs, and/or schedule delays. • Life-cycle costs not accurate because of poor logistics supportability analyses. • Logistics analyses results not included in cost-performance tradeoffs. • Design trade studies do not include supportability considerations.

Table 4-2. Significant Risks by Critical Risk Areas

Risk Area	Significant Risks
Production/ Facilities	• Production implications not considered during concept exploration. • Production not sufficiently considered during design. • Inadequate planning for long lead items and vendor support. • Production processes not proven. • Prime contractors do not have adequate plans for managing subcontractors. • Sufficient facilities not readily available for cost-effective production. • Contract offers no incentive to modernize facilities or reduce cost.
Concurrency	• Immature or unproven technologies will not be adequately developed before production. • Production funding will be available too early—before development effort has sufficiently matured. • Concurrency established without clear understanding of risks.
Capability of Developer	• Developer has limited experience in specific type of development. • Contractor has poor track record relative to costs and schedule. • Contractor experiences loss of key personnel. • Prime contractor relies excessively on subcontractors for major development efforts. • Contractor will require significant capitalization to meet program requirements.
Cost/Funding	• Realistic cost objectives not established early. • Marginal performance capabilities incorporated at excessive costs; satisfactory cost-performance tradeoffs not done. • Excessive life-cycle costs due to inadequate treatment of support requirements. • Significant reliance on software. • Funding profile does not match acquisition strategy. • Funding profile not stable from budget cycle to budget cycle.
Schedule	• Schedule not considered in trade-off studies. • Schedule does not reflect realistic acquisition planning. • APB schedule objectives not realistic and attainable. • Resources not available to meet schedule.
Management	• Acquisition strategy does not give adequate consideration to various essential elements, e.g., mission need, test and evaluation, technology, etc. • Subordinate strategies and plans are not developed in a timely manner or based on the acquisition strategy. • Proper mix (experience, skills, stability) of people not assigned to PMO or to contractor team. • Effective risk assessments not performed or results not understood and acted upon.

Table 4-2. Significant Risks by Critical Risk Areas (continued)

should encourage offerors to extend the contract WBS (CWBS) to reflect how they will identify all elements at any level that are expected to be high cost or high risk. The RFP should also encourage offerors to cite any elements of the CWBS provided in the draft RFP that are not consistent with their planned approach.

In the solicitation, PMs may ask offerors to include a risk analysis and a description of their management plans, and also to develop a supporting program plan and an integrated master schedule in their proposals. These proposals will support the Government's source selection evaluation and the formulation of a most probable cost estimate for each proposal. In addition, the RFP may identify the requirement for periodic risk assessment reports that would serve as inputs to the PM's assessment and monitoring processes thereby ensuring that risks are continuously assessed.

4.6.4 The Offeror's Proposal

The offerors should develop the proposed program plans and documentation at a level that is adequate to identify risks, develop associated management activities that they will use throughout the program, and integrate resources, technical performance measures, and schedule in the proposed program plans. Program plans should extend the CWBS to reflect the offeror's approach and include the supporting activities, critical tasks, and processes in the CWBS dictionary. The associated schedules for each should be incorporated into an integrated master schedule. Plans should also have an estimate of the funds required to execute the program and include a breakout of resource requirements for high-risk areas.

The information required and the level of detail will depend on the acquisition phase, the category, and criticality of the program, as well as on the contract type and value. However, the detail submitted with the proposal must be at a sufficiently low level to allow identification of possible conflicts in the planned acquisition approach and to support the Government's proposal evaluation. Generally, the CWBS should be defined below level 3, by the contractor, only to the extent necessary to capture those lower level elements that are high cost, high risk, or of high management interest.

4.6.5 Basis for Selection

DoD acquisition management must focus on balancing cost, schedule, performance, and risk by selecting the contractor team that provides the best value to the user within acceptable risk limits. Therefore, the RFP/Source Selection process must evaluate each offeror's capability for meeting product and process technical, cost and schedule requirements while addressing and controlling the risks inherent in a program.

The evaluation team should discriminate among offerors based upon the following:

- Risks determined by comparison with the best practices baseline.
- Ability to perform with a focus on the critical risk elements inherent in the program.
- Adherence to requirements associated with any mandatory legal items.
- Past performance on efforts similar to the proposed program being evaluated.

The process of choosing among offerors may be enhanced if the evaluation team includes risk management as a "source selection discriminator." Risk management then becomes an important factor in the Source Selection Authority determination of who provides the most executable program.

4.6.6 Source Selection

The purpose of a source selection is to select the contractor whose cost, schedule and performance can best be expected to meet the Government's requirements at an affordable price. To perform this evaluation, the Government must assess both *proposal risk* and *performance risk* for each proposal. These risk assessments must be done entirely within the boundaries of the source selection process. Previous assessments of any of the offerors may not be applicable or allowable.

4.6.6.1 Proposal Risk. This refers to the risk associated with the *offeror's proposed approach* to meet the Government cost, schedule, and performance requirements. The evaluation of proposal risk includes an assessment of proposed time and resources and recommended adjustments. This assessment should be performed according to the definitions and evaluation standards developed for the source selection. Proposal risk is, in essence, a moderate expansion of past evaluation processes. Historically, evaluators selected contractors who demonstrated that they understood the requirements and offered the best value approach to meeting the Government's needs. The expansion on this concept is the specific consideration of risk.

Technical and schedule assessments are primary inputs to the most probable cost estimate for each proposal. It is important to estimate the additional resources needed to control any risks that have moderate or high risk ratings. Offerors may define them in terms of additional time, personnel loading, hardware, or special actions such as additional tests. However, whatever the type of the required resources, it is essential that cost estimates be integrated and consistent with the technical and schedule evaluations.

4.6.6.2 Performance Risk. A performance risk assessment is an evaluation of the contractor's past and present performance record to establish a level of confidence in the contractor's ability to perform the proposed effort. Such an evaluation is not limited to programmatic technical issues, but also includes assessment of critical vendor financial viability. Financial cap-ability analyses and industrial capability assess-ments, conducted in accordance with DoD Handbook 5000.60H, provide insight to a contractor's ability to perform the proposed effort.

A range of methods are available to the PM to evaluate performance risk. The Performance Risk Assessment Group (PRAG) is a group of experienced Government personnel that are appointed by the source selection advisory council Chairperson to permit performance risk to be used, if appropriate. Performance risk may be separately assessed for each evaluation factor or as a whole with the assessment provided directly to the source selection advisory council/authority for final decision or indirectly through the Source Selection Evaluation Board. The assessment relies heavily (although not exclusively) on the contractor performance evaluations and surveys submitted by the PMO and Defense Contract Management Agency (DCMA).

4.7 RISK MANAGEMENT: POST-CONTRACT AWARD

Post-contract award risk management builds on the work done during the pre-contract award phase. With the award of the contract, the relationship between the Government and the contractor changes as teams are formed to address program risk. These teams should validate pre-contract award management plans by reviewing assessments, handling plans, and monitoring intentions. The extent of assessments increases as the contractor develops and refines his design, test and evaluation, and manufacturing plans. The Government PMO should work with the contractor to refine handling plans.

The process begins with an Integrated Baseline Review (IBR) after contract award to ensure that reliable plans and performance measurement baselines capture the entire scope of work, are consistent with contract schedule requirements, and have adequate resources assigned to complete program tasks. The IBR could be conducted to incorporate other steps identified below. These steps suggest an approach that the PMO might take to initiate the program's risk management plans and activities after contract award. They are intended to be a starting point, and the PMO should tailor the plan to reflect each program's unique needs.

- Conduct initial meeting with the contractor to describe the program's objectives and approach to managing risks. The PM may also present the risk management plan.

- Train members of the PMO and the contractor's organization on risk management basics, incorporating the program's management plan and procedures into the training.

- Review the pre-contract award risk plan with the PMO and contractor, revise it as necessary, and share results with the contractor.

- Conduct in-depth review of the pre-contract award risk assessments and expand the review to include any new information obtained since the award of the contract.

- Review and revise risk-handling plans to reflect the reassessment of risks.

- Review the program's documentation requirements with the contractor. Ensure that the PMO and contractor understand the purpose, format, and contents of various risk reports.

- Initially, it may be necessary to establish a formalized PMO-contractor risk management organization for the program, consistent with the terms of the contract.

- Working with the contractor, refine the risk-monitoring plans and procedures.

- Establish the program reporting requirements with the contractor. Describe the risk management information system that the program has established, including procedures for providing information for data entry, and identify reports for the PMO and contractor.

- In conjunction with the contractor, identify other risk-management activities that need to be performed.

- Manage the program risk in accordance with the risk management plan and contract.

- Working with the contractor, refine the risk-monitoring plans and procedures and develop appropriate measures and metrics to track moderate- and high-risk items.

4.8 RISK MANAGEMENT REPORTING AND INFORMATION SYSTEM

The PMO should have a practical method for risk-management reporting, and an information system that supports a risk management program. The reporting needs of the PM establish the type, format, and frequency of information sharing. The IPT concept suggests that the entire acquisition program team needs access to the risk management information, and the prime contractor(s) should have access to information, consistent with acquisition regulations. The reporting and information system chosen may be Government- or contractor-owned. See Chapter 5 for an example of an MIS.

4.9 RISK MANAGEMENT TRAINING

A successful management program depends, to a large extent, on the level of risk management training the PMO members and the functional area experts receive. The training will prepare them for critical tasks, such as risk assessments. DoD schools offer some risk-management training; however, PMs will need to organize and conduct principal training for the program office. A three-part framework for training covers program-specific risk management issues, general structure and process, and techniques.

(1) The program-specific training should ensure that everyone has a common vision. It should cover the acquisition strategy, the companion risk management plan, the PM's risk-management structure and associated responsibilities, and the MIS.

(2) The following topics provide a starting point for general training syllabus development. The final syllabus should be tailored to meet the program's specific needs. Table 4-3 provides a list of references that will be useful in developing the syllabus and lesson plans.

- Concept of Risk,
- Risk Planning,
- Risk Identification,
- Risk Analysis (as applicable),
- Risk Handling, and
- Risk Monitoring.

(3) The third area of training concerns risk-management techniques, concentrating on the techniques the PMO plans to employ. The training should focus on how to use the techniques and should include examples of their use. Chapter 5, *Risk Management Techniques*, of this *Guide* provides a starting point. It contains a general discussion of a set of techniques that address all elements of the risk management process. The discussion of each technique contains a list of references that provide a more in-depth description of the technique. The set of techniques is not exhaustive and the program office should add to the list, if necessary.

Document	Description
DoD 4245.7-M, *Transition from Development to Production*, September 1985.	Provides a structure for identifying technical risk areas in the transition from a program's development to production phases. The structure is geared toward development programs but, with modifications, could be used for any acquisition program. The structure identifies a series of templates for each of the development contractor's critical engineering processes. The template includes potential areas of risk and methods for reducing risk in each area.
Risk Management Concepts and Guidance, Defense Systems Management College, March 1989. (Superseded by this *Risk Management Guide*.)	Devoted to various aspects of risk management.
Systems Engineering Management Guide, Defense Acquisition University Press, January 2001, Section 15.	Devoted to risk analysis and management and provides a good overview of the risk management process.
Continuous Risk Management Guide, Software Engineering Institute, Carnegie Mellon University, 1996.	Provides a risk management methodology similar to the one described in the *Defense Acquisition Deskbook*. Its value is that it subdivides each process into a series of steps; this provides useful insights. Appendix A describes 40 risk-management techniques, the majority of which are standard management techniques adapted to risk management. This makes them a useful supplement to the *Defense Acquisition Deskbook* identified techniques.
A Systems Engineering Capability Maturity Model, Version 1.0 Software Engineering Institute (Carnegie Mellon University), Handbook SECMM-94-04, December 1994.	Describes one approach to conducting an Industry Capabilities Review. Section PA 10 (pp. 4-72–4-76) discusses software risk management. The material presented in this handbook also can be tailored to apply to system and hardware risk.
A Software Engineering Capability Maturity Model, Version 1.01 Software Engineering Institute (Carnegie Mellon University), Technical Report, December 1996.	Describes an approach to assess the software acquisition processes of the acquiring organization and identifies areas for improvement.
Capability Maturity Model for Software (SM-CMM), Version 1.1,/CMU/SEI-93-TR-24, February 1993.	This is a tool that allows an acquiring organization to assess the software capability maturity of an organization.
Taxonomy-Based Risk Identification, Software Engineering Institute, Carnegie Mellon University, CMU/SEI-93-TR-6 (ESC-TR-93-183, June 1993.	Describes a method for facilitating the systematic and repeatable identification of risks associated with the development of a software-intensive project. This method has been tested in active Government-funded defense and civilian software development projects. The report includes macro-level lessons learned from the field tests.
NAVSO P-6071.	Navy "best practices" document with recommended implementations and further discussion on the material in DoD 4245.7-M.

Table 4-3. Risk Management Reference Documents

Document	Description
Risk Management, AFMC Pamphlet 63-101, July 1997.	An excellent pamphlet on risk management that is intended to provide PMs and the PMO with a basic understanding of the terms, definitions, and processes associated with effective risk management. It is very strong on how to perform pre-contract award risk management.
Defense Acquisition Deskbook	Primary reference tool for defense acquisition work force; contains over 1,000 mandatory and discretionary publications and documents which promulgate acquisition policy and guidance. (http://www.deskbook.osd.mil)
Acquisition Software Development Capability Evaluation, AFMC Pamphlet 63-103, 15 June 94.	Describes one approach to conducting an Industry Capabilities Review. This two-volume pamphlet was generated from material originated at Aeronautical Systems Center. The concepts support evaluations during source selection and when requested by IPTs. The material presented in this pamphlet also can be tailored to apply to system and hardware risk management.
Risk Management Critical Process Assessment Tool, Air Force SMC/AXD, Version 2, 9 June 1998.	Provides guidance and extensive examples for developing RFP Sections “L” and “M,” plus source selection standards or risk management. Also includes technical evaluation and review questions, which are helpful for assessing a risk management process; and risk trigger questions, which are helpful for risk identification.
NAVSO P-3686, *Top Eleven Ways to Manage Technical Risk*, October 1998.	Contains Navy approach to risk management with baseline information, explanations, and best practices that contribute to a well-founded technical risk management program.
Risk Focus Area of the Program Management Community of Practice (www.pmcop.dau.mil)	Provides comprehensive and ready source of current tools, papers, and practices in risk management field.

Table 4-3. Risk Management Reference Documents (continued)

5

RISK MANAGEMENT TECHNIQUES

5.1 INTRODUCTION

This Chapter provides top-level information on a number of techniques currently used in DoD, and a combination of techniques used by the Services, industry, and academia. Collectively, they focus on the components of the risk management process and address critical risk areas and processes. The write-ups describe the techniques and give information on their application and utility. The descriptions are at a level of detail that should permit potential users to evaluate the suitability of the techniques for addressing their needs; however, the material does not, in most cases, provide all the information that is required to use a technique. Readers will find that if a particular technique looks promising, they can obtain enough information from the references and tools that will enable program offices to apply them. The descriptions are in a format that aids comparison with other approaches.

5.2 OVERVIEW

Techniques are available to support risk management activities. None are required by DoD, but some have been successfully used in the past by DoD PMs. Many of the techniques support processes that are part of sound management and systems engineering and give Government and contractor PMs the tools for considering risk when making decisions on managing the program.

Several tools have been developed to support each of the components of the risk management process, i.e., planning, assessing, handling, and monitoring and documenting. Although tool developers may claim otherwise, none are integrated to totally satisfy all needs of a PM. Most likely, a PM will choose an overall risk strategy, write a plan to reflect his strategy, review the list of proven techniques to support the components of risk management, assess the techniques against the program's needs and available resources, tailor the techniques to suit the needs of the program, and train program office members to implement the plan.

5.3 RISK PLANNING TECHNIQUES

5.3.1 Description

This technique suggests an approach to risk planning; the process of developing and documenting an organized, comprehensive approach. It also suggests interactive strategy and methods for identifying and tracking risk drivers, developing risk-handling plans, performing continuous assessments to determine how risks have changed, and planning adequate resources. The risk planning technique is applicable to all functional areas in the program, especially critical areas and processes. Using the acquisition strategy as a starting point results in the development of a program risk management strategy, from which flows a management plan that provides the detailed information and

direction necessary to conduct an effective management program. This risk management plan provides the PM with an effective method to define a program, one that fixes responsibility for the implementation of its various aspects, and supports the acquisition strategy.

The technique should first be used in the Concept and Technology Development (CTD) Phase following the development of the initial acquisition strategy. Subsequently, it may be used to update the management plan on the following occasions: (1) whenever the acquisition strategy changes, or there is a major change in program emphasis; (2) in preparation for major decision points; (3) in preparation for and immediately following technical audits and reviews; (4) concurrent with the review and update of other program plans; and (5) in preparation for a PMO submission.

The PMO risk management coordinator, if assigned, develops the risk management plan based on guidance provided by the PM, and coordinating with the Program Level IPT. To be effective, the PM must make risk management an important program management function and must be actively involved in the risk planning effort. Planning requires the active participation of essentially the entire PMO and contractor team.

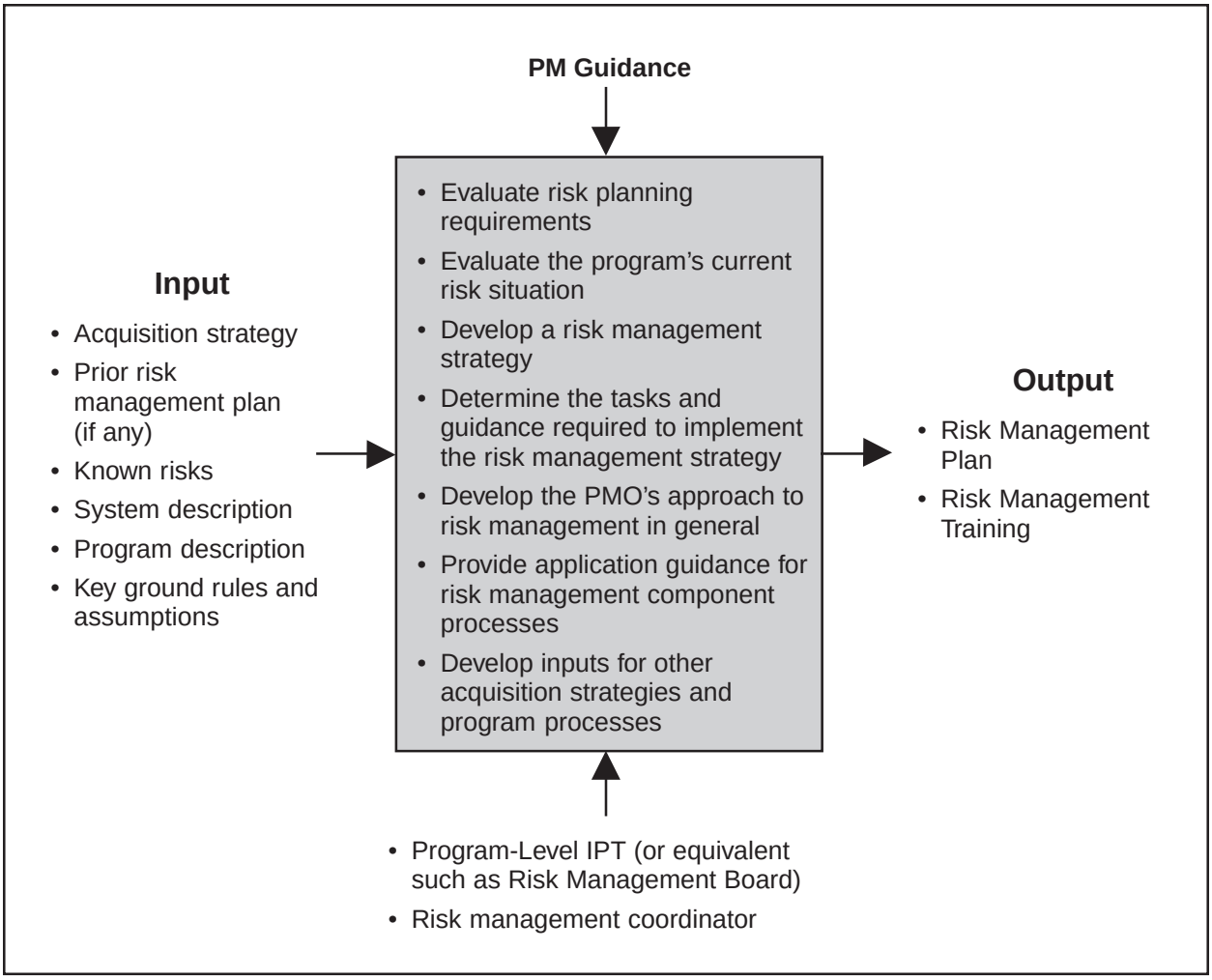

Figure 5-1. Risk Planning Technique Input and Output

5.3.2 Procedures

Figure 5-1 graphically depicts the process to be followed in applying this technique. The procedure consists of a number of iterative activities that result in the development of the risk management strategy and a Risk Management Plan.

The acquisition strategy and related management planning efforts (program management, and systems engineering), program constraints, and any existing risk management planning are integrated and evaluated in the context of the PM's guidance, which provides the direction for the planning process. Typical types of PM guidance are concerns about certain categories of risk, guidance on funding of handling activities, emphasis to be placed on risk management training, and frequency and type of internal reports.

The integration and evaluation of the primary inputs establish the requirements and scope of the planning effort through an assessment of the program's current risk situation. The results of the assessment provide the basis for development of management strategy. The strategy should reflect the level of risk that the PM is prepared to accept, and should provide guidance on how and when known risks will be reduced to acceptable levels. It should also describe the risk management process the PMO will employ and the organization and structure of the management program, addressing things such as risk ratings, the use of an MIS, policy and procedures on sharing risk management information, and training.

The PMO should create an MIS early in the planning process. It will serve as a planning source and the data may be used for creating reports. It will also become the repository for all current and historical information related to risk. Eventually, this information may include risk assessment documents, contract deliverables, if appropriate, and other risk-related reports.

Based on the management strategy, the plan identifies specific tasks to be accomplished and assigns responsibility for their execution. The timing of these tasks should be incorporated into an integrated critical path master schedule or equivalent. Guidance for task execution and control should also be developed, covering such things as the suggested techniques to be used for each component, any assistance available to Sub-Tier IPTs, the use of funds, the policy on the use of independent risk assessors, etc. This information may be documented in a risk management plan. A sample format is shown in Figure 5-2. Appendix B contains two examples of a Risk Management Plan.

The contents of the risk management strategy and plan should be consistent with the acquisition strategy and other program plans derived from the acquisition strategy. Hence, it should be tailored to each program rather than attempting to use the same process and its implementation on all programs. This will help to ensure that risk is considered in all program activities and that it does not become a "stove pipe" function.

5.4 RISK ASSESSMENT TECHNIQUES

5.4.1 Product (WBS) Risk Assessment

5.4.1.1 Description. This technique identifies those risks associated with a given system concept and design. The difference between the process (DoD 4245.7-M) technique and this approach is that DoD 4245.7-M addresses the contractor's engineering and manufacturing *process* and this technique focuses on the resulting *product*. This technique is used to identify and analyze risks in the following critical risk areas: design and engineering, technology, logistics, production, concurrency, plus others as needed for both hardware and software.

INTRODUCTION. This section should address the purpose and objective of the plan, and provide a brief summary of the program, to include the approach being used to manage the program, and the acquisition strategy.

PROGRAM SUMMARY. This section contains a brief description of the program, including the acquisition strategy and the program management approach. The acquisition strategy should address its linkage to the risk management strategy.

DEFINITIONS. Definitions used by the program office should be consistent with DoD definitions for ease of understanding and consistency. However, the DoD definitions allow program managers flexibility in constructing their risk management programs. Therefore, each program's risk management plan may include definitions that expand the DoD definitions to fit its particular needs. For example, each plan should include, among other things, definitions for the ratings used for technical, schedule, and cost risk.

RISK MANAGEMENT STRATEGY AND APPROACH. Provide an overview of the risk management approach, to include the status of the risk management effort to date, and a description of the program risk management strategy.

ORGANIZATION. Describe the risk management organization of the program office and list the responsibilities of each of the risk management participants.

RISK MANAGEMENT PROCESS AND PROCEDURES. Describe the program risk management process to be employed, i.e., risk planning, assessment, handling, monitoring and documentation, and a basic explanation of these components. Also provide guidance for each of the risk management steps in the process. If possible, the guidance should be as general as possible to allow the program's risk management organization (e.g., IPTs) flexibility in managing the program risk, yet specific enough to ensure a common and coordinated approach to risk management. It should address how the information associated with each element of the risk management process will be documented and made available to all participants in the process, and how risks will be tracked, to include the identification of specific metrics if possible.

RISK PLANNING. This section describes the risk planning process and provides guidance on how it will be accomplished, and the relationship between continuous risk planning and this RMP. Guidance on updates of the RMP and the approval process to be followed should also be included.

RISK ASSESSMENT. This section of the plan describes the assessment (identification and analysis) process. It includes procedures for examining the critical risk areas and processes to identify and document the associated risks. It also summarizes the analyses process for each of the risk areas leading to the determination of a risk rating. This rating is a reflection of the potential impact of the risk in terms of its variance from known Best Practices or probability of occurrence, its consequence, and its relationship to other risk areas or processes. This section may include:

- Overview and scope of the assessment process
- Sources of information
- Information to be reported and formats
- Description of how risk information is retained
- Assessment techniques and tools.

RISK HANDLING. This section describes the risk-handling options, and identifies tools that can assist in implementing the risk-handling process. It also provides guidance on the use of the various handling options for specific risks.

RISK MONITORING. This section describes the process and procedures that will be followed to monitor the status of the various risk events identified. It should provide criteria for the selection of risks to be reported on, and the frequency of reporting. Guidance on the selection of metrics should also be included.

RISK MANAGEMENT INFORMATION SYSTEM, DOCUMENTATION AND REPORTS. This section describes the MIS structure, rules, and procedures that will be used to document the results of the risk management process. It also identifies the risk management documentation and reports that will be prepared; specifies the format and frequency of the reports; and assigns responsibility for their preparation.

Figure 5-2. Sample Format for Risk Management Plan

The WBS is the starting point to describe contract work to be done and the resulting product and is the basis for determining risk events in each critical risk area. The risk events—events that *might* have a detrimental impact on the system, subsystems, or components—are evaluated to identify and characterize specific risks ratings and prioritization.

This technique should be used shortly after the completion of the prime contractor's WBS. Thereafter, it should be used regularly up to the start of production. The technique can be used independently or in conjunction with other risk assessment techniques, such as the Process (DoD 4245.7-M) Risk Assessment technique. It may, if appropriate, also be used in conjunction with the Integrated Baseline Review (IBR), which is conducted within 6 months of contract award. See Section 1.4.2.4.3 of the *Defense Acquisition Deskbook* (http://www.deskbook.osd.mil) for a discussion of an IBR. A World Wide Website is also available at www.acq.osd.mil./pm/ibrmats/ibrmats.htm, which discusses the IBR Process.

To apply this technique, joint Government and industry evaluation teams should examine the appropriate WBS levels in each Sub-Tier IPTs product area. If necessary, complementary industry-only teams may take an in-depth look at selected areas at lower WBS levels. At times, it may be desirable to include outside industry experts on the teams to aid in the examination of specific WBS elements or functional areas.

5.4.1.2 Procedures. Figure 5-3 depicts the process used in this technique. The first step is to review the WBS elements down to the level being considered, and identify risk events. This review should consider the critical areas (design and engineering, technology, logistics, etc.) that may help to describe risk events. Table 5-1 shows a partial listing of these elements.

Using information from a variety of sources, such as program plans, prior risk assessments, expert interviews, etc., the WBS elements are examined to identify specific risks in each critical area. The risk event, are then analyzed to determine probability of occurrence and consequences/impacts,

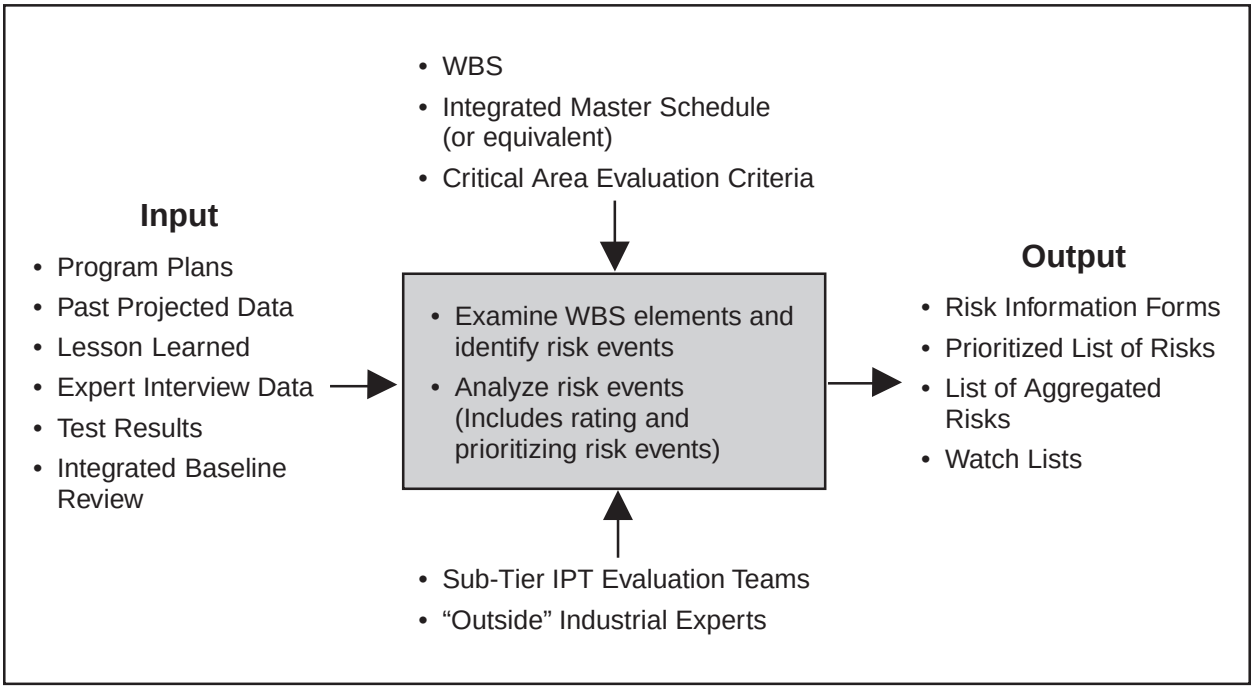

Figure 5-3. Product (WBS) Risk Assessment Technique Input and Output

Critical Risk Areas	Example Elements	
Design and Engineering	• Design/technology approach • Operational environments • External/internal interfaces • Use of standard parts/program parts list • System/subsystem critical design requirement	• Integration requirements • Human-machine interface • Design growth capacity • Design maturity • Safety and health hazards • Manpower, training and skill profiles
Logistics	• Operations and Maintenance (O&M) concept • System diagnostic requirement • Repairability and Maintainability (R&M) requirements • Supply support requirements • Built-in Test (BIT) requirements	• Support equipment requirements • Maintenance interfaces • Level of repair decisions • Training equipment design
Testing	• Integrated test • Qualification testing • Subsystem test limits	• Test environmental acceleration • Supportability test results
Manufacturing	• Design producibility • Manufacturing capability requirements • Parts/assemblies availability	• Special tooling/test equipment planning personnel availability • Process/tooling proofing • Production equipment availability
Concurrency	• Program schedule adequacy	• Development phases concurrency

Table 5-1. Critical Risk Areas and Example Elements

along with any interdependencies and risk event priorities. Several techniques and tools are available to accomplish this, including, among others, technology assessments, modeling and simulation, hazard analysis, and fault tree analysis.

The results of this analysis should be documented in a program-specific standard format, such as a Risk Information Form (RIF). The risks, along with others identified using other techniques, can be prioritized and aggregated using the technique described later in this chapter.

5.4.2 Process (DoD 4245.7-M) Risk Assessment

5.4.2.1 Description. This technique is used to assess (identify and analyze) program technical risks resulting from the contractor's processes. It is based on the application of the technical risk area templates found in DoD 4245.7-M. These templates describe the risk areas contained in the various technical processes (e.g., design, test, production, etc.) and specify methods for reducing risks in each area. Success of any risk reduction efforts associated with this technique will depend on the contractor's ability and willingness to make

a concerted effort to replace any deficient engineering practices and procedures with best industrial practices.

One of the primary benefits of this technique is that it addresses pervasive and important sources of risk in most DoD acquisition programs and uses fundamental engineering principles and proven procedures to reduce technical risks. The technique is accepted by many aerospace companies in normal business activities, and in fact, was developed by a group of Government and aerospace experts.

The technique is primarily applicable during the Concept and Technology Development (CTD) Phase, and the System Demonstration part of the System Development and Demonstration (SDD) Phase of program development. In the CTD Phase it provides a detailed checklist of processes that the contractor needs to address; in the System Demonstration part of the SDD Phase, the processes are being implemented in preparation for Low Rate Initial Production (LRIP). The description of each template in DoD 4245.7-M shows the phases in which the template should be applied. The specific timing of the application within the phases should be determined based on the type of program, the acquisition strategy and plans, and the judgment of program officials. It should also be used in preparation for milestone decisions and when preparing for source selection. This technique may be used independently or in conjunction with other risk assessment techniques. When feasible, a Government-industry evaluation team should be formed early in the program to apply this technique.

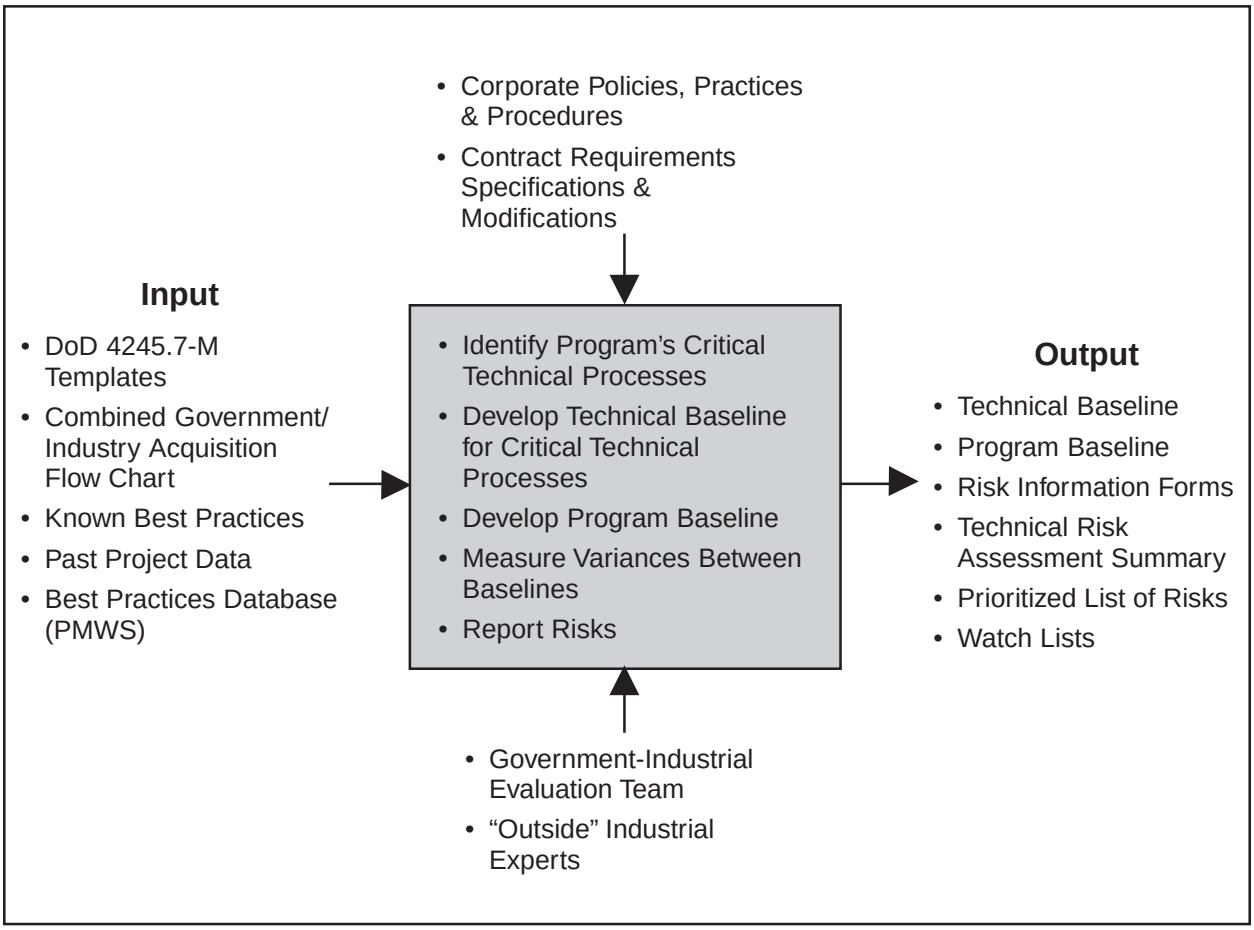

Figure 5-4. Process (DoD 4245.7-M) Risk Assessment Technique Input and Output

5.4.2.2 Procedures. Figure 5-4 shows the basic approach used in this technique. The DoD 4245.7-M templates are used in conjunction with the contract requirements and specifications to identify those technical processes critical to the program and to establish a program baseline of contractor processes. When possible, the program baseline should be determined by evaluating actual contractor performance, as opposed to stated policy. For example, design policy should be determined from interviewing designers and not simply from reviewing written corporate policies.

This program baseline should then be compared to a baseline of industry-wide processes and practices that are critical to the program. The baseline should be developed by reviewing and compiling known best practices in use by various companies in both defense and non-defense sectors. One source of best practices information is the Program Manager's Work Station (PMWS), a series of PC expert systems designed to aid in the implementation of DoD 4245.7-M. The point of contact for the PMWS is the Best Manufacturing Practices Center of Excellence (**http://www.bmpcoe.org**).

The differences between the two baselines are a reflection of the technical process risk present. These results should be documented in a standard format, such as a program-specific Risk Information Form (see MIS discussion this section) to facilitate the development of a risk handling and risk reporting plan.

5.4.3 Program Documentation Evaluation Risk Identification

5.4.3.1 Description. This technique provides a methodology for comparing key program documents and plans to ensure that they are consistent and traceable to one another. Program documents and plans are hierarchical in nature. If the contents (activities, events, schedules, requirements, specifications, etc.) of a document or plan do not flow from or support the contents of those above, below, or adjacent to it, there is a strong chance that risk will be introduced into the program or that known risks will not be adequately addressed. This technique reduces those risks and improves the quality of program documentation.

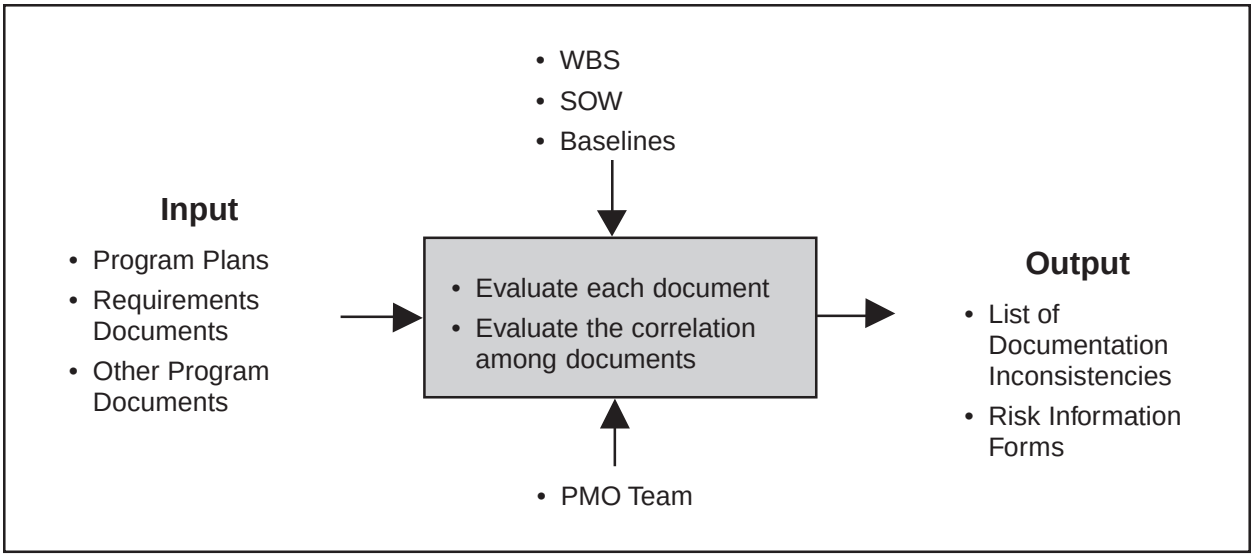

Figure 5-5. Plan Evaluation Technique Input and Output

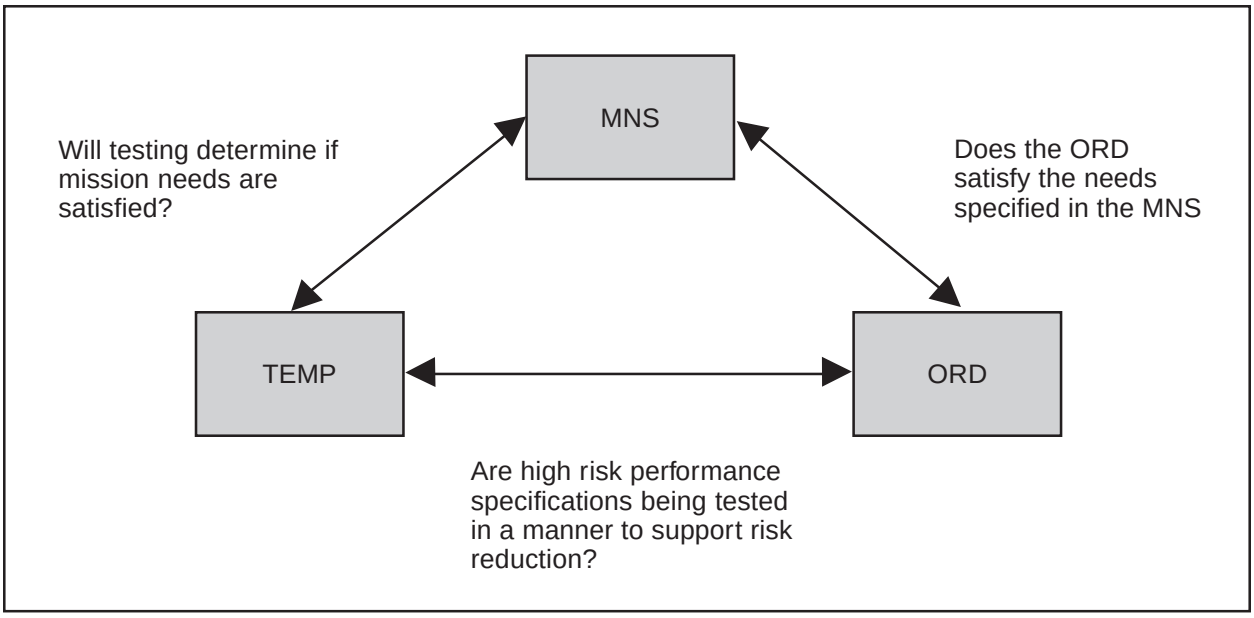

Figure 5-6. Concept Technology Development (CTD) Phase Correlation of Selected Documents (Example)

This technique can be used in any acquisition phase as documents or plans are being developed or updated. The comparison of program documentation and plans should be performed by a small team of experienced, knowledgeable personnel who are intimately familiar with the total program.

5.4.3.2 Procedures. Figure 5-5 shows the process used in this technique. The primary inputs to the process are the PMO documents that detail the steps involved in executing the program. These include, for example, the Mission Need Statement (MNS), Operational Requirements Document (ORD), acquisition plan, any master management plan, Test and Evaluation Master Plan (TEMP), manufacturing plan, etc. Another set of key input documents are those used to communicate with the prime contractor, e.g., WBS, specifications, Statement of Work (SOW) or equivalent such as, Statement of Objectives, etc. Before any comparison, the PMO should review all documents for accuracy and completeness. Figure 5-6 shows an example of the type of correlation that should exist among the MNS, ORD, and TEMP during the CTD Phase.

If the comparison shows any gaps or inconsistencies, reviewers should identify them as possible risks on a RIF, the output of this process.

5.4.4 Threat and Requirements Risk Assessment

5.4.4.1 Description. This technique describes an approach to assess risks associated with requirements and threat and to identify requirements and threat elements that are risk drivers. Because operational needs, environmental demands, and threat determine system performance requirements, to a large degree, they are a major factor in driving the design of the system and can introduce risk in a program. Further, with the introduction of CAIV, PMs and users are directed to examine performance re-quirements and identify areas that are not critical and are available for trade to meet cost objectives. Risk is a factor in CAIV considerations.

The requirements risk assessment process focuses on: determining if operational requirements are properly established and clearly stated for each

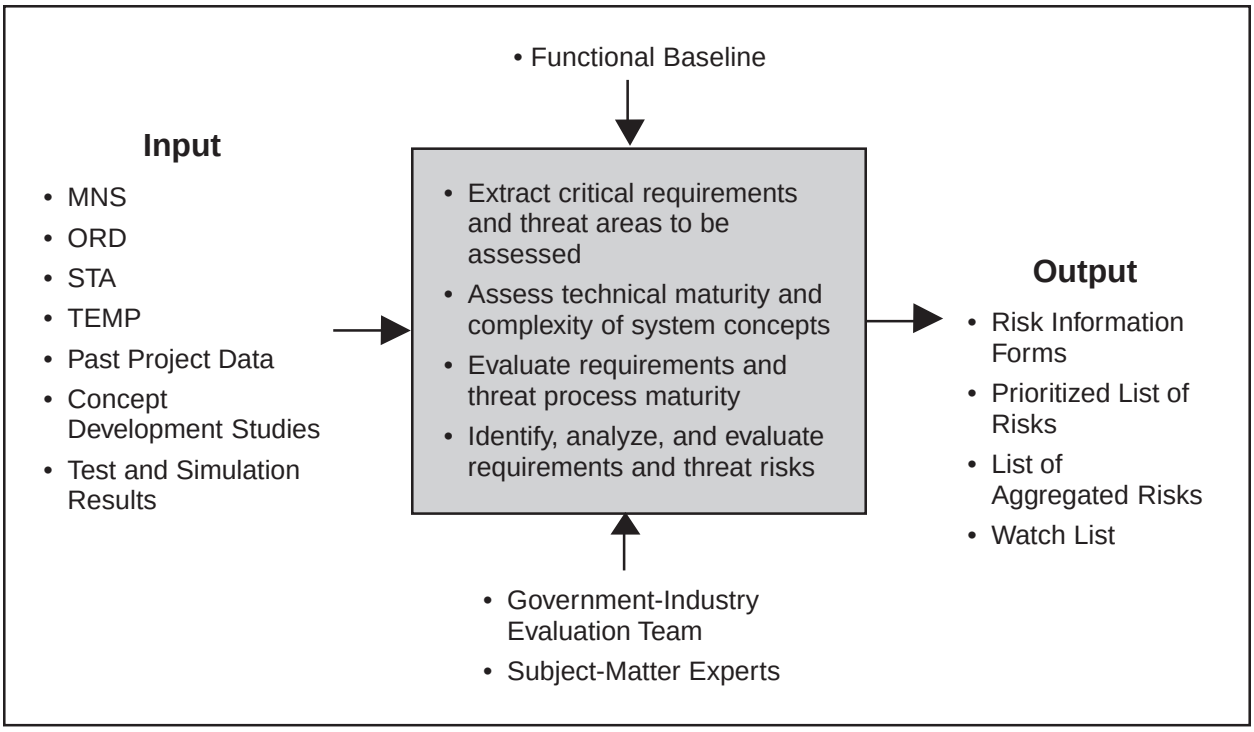

Figure 5-7. Threat and Requirement Risk Assessment Technique Input and Output

program phase; ensuring that requirements are stable and the operating environment is adequately described; addressing logistics and suitability needs; and determining if requirements are too constrictive, thereby identifying a specific solution. The evaluation of the threat risk assessment process' maturity addresses: uncertainty in threat accuracy and stability, sensitivity of design and technology to threat, vulnerability of the system to threat countermeasures, and vulnerability of the program to intelligence penetration. PMs should view requirements in the context of the threat and accurately reflect operational, environmental, and suitability requirements in design documents.

PMs should use threat and requirements assessments during the early phases of program development and, as necessary, as the program advances through development. Early and complete understanding of the requirements and threat precludes misunderstandings between the requirements and development communities, helps to identify risk areas, and allows early planning to handle risk. Consequently, the user should be actively involved in this process from the beginning.

5.4.4.2 Procedures. Figure 5-7 depicts the process used in this technique. The basic approach is to conduct a thorough review of the documents containing performance requirements and threat information, e.g., ORD, TEMP, System Specification, System Threat Assessment (STA), Design Reference Mission Profile, etc., to determine stability, accuracy, operating environment, logistics and suitability requirements, and consistency between these requirements and the threat considerations cited above. There should be an understanding between the users and the developers on Key Performance Parameters (KPPs) in order to identify the requirements that are most important and critical to program success. The Design Reference Mission Profile and Design Requirements templates in DoD 4245.7-M and the Program Documen-

tation Evaluation Risk Identification technique may be useful in support of this technique.

Requirements should be thoroughly reviewed to identify those that drive performance. This will require the "flow down" of performance requirements to components and subassemblies and the identification of technologies/techniques to be used in these components/subassemblies that may significantly affect the system's ability to meet users' needs.

Designers should determine the sensitivity of system performance to the requirements and threat and identify risk drivers. Models and simulations are useful tools to determine this sensitivity. For example, the U.S. Army Materiel System Analysis Activity (AMSAA) has such an analytic model, the AMSAA Risk Assessment Methodology.

The PMWS can also be useful. The risk identified in this technique should be documented in a program-specific format, such as a RIF (see Annex B).

5.4.5 Cost Risk Assessment

5.4.5.1 Description. This technique provides a program-level cost estimate at completion (EAC) that is a function of performance (technical), and schedule risks. It uses the results of previous assessments of WBS elements and cost probability distributions developed for each of the elements. These individual WBS elements are aggregated using a Monte Carlo simulation to obtain a probability distribution of the program-level cost EAC probability distribution function. These results are then analyzed to determine the actual risk of cost overruns and to identify the cost drivers.

The use of these cost probability distributions as the basis for the program-level cost estimate results in a more realistic EAC than the commonly used single point estimates for WBS elements, since they address both the probability of occurrence and consequences/impacts of potential risk events. Their use also eliminates a major cause of underestimating (use of point estimates) and permits the evaluation of performance (technical) or schedule causes of cost risk. Thus, this technique provides a basis for the determination of an "acceptable" level of cost risk.

This technique can be used in any of the acquisition phases, preferably at least once per phase beginning in the CTD Phase although suitable data may not exist until the System Integration (SI) Part of the SDD Phase in some cases. It should be used in conjunction with performance (technical) and schedule risk assessments and may be performed by small Government-industry teams consisting of risk analysts, cost analysts, schedule analysts and technical experts who understand the significance of previous performance and schedule risk assessments. They should report to the Program IPT. This technique requires close and continuous cooperation among cost analysts and knowledgeable technical personnel and the support of the prime contractor's senior management to help get valid cost data.

5.4.5.2 Procedures. Figure 5-8 depicts the process used in applying this technique. The first step is to identify the lowest WBS level for which cost probability distribution will be constructed. The level selected will depend on the program phase; e.g., during the CTD Phase, it may not be possible to go beyond level 2 or 3, simply because the WBS has not yet been developed to lower levels. As the program advances into subsequent phases and the WBS is expanded, it will be possible and necessary to go to lower levels (4, 5, or lower). Specific performance (technical) and schedule risks are then identified for these WBS elements.

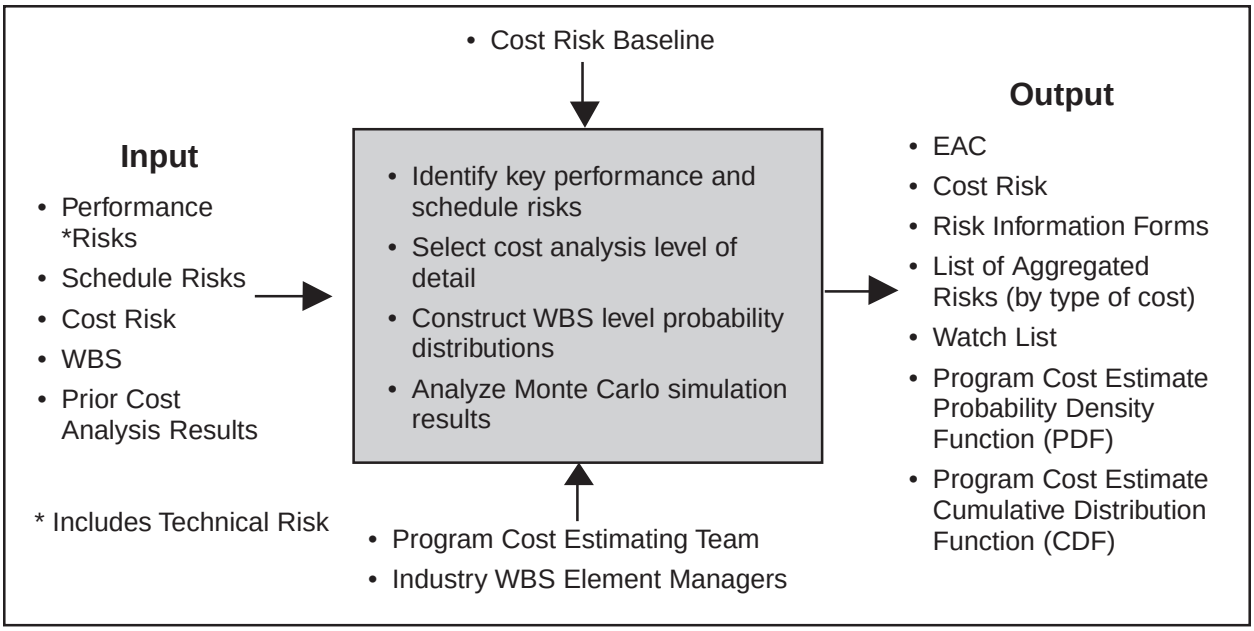

Figure 5-8. Cost Risk Assessment Top-Level Diagram

To develop the WBS elements cost probability distributions, the team, working with the prime contractor's WBS element managers, determines the cost range for each element being investigated. The cost range encompasses cost estimating uncertainty, schedule risk, and technical risk. The validity of the cost data used to construct the distribution is critical. In fact, collecting *good* data is the largest part of the cost risk job. Consequently, PMOs should place major emphasis on this effort.

The element cost probability distributions are aggregated and evaluated using a Monte Carlo simulation program. All Monte Carlo processes contain limitations, but they are more informative than point estimates. Any number of these simulations are readily available to perform this aggregation, and one that meets the specific needs of the program should be selected. The results of this step will be a program-level cost EAC and a cost distribution that shows the cumulative probability associated with different cost values. These outputs are then analyzed to determine the level of cost risk and to identify the specific cost drivers. Cost risk is determined by comparing the EAC with the cost baseline developed as part of the acquisition program baseline. Since the EAC and program cost distribution are developed from WBS element risk assessments, it is possible to determine the cost risk drivers. The cost drivers can also be related back to the appropriate performance and schedule risks. The results of the analysis (cost risks and drivers) should be documented in RIFs.

5.4.6 Quantified Schedule Risk Assessment

5.4.6.1 Description. This technique provides a means to determine program-level schedule risk as a function of risk associated with various activities that compose the program. It estimates the program-level schedule by developing probability distributions for each activity duration and aggregating these distributions using a Monte Carlo simulation or other analytical tools. The resulting program-level schedule is then analyzed to determine the actual schedule risk and to identify the schedule drivers.

This technique expands the commonly used Critical Path Method (CPM) of developing a program schedule to obtain a realistic estimate of schedule risk. The basic CPM approach uses single point estimates for the duration of program activities to develop the program's expected duration and schedule. It invariably leads to underestimating the time required to complete the program and schedule overruns, primarily because the point estimates do not adequately address the uncertainty inherent in individual activities. The uncertainty can be caused by a number of factors and may be a reflection of the risk present in the activity.

The quantified schedule technique accounts for uncertainty by using a range of time that it will take to complete each activity instead of single point estimates. These ranges are then combined to determine the program-level schedule estimate. This approach enables PMs to estimate early in a program if there is a significant probability/likelihood of overrunning the program schedule and by how much. It also identifies high risk program activities that may or may not be on the program "critical path."

This technique can be used in any acquisition phase beginning with the completion of the first statement of work. The schedule probability distribution function for each key activity should be developed as soon as the activity is included in the master schedule. The distribution functions should be periodically reviewed and revised, if necessary, at least once per phase. The technique should be applied by a small Government-industry team consisting of schedule analysts and technical experts who understand the significance of prior risk performance assessments.

5.4.6.2 Procedures. Figure 5-9 shows the process used in this technique. The first step is to identify the lowest activity level for which duration/schedule probability distribution functions will be constructed. The WBS should be used as the starting point for identifying activities and constructing a network of activities. The WBS level selected will depend on the program phase.

Next, the contractor should construct a CPM schedule for these activities. To develop the

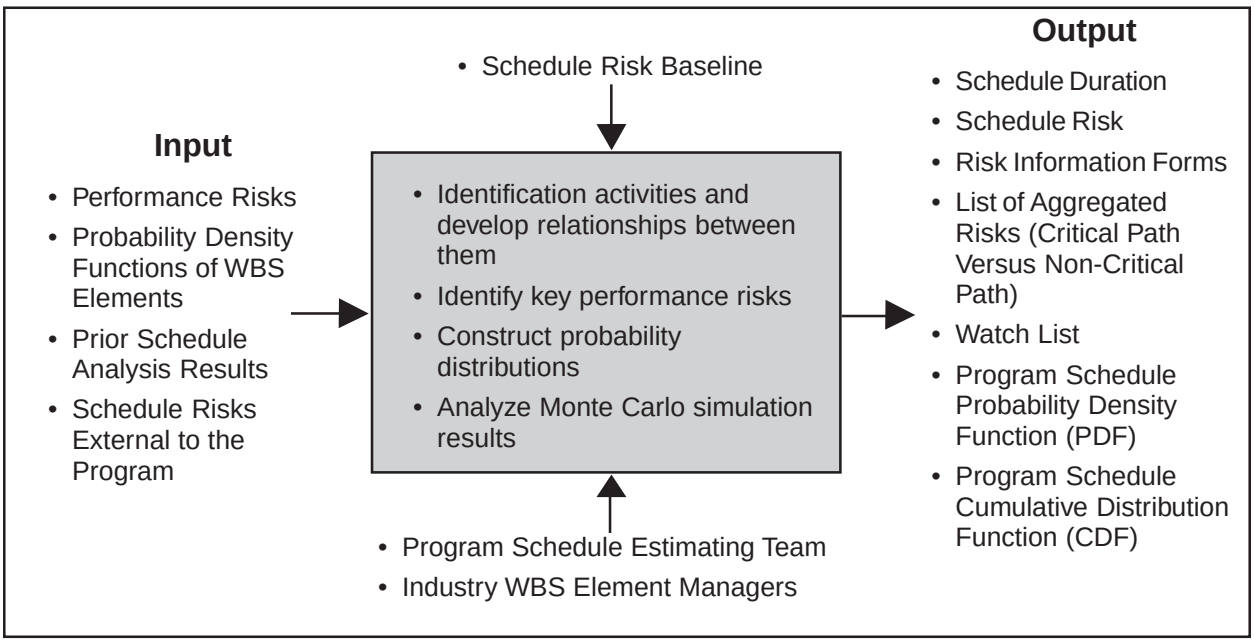

Figure 5-9. Schedule Risk Assessment Technique Input and Output

activity duration probability distribution functions, the team, working with the prime contractor's WBS element managers, determines and analyzes duration range for each activity being investigated. This analysis should be done by schedule analysts working closely with knowledgeable technical people.

The activity duration probability distributions are aggregated using a Monte Carlo simulation program, such as ©Risk, Risk + for Microsoft Project, or Crystal Ball. The result of this step is a program-level schedule and distribution function that shows the cumulative probability associated with different duration values. These outputs are then analyzed to determine the level of schedule risk and to identify the specific schedule drivers. Risk is determined by comparing the program-level schedule with the deterministic schedule baseline developed as part of the acquisition program baseline. The fact that the schedule and distribution are developed from WBS element risk assessments makes it possible to determine the schedule risk drivers. These drivers can also be related back to the appropriate performance risks. The results of the analysis (schedule risks and drivers) should be documented in RIFs. The analysis requires continued close cooperation between the schedule analysts and technical personnel familiar with the details of the program.

5.4.7 Expert Interviews

5.4.7.1 Description. A difficult part of the risk management process is data gathering. This technique provides a means for collecting risk-related data from subject-matter experts and from people who are intimately involved with the various aspects of the program. It relies on "expert" judgment to identify and analyze risk events, develop alternatives, and provide "analyzed" data. It is used almost exclusively in a support role to help develop technical data, such as probability and consequences/impacts information, required by a primary risk assessment technique. It can address all the functional areas that make up the critical risk areas and processes, and can be used in support of risk handling.

Expert judgment is a sound and practical way of obtaining necessary information that is not available elsewhere or practical to develop using engineering or scientific techniques. However, interviewers should be aware that expert opinions may be biased because of over-reliance on certain information and neglect of other information; unwarranted confidence; the tendency to recall most frequent and most recent events; a tendency to neglect rare events; and motivation. Results may have to be tempered because of these biases.

5.4.7.2 Procedures. Figure 5-10 depicts the process used in this technique. The first step in the process is to identify risk areas and processes that are to be evaluated using the expert interview technique. Other techniques described in this section (e.g., WBS Risk Assessment, Process Risk Assessment, etc.) can be used for this purpose.

Once the areas and processes are known, subject-matter experts and program/contractor personnel knowledgeable of the areas and processes should be identified to be interviewed. Similarly, qualified interviewers should be selected for each area and process.

Interviewers should prepare themselves by preparing a strategy and selecting a methodology for analysis and quantification of data. The references list sources for practical techniques for quantifying expert judgment. (See Appendix D for additional guidance in this area.)

After the interview, evaluators analyze the data for consistency, resolve any issues, and document the results. Commercial "Groupware" software is available to assist in compiling and documenting the results of interviews.

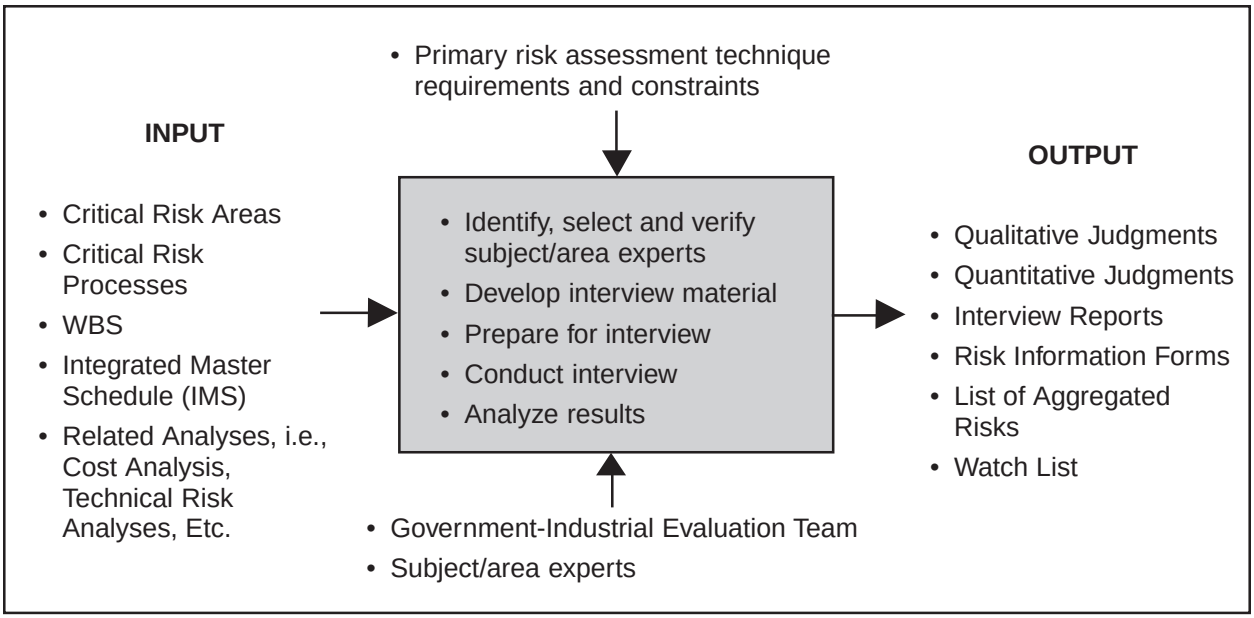

Figure 5-10. Expert Interview Technique Input and Output

5.4.8 Analogy Comparison/ Lessons-Learned Studies

5.4.8.1 Description. This technique uses lessons learned and historical information about the risk associated with programs that are similar to the new system to identify the risk associated with a new program. It is normally used to support other primary risk assessment techniques, e.g., Product (WBS) Risk Assessment, Process Risk Assessment, etc. The technique is based upon the concept that "new" programs are originated or evolved from existing programs or simply represent a new combination of existing components or subsystems. This technique is most appropriate when systems engineering and systems integration issues, plus software development, are minimal. A logical extension of this premise is that key insights can be gained concerning aspects of a current program's risks by examining the successes, failures, problems, and solutions of similar existing or past programs. This technique addresses all the functional areas that make up the critical risk areas and processes.

5.4.8.2 Procedures. Figure 5-11 depicts the process used in this technique. The first step in this approach is to select or develop a baseline comparison system (BCS) that closely approximates the characteristics of the new system/ equipment to as low a level as possible and uses the processes similar to those that are needed to develop the new system. For processes, industry-wide best practices should be used as a baseline. The PMWS is a useful tool for identifying these best practices.

Relevant BCS data are then collected, analyzed, and compared with the new system requirements. The BCS data may require adjustment to make a valid comparison; for example, apply appropriate inflation indices for cost comparisons, adjust design schedule for software evolution versus software development, etc. The comparisons can be a major source of risk assessment data and provide some indication of areas that should be investigated further. This technique is especially useful as a front-end analysis of a new start program.

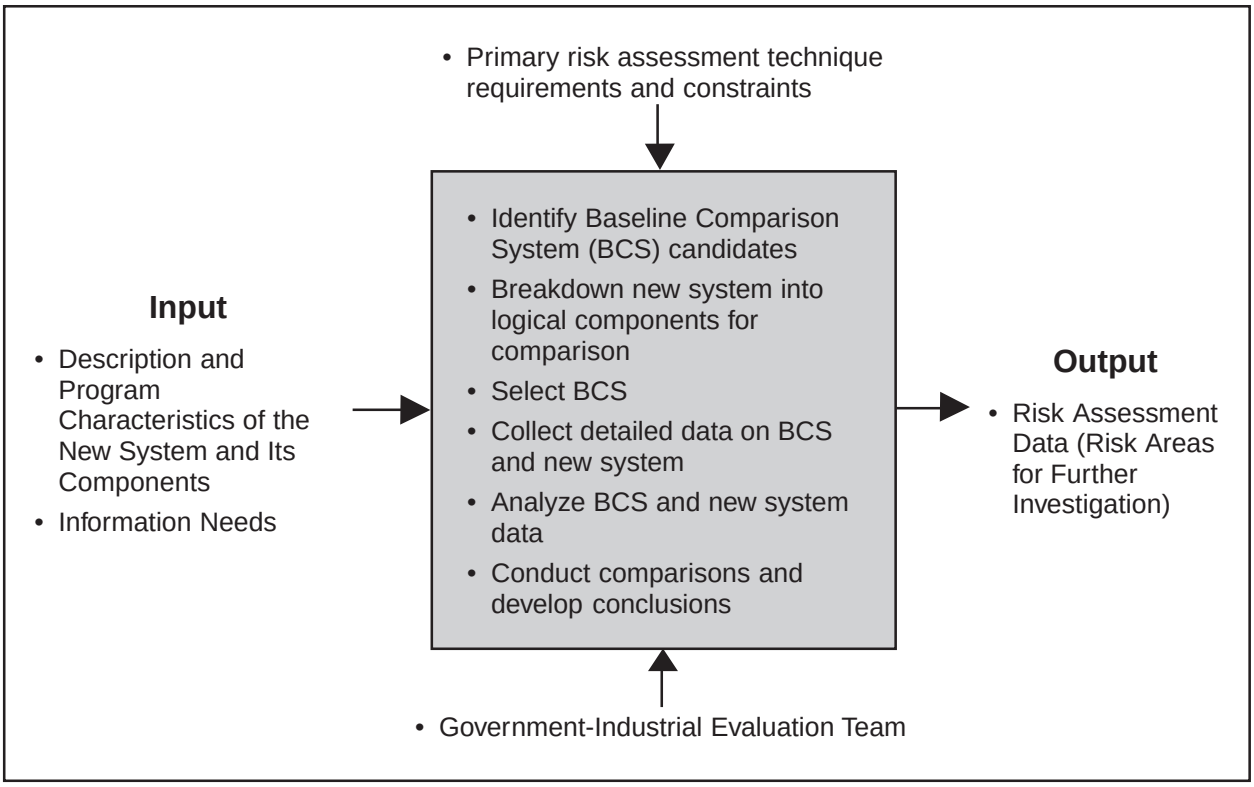

Figure 5-11. Analogy Comparison/Lessons-Learned Studies Top-Level Diagram

5.5 RISK PRIORITIZATION

5.5.1 Description

This technique provides a means to prioritize the risks present in a program. It is a part of risk analysis. The prioritized list provides the basis for developing handling plans, preparing a handling task sequence list, and allocating handling resources.

When using this technique, PMs establish definitive criteria to evaluate the risks, such as, probability (probability/likelihood) of failure, (P_F), and consequence/impact of failure (C_F), along with any other factors considered appropriate. The risks are evaluated using qualitative expert judgment and multi-voting methods to prioritize and aggregate risks. (See References-SEI, *Continuous Risk Management*, 1996, for a discussion of multi-voting methods.)

A qualitative approach using subject-matter experts is generally preferred in this technique because of the tendency to rely on ordinal values to describe P_F, C_F and the inherent inaccuracies resulting from any attempts to use quantifiable methods derived from raw (uncalibrated) ordinal scales.

This technique should be used appropriately during the CTD Phase, and SI and SD parts of the SDD Phase, at the conclusion of a major risk assessment undertaking, when there has been a significant change in the acquisition strategy, when risk monitoring indicates significant changes in the status of a number of risks, and prior to a milestone review.

The PMO risk management coordinator (if assigned) may function as a facilitator and support the program IPT in applying this technique.

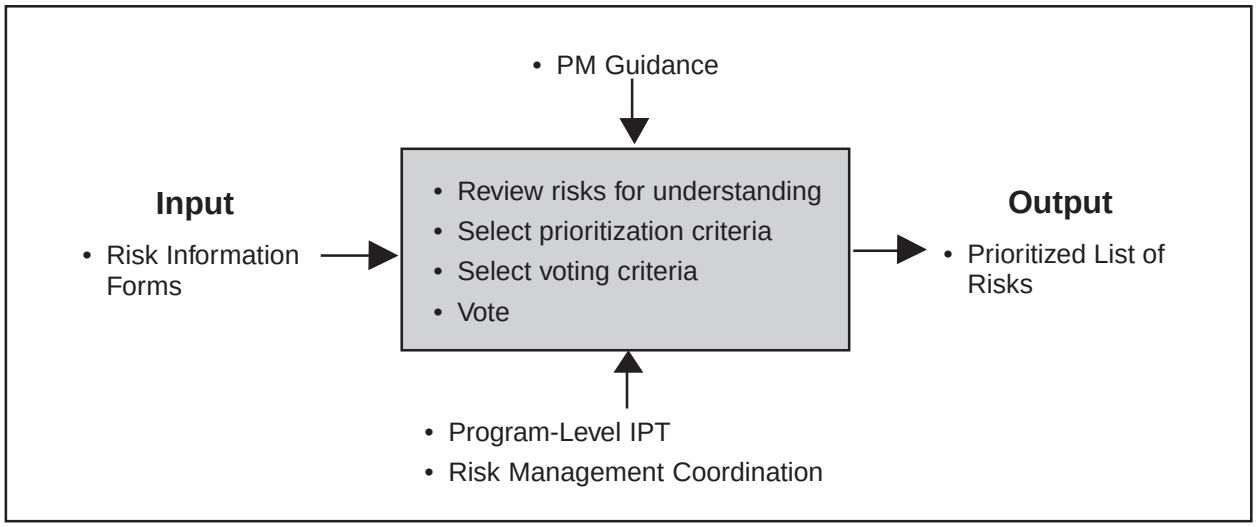

Figure 5-12. Risk Prioritization Technique Input and Output

5.5.2 Procedures

Figure 5-12 depicts the process used to prioritize the risks present in a program. The inputs of this process are risks that have been identified.

The evaluation team, through consensus or as directed by the Risk Management Plan, selects the prioritization criteria. P_F and C_F should always be part of the criteria, along with any other appropriate factors. Urgency, an indication of the time available before the procedures for handling the specific risk must be initiated, is often considered in the evaluation. The PM may also choose to rank-order the prioritization criteria, e.g., consequence/impact is more important than probability.

A multi-voting method is useful to prioritize risks (see References-Scholtes, 1988; Linstone, 1975). The Delphi method is a simple and effective method of arriving at a consensus among a group of experts. The procedure is for team members to vote on the priority of each risk and tally the results, which are fed back to the team. Team members vote again and the process is repeated until no changes occur in the results. It is normal to reach the final outcome within a few voting sessions. If there are a large number of risks, they may be broken into smaller groups for ranking. As a general rule, no more than 10 items should be prioritized per vote. The results of the series of votes are documented in the prioritized list of risks.

PM guidance, which operates as a technique control function, can be used, for example, to specify prioritization criteria and prescribe the format of the prioritized list of risks.

5.5.2.1 Risk Aggregation. Figure 5-13 shows the process for this technique, which relies on qualitative judgment and multi-voting methods to summarize risks at the critical risk area and process level in terms of P_F and C_F. The risks identified in the RIFs and the prioritized list of risks are first grouped according to critical risk areas and processes, and listed in priority sequence.

Within each area and process, the individual risks are evaluated against a set of established criteria to determine the overall aggregate risk rating for the area/process. Aggregation criteria needs to be established separately for P_F and C_F ; P_F and C_F should not be combined into a single index,

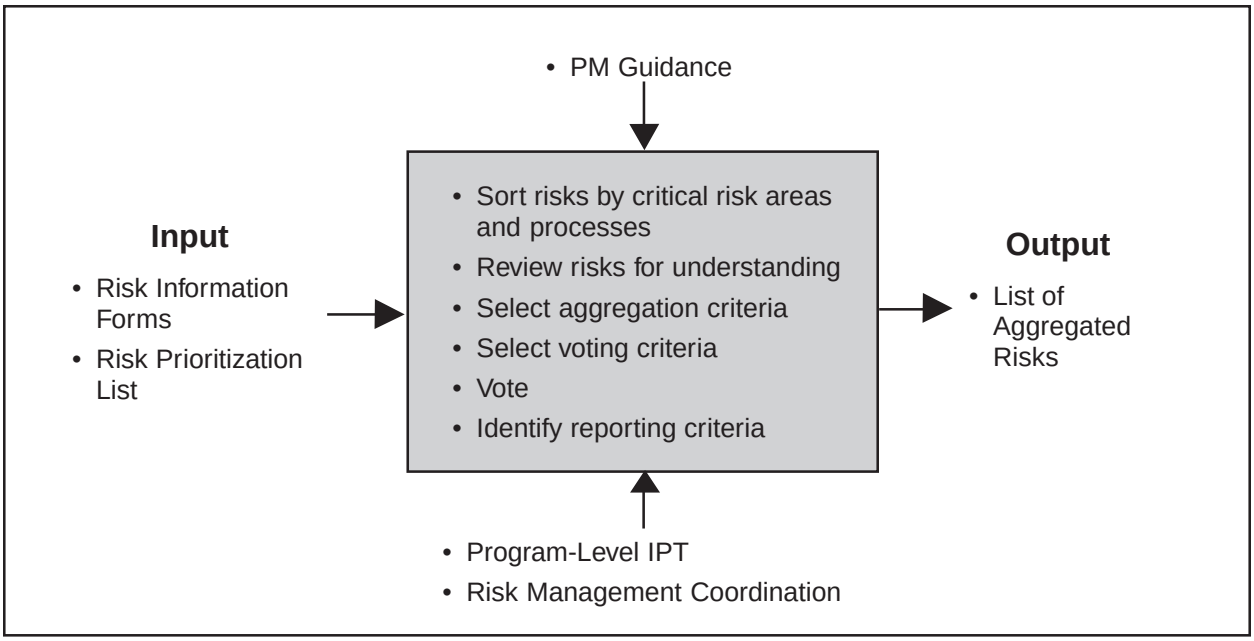

Figure 5-13. Risk Aggregation Technique Input and Output

e.g., moderate risk. Examples of aggregation criteria include: (1) most undesirable P_F and C_F of all the risks within a risk area or process becomes the aggregated values for the area or process, or (2) the P_F and C_F for each area or process represents the mean value for that area or process.

The team then votes on each risk area and process to determine its rating for P_F and C_F, and the results are documented. In addition to the P_F and C_F ratings for each critical risk area and process, those risks that tend to "drive" the aggregate risk rating for the area/process should be included in a list of aggregated risks to give substance to the aggregated ratings, e.g., all risks in which either P_F or C_F are rated as high. Figure 5-14 provides a sample list of aggregated risks.

Program XY Risk Status

Risk Area Status: Design P_F: Hi C_F: Hi
Significant Design Risks:
1. Risk Title: Aircraft Weight P_F: Hi C_F: Hi
Risk Event: Exceed aircraft weight budget by 10%. Decrease range-payload by 4%.
Action: Developing risk-handling plan. User reviewing requirements.

Risk Area Status: Logistics P_F: Hi C_F: Mod/Hi
Significant Logistics Risks: etc.

Figure 5-14. List of Aggregated Risks

Risk Matrix is a software tool that is designed to aid in managing the identification, rating, and prioritization of key risks that might affect a project. It provides a structured method for prioritizing project risks and for tracking the status and effects of risk-handling efforts. The major feature that Risk Matrix offers the program office is a means to both rate and rank program risks. This is helpful in differentiating among risks that have the same rating. For example, if a program has eight risks that the program office has evaluated/rated as high, Risk Matrix provides the means to rank them in order of severity. The user can use this ranking as a guide to help focus risk-handling efforts. Risk Matrix was developed by the Air Force Electronic Systems Center (ESC) and The Mitre Corporation and is available to program offices at no cost. Another useful software tool to use in voting on risks is "Expert Choice"—based on the Analytical Hierarchy Process (AHP). Whatever software tool is used, the analyst should recognize that a number of inherent limitation exist with such software tools, (e.g., unintentionally biasing the voting process) that can lead to erroneous results.

5.6 RISK-HANDLING TECHNIQUES

5.6.1 General (e.g., Moderate and High Risk-Rated Items)

After the program's risks have been assessed, the PM must develop approaches to handle significant ones by analyzing various handling techniques and selecting those best fitted to the program's circumstances. The PM should reflect these approaches in the program's acquisition strategy and include the specifics on what is to be done to deal with the risk, when it should be accomplished, who is responsible, and the cost and schedule impact.

As described in Chapter 2, there are essentially four risk-handling techniques, or options. *Risk avoidance* eliminates the sources of high risk and replaces them with a lower-risk solution. *Risk transfer* is the reallocation of risk from one part of the system to another, or the reallocation of risks between the Government and the prime contractor or within Government agencies. *Risk control* manages the risk in a manner that reduces the probability/likelihood of its occurrence and/or minimizes the risk's effect on the program. *Risk assumption* is the acknowledgment of the existence of a particular risk situation and a conscious decision to accept the associated level of risk without engaging in any special efforts to control it. There is a tendency on many programs to select "control" as the risk-handling option without seriously evaluating assumption, avoidance, and transfer. This is unwise, since control may not be the best option, or even appropriate option in some cases. An unbiased assessment of risk-handling options should be performed to determine the most appropriate option.

In determining the "best" overall risk-handling strategy to be adopted, a structured approach should be taken.

A structured approach for developing a risk-handling strategy has been described by Dr. Edmund Conrow in his book *Effective Risk Management: Some Keys to Success*. (See Reference.) A risk-handling strategy is composed of the selected risk-handling option and the specific implementation activity. The risk-handling option is first chosen, then the best implementation activity is picked for the selected option. This avoids a common mistake —choosing the implementation activity without first evaluating all four risk-handling (generic) options. In cases where a relatively high risk exists, or where the other circumstances dictate, one or more backup risk-handling strategies may be needed. In these cases, the selection process issued again to choose the option and implementation activity. The backup strategy may have a different option than used in the primary

risk-handling strategy, and will certainly have a different implementation activity.

For each evaluated event risk, all potentially applicable options or techniques should be identified and evaluated, using the following criteria:

- **Feasibility –** Feasibility is the ability to implement the handling technique/option and includes an evaluation of the potential impact of the technique/option in the following areas:

  – Technical considerations, such as testing, manufacturing, and maintainability, caused by design changes resulting from risk-handling techniques.

  – Adequacy of budget and schedule flexibility to apply the technique.

  – Operational issues such as usability (man-machine interfaces), transportability, and mobility.

  – Organizational and resource considerations, e.g., manpower, training, and structure.

  – Environmental issues, such as the use of hazardous materials to reduce technical risk.

  – External considerations beyond the immediate scope of the program, such as the impact on other complementary systems or organizations.

- **Cost and schedule implications –** The risk-handling techniques have a broad range of cost implications in terms of dollars, as well as other limited resources, e.g., critical materials and national test facilities. The magnitude of the cost and schedule implications will depend on circumstances and can be assessed using such techniques as cost-benefit analyses and the cost and schedule assessment techniques previously described. The approval and funding of risk-handling techniques should be part of the trade-off process that establishes and refines the CAIV cost and performance goals.

- **Effect on the system's technical performance –** The risk-handling techniques may affect the system's capability to achieve the required technical performance objectives. This impact must be clearly understood before adopting a specific technique. As the risk-handling techniques are assessed, the PMO should attempt to identify any additional parameters that may become critical to technical performance as a result of implementing them. Trade studies and sensitivity analyses can be useful in determining the expected effectiveness of this approach.

Once the risk-handling technique is selected, a set of program management indicators should be developed to provide feedback on program progress, effectiveness of the risk-handling options selected, and information necessary to manage the program. These indicators should consist of cost and scheduling data, technical performance measures, and program metrics.

Subsequent paragraphs in this section describe the various risk-handling technique: Risk Control, Avoidance, Assumption, Transfer (CAAT).

5.6.2 Risk Control

5.6.2.1 Description. In this risk-handling technique, the Government and contractor take active steps to reduce the probability/likelihood of a risk event occurring and to reduce the potential impact on the program. The common name for the control option is "mitigation." Most risk-control steps share two features: they require a commitment of program resources, and they may require additional time to accomplish them.

Thus, the selection of risk-control actions will undoubtedly require some tradeoff between resources and the expected benefit of the actions. Some of the many risk-control actions include the following:

Multiple Development Efforts – The use of two or more independent design teams (usually two separate contractors, although it could also be done internally) to create competing systems in parallel that meet the same performance requirements.

Alternative Design – Sometimes, a design option may include several risky approaches, of which one or more must come to fruition to meet system requirements. However, if the PMO studies the risky approaches, it may be possible to discover a lower-risk approach (with a lower performance capability). These lower-risk approaches could be used as backups for those cases where the primary approach(es) fail to mature in time. This option presumes there is some trading room among requirements. Close coordination between the developer and the user is necessary to implement lower capability options.

Trade Studies – Systems engineering decision analysis methods include trade studies to solve a complex design problem. The purpose of the trade studies is to integrate and balance all engineering requirements in the design of a system. A properly done trade study considers risks associated with alternatives.

Early Prototyping – The nature of a risk can be evaluated by a prototype of a system (or its critical elements) built and tested early in the system development. The results of the prototype can be factored into the design and manufacturing process requirements. In addition to full-up systems, prototyping is very useful in software development and in determining a system's man-machine interface needs. The key to making prototyping successful as a risk-control tool is to minimize the addition of new requirements to the system after the prototype has been tested (i.e., requirement changes not derived from experience with the prototype). Also, the temptation to use the prototype design and software without doing the necessary follow-on design and coding/manufacturing analyses should be avoided.

Incremental Development – Incremental development is completion of the system design and deployment in steps, relying on pre-planned product improvements (P3I) or software improvements after the system is deployed to achieve the final system capability. Usually, these added capabilities are not included originally because of the high risk that they will not be ready along with the remainder of the system. Hence, development is split, with the high-risk portion given more time to mature. The basic system, however, incorporates the provisions necessary to include the add-on capabilities. Incremental development of the initial system requirements are achieved by the basic system.

Technology Maturation Efforts – Technology maturation is an off-line development effort to bring an element of technology to the necessary level so that it can be successfully incorporated into the system (usually done as part of the technology transition process). Normally, technology maturation is used when the desired technology will replace an existing technology, which is available for use in the system. In those cases, technology maturation efforts are used in conjunction with P3I efforts. However, it can also be used when a critical, but immature, technology is needed. In addition to dedicated efforts conducted by the PMO, Service or DoD-wide technology improvement programs and advanced technology demonstrations by Government laboratories as well as industry should be considered.

Robust Design – This approach uses advanced design and manufacturing techniques that promote achieving quality through design. It normally results in products with little sensitivity to variations in the manufacturing process.

Reviews, Walk Throughs, and Inspections – These three risk control actions can be used to reduce the probability/likelihood and potential consequences/impacts of risks through timely assessments of actual or planned events in the development of the product. They vary in the degree of formality, level of participants, and timing.

Reviews are formal sessions held to assess the status of the program, the adequacy and sufficiency of completed events, and the intentions and consistency of future events. Reviews are usually held at the completion of a program phase, when significant products are available. The team conducting the review should have a set of objectives and specific issues to be addressed. The results should be documented in the form of action items to be implemented by the PMO or contractor. The type of review will dictate the composition of the review team, which may include developers, users, managers, and outside experts.

A walk through is a technique that can be very useful in assessing the progress in the development of high- or moderate-risk components, especially software modules. It is less formal than a review, but no less rigorous. The person responsible for the development of the component "walks through," the product development (to include perceptions of what is to be done, how it will be accomplished, and the schedule) with a team of subject-matter experts. The team reviews and evaluates the progress and plans for developing the product and provides immediate and less formal feedback to the responsible person, thus enabling improvements or corrective actions to be made while the product is still under development. This technique is applied during the development phases, as opposed to reviews, which are normally held at the completion of a phase or product.

Inspections are conducted to evaluate the correctness of the product under development in terms of its design, implementation, test plans, and test results. They are more formal and rigorous than either reviews or walk throughs and are conducted by a team of experts following a very focused set of questions concerning all aspects of the product.

Design of Experiments – This is an engineering tool that identifies critical design factors that are difficult to meet.

Open Systems – This approach involves the use of widely accepted commercial specifications and standards for selected system interfaces, products, practices, and tools. It provides the basis for reduced life-cycle costs, improved performance, and enhanced interoperability, especially for long-life systems with short-life technologies. Properly selected and applied commercial specifications and standards can result in lower risk through increased design flexibility; reduced design time; more predictable performance; and easier product integration, support, and upgrade. However, a number of challenges and risks are associated with the use of the open systems approach and must be considered before implementation. These include such issues as: maturity and acceptability of the standard, and its adequacy for military use; the loss of control over the development of products used in the system; the amount of product testing done to ensure conformance to standards; and the higher configuration management workload required.

See *Defense Acquisition Deskbook* Section 1.2.2.2.5 for a more detailed discussion of the use of open systems. (Additional information is

also available at the Open Systems Joint Task Force Website at www.acq.osd.mil/osjtf/.)

Use of Standard Items/Software Module Reuse – The use of standard items and software module reuse should be emphasized to the extent possible to minimize development risk. Standard items range from components and assemblies to full-up systems. A careful examination of the proposed system option will often find more opportunities for the use of standard items or existing software modules than first considered. Even when the system must achieve previously unprecedented requirements, standard items can find uses. A strong program policy emphasizing the use of standard items and software reuse is often the key to taking advantage of this source of risk control. Standard items and software modules have proven characteristics that can reduce risk. However, the PMO must be cautious when using standard items in environments and applications for which they were not designed. A misapplied standard item often leads to problems and failure. Similarly, if the cycle for a fielded product extends for many years, it is possible that key software tools and products will become obsolete or will no longer be supported. If this occurs, costly redesign may result if software re-development is necessary.

Two-Phase Development – This risk control approach incorporates a formal risk-reduction effort in the initial part of the SDD phase. It may involve using two or more contractors with a down-select occurring at a predefined time (normally after the preliminary design review). A logical extension of this concept is the "spiral" development model, which emphasizes the evaluation of alternatives and risk assessments throughout the system's development and initial fielding.

Use of Mockups – The use of mockups, especially man-machine interface mock-ups, can be used to conduct early exploration of design options. They can assist in resolving design uncertainties and providing users with early views of the final system configuration.

Modeling/Simulation – The use of modeling and simulation can provide insights into a system's performance and effectiveness sensitivities. Decision makers can use performance predictions to assess a system's military worth not only before any physical prototypes are built, but also throughout the system life cycle. Modeling and simulation can help manage risk by providing information on design capabilities and failure modes during the early stages of design. This allows initial design concepts to be iterated without having to build hardware for testing. The T&E community can use predictive simulations to focus the use of valuable test assets on critical test issues. They can also use extrapolated simulations to expand the scope of evaluation into areas not readily testable, thus reducing the risk of having the system fail in the outer edges of the "test envelope." Additionally, a model can serve as a framework to bridge the missing pieces of a complete system until those pieces become available.

Although modeling and simulation can be a very effective risk-handling tool, it requires resources, commitment to refine models as the system under development matures, and a concerted verification and validation effort to ensure that decisions are based on credible information.

Key Parameter Control Boards – When a particular parameter (such as system weight) is crucial to achieving the overall program requirements, a control board for that parameter may be appropriate. This board has representatives from all affected technical functions and may be chaired by the PM. It provides management focus on the parameter and signals the importance of achieving the parameter to the technical community. If staffed

properly by all affected disciplines, it can also help avoid sacrificing other program requirements to achieve that requirement.

Manufacturing Screening – For programs in late SDD and early production and deployment, various manufacturing screens (including environmental stress screening (ESS)) can be incorporated into test article production and low-rate initial production to identify deficient manufacturing processes. ESS is a manufacturing process for stimulating parts and workmanship defects in electronic assemblies and units. These data can then be used to develop the appropriate corrective actions.

Test, Analyze, and Fix (TAAF) – TAAF is the use of a period of dedicated testing to identify and correct deficiencies in a design. It was originally conceived as an approach to improve reliability; it can also be used for any system parameter whose development could benefit from a dedicated period of testing and analysis. Although a valuable aid in the development process, TAAF should not be used in lieu of a sound design process.

Demonstration Events – Demonstration events are points in the program (usually tests) that are used to determine if risks are being successfully abated. Careful review of the planned development of each risk area will reveal a number of opportunities to verify the effectiveness of the development approach. By including a sequence of demonstration events throughout the development, PMO and contractor personnel can monitor the process and identify when additional efforts are needed. Demonstration events can also be used as information-gathering actions, as discussed before, and as part of the risk-monitoring process. Table 5-2 contains examples of demonstration events.

Process Proofing – When particular processes, especially those of manufacturing and support, are critical to achieving system requirements, an early process proof demonstration is useful to abate risk. If the initial proof is unsuccessful, time

Item	Demonstration Event	Completion Date
Rocket Motor	Three Case Burst Tests Propellant Characterization Thermal Barrier Bond Tests Ignition and Safe/Arm Tests Nozzle Assembly Tests	By completion of preliminary design
	10 Development Motor Firings — Temperature and Altitude Cycle — Vibration and Shock — Aging	By completion of final design
Central Computer	Test Breadboard Develop/Test Unique Microcircuits	By completion of preliminary design
	Build/Test Prototype	By completion of final design

Table 5-2. Examples of Demonstration Events

is still available to identify and correct deficiencies or to select an alternative approach.

No single technique or tool is capable of providing a complete answer—a combination must be used. In general, risk-monitoring techniques are applied to follow through on the planned actions of the risk-handling program. They track and evaluate the effectiveness of handling activities by comparing planned actions with what is actually achieved. These comparisons may be as straightforward as actual versus planned completion dates, or as complex as detailed analysis of observed data versus planned profiles. In any case, the differences between planned and actual data are examined to determine status and the need for any changes in the risk-handling approach.

PMO personnel should also ensure that the indicators/metrics selected to monitor program status adequately portray the true state of the risk events and handling actions. Otherwise, indicators of risks that are about to become problems will go undetected. Subsequent sections identify specific techniques and tools that will be useful to PMOs in monitoring risks and provide information on selecting metrics that are essential to the monitoring effort. The techniques focus primarily at the program level, addressing cost, schedule, and performance risks.

5.6.2.2 Procedures. Risk control involves developing a risk-reduction plan, with actions identified, resourced, and scheduled. Success criteria for each of the risk-reduction events should also be identified. The effectiveness of these actions must be monitored using the types of techniques described in Section 5.7.

5.6.3 Risk Avoidance

5.6.3.1 Description. This technique reduces risk through the modification or elimination of those operational requirements, processes or activities that cause the risks. Eliminating operational requirements requires close coordination with the users. Since this technique results in the reduction of risk, it should generally be initiated in the development of a risk-handling plan. It can be done in parallel with the initial operational requirements analysis and should be supported by a cost-benefit analysis.

5.6.3.2 Procedures. Analyzing and reviewing the proposed system in detail with the user is essential to determine the drivers for each operational requirement. Operational requirements scrubbing involves eliminating those that have no strong basis. This also provides the PMO and the user with an understanding of what the real needs are and allows them to establish accurate system requirements for the critical performance. Operational requirements scrubbing essentially consists of developing answers to the following questions:

- Why is the requirement needed?
- What will the requirement provide?
- How will the capability be used?
- Are the requirements specified in terms of functions and capabilities, rather than a specific design?

Cost/requirement trade studies are used to support operational requirements scrubbing. These trades examine each requirement and determine the cost to achieve various levels of the requirement (e.g., different airspeeds, range, payloads). The results are then used to determine, with the user, whether a particular requirement level is worth the cost of achieving that level. Trade studies are an inherent part of the systems engineering process. (See *Desk-book* 2.6.1 for details on systems engineering process.)

5.6.4 Risk Assumption

5.6.4.1 Description. This technique is used in every program and acknowledges the fact that, in any program, risks exist that will have to be accepted without any special effort to control them. Such risks may be either inherent in the program or may result from other risk-controlling actions (residual risks). The fact that risks are assumed does not mean that they are ignored. In fact, every effort should be made to identify and understand them so that appropriate management action can be planned. Also, risks that are assumed should be monitored during development; this monitoring should be well-planned from the beginning.

5.6.4.2 Procedures. In addition to the identification of risks to be assumed, the following steps are key to successful risk assumption:

- Identify the resources (time, money, people, etc.) needed to overcome a risk if it materializes. This includes identifying the specific management actions that will be used, for example, redesign, retesting, requirements review, etc.

- Whenever a risk is assumed, a schedule and cost risk reserve should be set aside to cover the specific actions to be taken if the risk occurs. If this is not possible, the program may proceed within the funds and schedule allotted to the effort. If the program cannot achieve its objectives, a decision must be made to allocate additional resources, accept a lower level of capability (lower the requirements), or cancel the effort.

- Ensure that the necessary administrative actions are taken to quickly report on the risk event and implement these management actions, such as contracts for industry expert consultants, arrangements for test facilities, etc., and report on occurrences of the risk event.

5.6.5 Risk Transfer

5.6.5.1 Description. This technique involves the reduction of risk exposure by the reallocation of risk from one part of the system to another or the reallocation of risks between the Government and the prime contractor, or between the prime contractor and its sub-contractor.

5.6.5.2 Procedures. In reallocating risk, design requirements that are risk drivers are transferred to other system elements, which may result in lower system risk but still meet system requirements. For example, a high risk caused by a system timing requirement may be lowered by transferring that requirement from a software module to a specially designed hardware module capable of meeting those needs. The effectiveness of requirements reallocation depends on good system engineering and design techniques. In fact, efficient allocation of those requirements that are risk drivers is an integral part of the systems engineering process. Modularity and functional partitioning are two design techniques that can be used to support this type of risk transfer. In some cases, this approach may be used to concentrate risk areas in one area of the system design. This allows management to focus attention and resources on that area.

For the Government/contractor risk-transfer approach to be effective, the risks transferred to the contractor must be those that the contractor has the capacity to control and manage. These are generally risks associated with technologies and processes used in the program — those for which the contractor can implement proactive solutions. The types of risks that are best managed by the Government include those related to the stability of and external influences on program requirements, funding, and schedule, for example. The contractor can support the management of these risks through the development of flexible program plans, and the

incorporation of performance margins in the system and flexibility in the schedule. A number of options are available to implement risk transfer from the Government to the contractor: warranties, cost incentives, product performance incentives, and various types of fixed price contracts. A similar assessment of prime contractor versus sub-contractor allocation of risks can also be developed and used to guide risk transfer between these parties.

5.7 RISK MONITORING

5.7.1 General

Risk monitoring is a continuous process to systematically track and evaluate the performance of risk-handling actions against established metrics throughout the acquisition process. It should also include results of periodic reassessments of program risk to evaluate both known and new risks to the program. If necessary, the PMO should reexamine the risk-handling approaches for effectiveness while conducting assessments. As the program progresses, the monitoring process will identify the need for additional risk-handling options.

An effective monitoring effort provides information to show if handling actions are not working and which risks are on their way to becoming actual problems. The information should be available in sufficient time for the PMO to take corrective action. The functioning of IPTs is crucial to effective risk monitoring. They are the "front line" for obtaining indications that handling efforts are achieving their desired effects.

The establishment of a management indicator system that provides accurate, timely, and relevant risk information in a clear, easily understood manner is key to risk monitoring. Early in the planning phase of the process, PMOs should identify specific indicators to be monitored and information to be collected, compiled, and reported. Usually, documentation and reporting procedures are developed as part of risk management planning before contract award and should use the contractor's reporting system. Specific procedures and details for risk reporting should be included in the risk management plans prepared by the Government and the contractor.

To ensure that significant risks are effectively monitored, handling actions (which include specific events, schedules, and "success" criteria) developed during previous risk management phases should be reflected in integrated program planning and scheduling. Identifying these handling actions and events in the context of WBS elements establishes a linkage between them and specific work packages, making it easier to determine the impact of actions on cost, schedule, and performance. The detailed information on risk-handling actions and events should be contained in various risk management documentation (both formal and informal). Experience has shown that the use of an electronic on-line database that stores and permits retrieval of risk-related information is almost essential to effective risk monitoring. The database selected or developed will depend on the program. A discussion of risk management information systems and databases and suggested data elements to be included in the databases is contained later in this chapter.

5.7.2 Earned Value Management

5.7.2.1 Description. Earned value (EV) is a management technique that relates resource planning to schedules and to technical performance requirements. It is useful in monitoring the effectiveness of risk-handling actions in that it provides periodic comparisons of the actual work accomplished in terms of cost and schedule with the work planned and budgeted. These comparisons are made using a performance baseline that

is established by the contractor and the PM at the beginning of the contract period. This is accomplished through the Integrated Baseline Review (IBR) process. The baseline must capture the entire technical scope of the program in detailed work packages. The baseline also includes the schedule to meet the requirements as well as the resources to be applied to each work package. Specific risk-handling actions should be included in these packages. See *Defense Acquisition Deskbook* Section 2.B.2.1 for a more detailed discussion of Earned Value and IBR.

5.7.2.2 Procedures. The periodic EV data can provide indications of risk and the effectiveness of handling actions. When variances in cost or schedule begin to appear in work packages containing risk-handling actions, or in any work package, the appropriate IPTs can analyze the data to isolate causes of the variances and gain insights into the need to modify or create handling actions.

5.7.3 Technical Performance Measurement

5.7.3.1 Description. Technical performance measurement (TPM) is a technique that compares estimated values of key performance parameters with achieved values, and determines the impact of any differences on system effectiveness. This technique can be useful in risk monitoring by comparing planned and achieved values of parameters in areas of known risk. The periodic application of this technique can provide early and continuing predictions of the effectiveness of risk-handling actions or the detection of new risks before irrevocable impacts on the cost or schedule occur.

5.7.3.2 Procedures. The technical performance parameters selected should be those that are indicators of progress in the risk-handling action employed. They can be related to system hardware, software, human factors, and logistics—any product or functional area of the system. Parameter values to be achieved through the planned handling action are forecast in the form of planned performance profiles. Achieved values for these parameters are compared with the expected values from the profile, and any differences are analyzed to get an indication of the effectiveness of the handling action. For example, suppose a system requires the use of a specific technology that is not yet mature and the use of which has been assessed as high risk. The handling technique selected is risk control, and an off-line technology maturation effort will be used to get the technology to the level where the risk is acceptable. The technology is analyzed to identify those parameters that are key drivers, and performance profiles that will result from a sufficiently mature technology are established. As the maturation effort progresses, the achieved values of these parameters are compared with the planned profile. If the achieved values meet the planned profile, it is an indicator that the risk-handling approach is progressing satisfactorily; if the achieved values fall short of the expected values, it is an indicator that the approach is failing to meet expectations and corrective action may be warranted.

5.7.4 Integrated Planning and Scheduling

5.7.4.1 Description. Once a contract has been awarded, techniques such as integrated planning and scheduling (integrated master plans and integrated master schedules) can become invaluable program baseline and risk-monitoring tools. Integrated planning identifies key events, milestones, reviews, all integrated technical tasks, and risk-reduction actions for the program, along with accomplishment criteria to provide a definitive measure that the required maturity or progress has been achieved. Integrated scheduling describes the detailed tasks that support the significant activities identified in integrated planning and timing of tasks. Also, the integrated

schedule can include the resources planned to complete the tasks. The events, tasks, and schedule resulting from integrated planning are linked with contract specification requirements, WBS, and other techniques such as TPM. When the events and tasks are related to risk-reduction actions, this linkage provides a significant monitoring tool, giving specific insights into the relationships among cost, schedule, and performance risks.

5.7.4.2 Procedures. In integrated planning, the Government and contractor (or other performing activity) should identify key activities of the program, to include risk-handling actions and success criteria. The contractor should then prepare the integrated schedule reflecting the planned completion of tasks associated with these activities. As the program progresses, the PMO can monitor effectiveness of handling activities included in the integrated planning events and schedule by comparing observed activity results with their criteria and determining any deviations from the planned schedule. Any failures of handling actions to meet either the event criteria or schedule should be analyzed to determine the deviation's impact, causes, and need for any modifications to the risk-handling approach.

5.7.5 Watch List

5.7.5.1 Description. The watch list is a listing of critical areas which management should pay special attention to during program execution. It is a straightforward, easily prepared

Potential Risk Area	Risk Reduction Actions	Action Code	Due Date	Date Completed	Explanation
• Accurately predicting shock environment shipboard equipment will experience.	• Use multiple finite element codes & simplified numerical models for early assessments.	SEA 03P31	31 Aug 01		
	• Shock test simple isolated deck, and proposed isolated structure to improve confidence in predictions.	SEA 03P31	31 Aug 02		
• Evaluating acoustic impact of the ship systems that are not similar to previous designs.	• Concentrate on acoustic modeling and scale testing of technologies not demonstrated successfully in large-scale tests or full-scale tests.	SEA 03TC	31 Aug 01		
	• Factor acoustic signature mitigation from isolated modular decks into system requirements. Continue model tests to validate predictions for isolated decks.	SEA 03TC	31 Aug 02		

Table 5-3. Watch List Example

document that is derived from a prioritized list of risks. It may include such things as the priority of the risk, how long it has been on the watch list, handling actions, planned and actual completion dates for handling actions, and explanations for any differences. See Table 5-3 for an example watch list.

5.7.5.2 Procedures. Watch list development is based on the results of the risk assessment. It is common to keep the number of risks on the watch list relatively small, focusing on those that can have the greatest impact on the program. Items can be added as the program unfolds and periodic reassessments are conducted. If a considerable number of new risks are significant enough to be added to the watch list, it may be an indicator that the original assessment was not accurate and that program risk is greater than initially thought. It may also indicate that the program is on the verge of becoming out of control. If a risk has been on the watch list for a long time because of a lack of risk-handling progress, a reassessment of the risk or the handling approach may be necessary. Items on the watch list should be reviewed during the various program reviews/meetings, both formal and informal.

5.7.6 Reports

5.7.6.1 Description. Reports are used to convey information to decision makers and program team members on the status of risks and the effectiveness of risk-handling actions. Risk-related reports can be presented in a variety of ways, ranging from informal verbal reports when time is of the essence to formal summary-type reports

Risk Management Status

Risk Plan #	Risk Issue	High	Moderate	Low	Status/Comment
98-12-9	Non-stock Listed Spares		●		Data still in review; need to assign part numbers.
98-12-10	Engineering Updates		→	Closed	Data reviewed; updates not required at this time.
98-12-11	Spares & Support		→	Closed	
98-12-12	Long Lead Requisitions		●		Spares listing approved in definitization conference. No current abatement plan.
98-12-13	T.O. Validation		→	Closed	Closed Issue.
98-12-14	**Lack of LSA Records for GFE***		●		**Contractor LSA plan submitted for approval; rescheduled for 5/95.**
98-12-15	Program Parts Obsolescence		→	●	Analysis in work, identifying last opportunity buys.
98-12-51	Design Maturity		→	Closed	Studying Commercial Mix Interface.
98-12-16	System Y Interface Definition		←		Questions about antenna location and cable raised risk.

(* Detail of highlighted item described in Figure 5-16.)

Figure 5-15. Example Showing Detailed List of Top-Level Risk Information

presented at milestone reviews. The level of detail presented will depend on the audience.

5.7.6.2 Procedures. Successful risk management programs include timely reporting of results of the monitoring process. Reporting requirements and procedures, to include format and frequency, are normally developed as part of risk management planning and are documented in the risk management plan. Reports are normally prepared and presented as part of routine program management activities. They can be effectively incorporated into program management reviews and technical milestones to indicate any technical, schedule, and cost barriers to the program objectives and milestones being met. One example of a status presentation is shown in Figure 5-15. It shows some top-level risk information that can be useful to the PMO as well as others external to the program.

Although this level of reporting can provide quick review of overall risk status for identified problems, more detailed risk planning and status can be provided on individual risk items. For example, some program IPTs have combined risk level and scheduled activities to provide a graphical overview of risk status for either internal or external review. One method for graphically showing risk status for an individual item is shown in Figure 5-16.

5.7.7 Management Indicator System

5.7.7.1 Description. A management indicator system is a set of indicators or metrics that provide the PMO with timely information on the

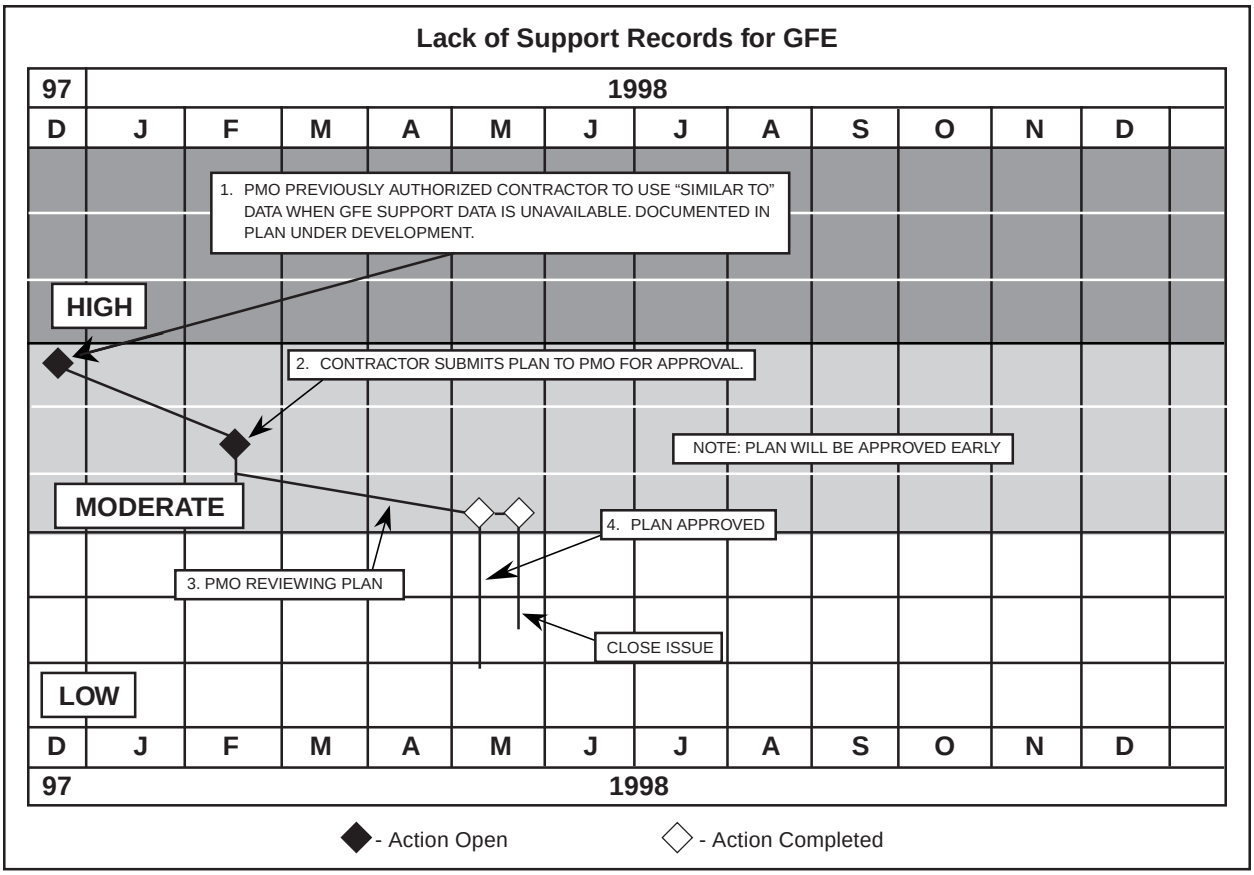

Figure 5-16. Example of More Complex Combination of Risk Level and Scheduled Tasks

status of the program and risk-handling actions, and is essential to risk monitoring and program success. To be meaningful, these metrics should have some objective value against which observed data can be measured, reflecting trends in the program or lack thereof. Metrics should be developed jointly by the PMO and the contractor. The contractor's approach to metrics should be a consideration in the proposal evaluation process. If the contractor does not have an established set of metrics, this may be an area of risk that will need to be addressed.

5.7.7.2 Procedures. Metrics can be categorized as relating to technical performance, cost, and schedule. Technical performance metrics can be further broken down into categories such as engineering, production, and support, and within these groups as either product- or process-related. Product-related metrics pertain to characteristics of the system being developed; they can include such things as planned and demonstrated values of the critical parameters monitored as part of the TPM process and system-unique data pertaining to the different steps in the development and acquisition processes. Table 5-4 provides examples of product-related metrics.

Process metrics pertain to the various processes used in the development and production of the system. For each program, certain processes are critical to the achievement of program objectives. Failure of these processes to achieve their requirements is symptomatic of significant problems. Metrics data can be used to diagnose and aid in problem resolution. They should be used in formal, periodic performance assessments of the various development processes and to evaluate how well the system development process is achieving its objectives. DoD 4245.7M, *Transition from Development to Production*, and other supporting documents such as NAVSO P-6071, *Best Practices*, identify seven process areas: funding, design, test, production, facilities, logistics, and management. Within each of these areas, a number of specific processes are

Engineering	Requirements	Production	Support
• Key Design Parameters – Weight – Size – Endurance – Range • Design Maturity – Open problems reports – Number of engineering change proposals – Number of drawings released – Failure activities • Computer Resource Utilization	• Requirements Traceability • Requirements Stability	• Manufacturing Yields • Incoming Material Yields • Delinquent Requisitions • Unit Production Cost • Process Proofing	• Special Tools and Test Equipment • Support Infrastructure Footprint • Manpower Estimates

Table 5-4. Examples of Product-Related Metrics

identified as essential to assess, monitor, and establish program risk at an acceptable level; the documents also provide risk indicators that can be used as the basis for selecting specific process metrics. Another document, *Methods and Metrics for Product Success*, July 1994, published by the Office of the Assistant Secretary of the Navy (RD&A), Product Integrity Directorate, provides a set of metrics for use in assessing and monitoring the design, test, and production risk areas. Table 5-5 provides examples of process-related metrics.

Cost and schedule metrics can be used to depict how the program is progressing toward completion. The information provided by the contractor in the earned value management system can serve as these metrics, showing how the actual work accomplished compares with the work planned in terms of schedule and cost. Other sources of cost and schedule metrics include the contractor's cost accounting information and the integrated master schedule. Table 5-6 provides examples of cost and schedule metrics.

Design Requirements	Trade Studies	Design Process	Integrated Test Plan	Failure Reporting System	Manufacturing Plan
• Development of requirements traceability plan • Development of specification tree • Specifications reviewed for: – Definition of all use environments – Definition of all functional requirements for each mission performed	• Users needs prioritized • Alternative system configurations selected • Test methods selected	• Design requirements stability • Producibility analysis conducted • Design analyzed for: – Cost – Parts reduction – Manufacturability – Testability	• All developmental tests at system and subsystem level identified • Identification of who will to test (Government, contractor, supplier)	• Contractor corporate-level management involved in failure reporting and corrective action process • Responsibility for analysis and corrective action assigned to specific individual with close-out date	• Plan documents methods by which design to be built • Plan contains sequence and schedule of events at contractor and subcontractor levels that defines use of materials, fabrication flow, test equipment, tools, facilities, and personnel • Reflects manufacturing inclusion in design process. Includes identification and assessment of design facilities

Table 5-5. Examples of Process Metrics

Cost	Schedule
Cost variance Cost performance index Estimate at completion Management reserve	Schedule variance Schedule performance index Design schedule performance Manufacturing schedule performance Test schedule performance

Table 5-6. Examples of Cost and Schedule Metrics

5.8 RISK MANAGEMENT INFORMATION SYSTEMS AND DOCUMENTATION

5.8.1 Description

To manage risk, PMs should have a database management system that stores and allows retrieval of risk-related data. The risk-management information system provides data for creating reports and serves as the repository for all current and historical information related to risk. This information may include risk assessment documents, contract deliverables, if appropriate, and any other risk-related reports. The PM should consider a number of factors in establishing the management information system and developing rules and procedures for the reporting system:

- Assign management responsibility for the reporting system;
- Publish any restrictions for entering data into the database;
- Identify reports and establish a schedule, if appropriate;
- Use standard report formats as much as possible;
- Ensure that the standard report formats support all users, such as the PM, IPTs, and IIPTs
- Establish policy concerning access to the reporting system and protect the database from unauthorized access.

With a well-structured information system, a PMO may create reports for senior management and retrieve data for day-to-day program management. Most likely, the PM will choose a set of standard reports that suits specific needs on a periodic basis. This eases definition of the contents and structure of the database. In addition to standard reports, the PMO will need to create ad hoc reports in response to special queries, etc. Commercial database programs now available allow the PMO to create reports with relative ease. Figure 5-17 shows a concept for a management and reporting system.

5.8.2 Risk Management Reports

The following are examples of basic reports that a PMO may use to manage its risk program. Each office should tailor and amplify them, if necessary, to meet specific needs.

Risk Information Form (RIF). The PMO needs a document that serves the dual purpose of a *source* of data entry information and a *report* of basic information for the IPTs. The RIF serves this purpose. It gives members of the project team, both Government and contractors, a format for reporting risk-related information. The RIF should be used when a potential risk event is identified and updated over time as information becomes available and the status

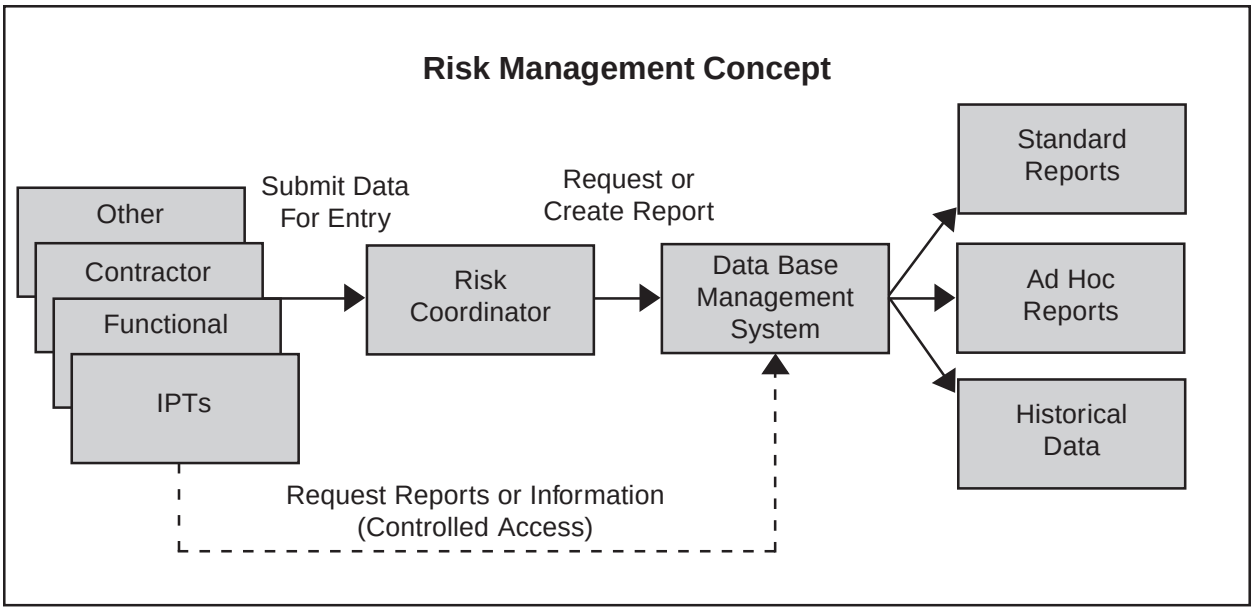

Figure 5-17. Conceptual Risk Management and Reporting System

changes. As a source of data entry, the RIF allows the database administrator to control entries. To construct the database and ensure the integrity of data, the PMO should design a standard format for a RIF.

Risk Assessment Report (RAR). Risk assessments form the basis for many program decisions, and the PM will probably need a detailed report of any assessment of a risk event. A RAR is prepared by the team that assessed a risk event and amplifies the information in the RIF. It documents the identification and analysis process and results. The RAR provides information for the summary contained in the RIF, is the basis for developing risk-handling plans, and serves as a historical recording of program risk assessment. Since RARs may be large documents, they may be stored as files. RARs should include information that links it to the appropriate RIF.

Risk-Handling Documentation. Risk-handling documentation may be used to provide the PM with the information he needs to choose the preferred mitigation option and is the basis for the handling plan summary that is contained in the RIF. This document describes the examination process for the risk-handling options and gives the basis for the selection of the recommended choice. After the PM chooses an option, the rationale for that choice may be included. There should be a plan for each risk-mitigation task. Risk-handling plans are based on results of the risk assessment. This document should include information that links it to the appropriate RIF.

Risk Monitoring Documentation. The PM needs a summary document that tracks the status of high and moderate risks. He can produce a risk-tracking list, for example, that uses information that has been entered from the RIF. Each PMO should tailor the tracking list to suit its needs. If elements of needed information are not included in the RIF, they should be added to that document to ensure entry into the database.

Database Management System (DBMS). The DBMS that the PM chooses may be commercial, Government-owned, or contractor-developed. It should provide the means to enter and access

data, control access, and create reports. Many options are available to users.

Key to the MIS are the data elements that reside in the database. The items listed in Table 5-7 are examples of risk information that might be included in a database that supports risk management. They are a compilation of several risk reporting forms used in current DoD programs and other risk document sources. "Element" is the title of the database field; "Description" is a summary of the field contents. PMs should tailor the list to suit their needs.

5.9 SOFTWARE RISK MANAGEMENT METHODOLOGIES

The management of risk in software intensive programs is essentially the same as for any other type of program. A number of methodologies specifically focus on the software aspects of developmental programs and can be useful in identifying and analyzing risks associated with software. Several of these methodologies are described in the U.S. Air Force publication, *Guide to Software Acquisition and Management*. Three of these methodologies are described below.

5.9.1 Software Risk Evaluation (SRE)

This is a formal approach developed by the Software Engineering Institute (SEI) using a risk management paradigm that defines a continuous set of activities to identify, communicate, and resolve software risks. These activities are to identify, analyze, plan, track, and control. (The SEI activities are analogous to the activities of the risk management process defined in this section.)

This methodology is initiated by the PM, who tasks an independent SRE team to conduct a risk evaluation of the contractor's software development effort. The team executes the following SRE functions in performing this evaluation, and prepares findings that will provide the PM with the results of the evaluation:

- **Detection** of the software technical risks present in the program. An SEI Taxonomy-Based Questionnaire is used to ensure that all areas of potential risk are identified. This questionnaire is based on the SEI Software Development Risk Taxonomy, which provides a systematic way of organizing and eliciting risks within a logical framework.

- **Specification** of all aspects of identified technical software risks, including their conditions, consequences/impacts, and source.

- **Assessment** of the risks to determine the probability of risk occurrence and the severity of its consequences/impacts.

- **Consolidation** of the risk data into a concise format suitable for decision making.

A detailed discussion of the SRE methodology is found in Software Engineering Institute Technical Report CMU/SEI-94-TR-19, *Software Risk Evaluation Model, Version 1.0*, December 1994.

5.9.2 Boehm's Software Risk Management Method

This risk management methodology, developed by Barry W. Boehm and described in IEEE Software, *Software Risk Management: Principles and Practices*, January 1991, consists of two primary steps, each with three subordinate steps. This risk management structure is shown in Table 5-8.

Boehm provides a number of techniques that can be used to accomplish each of the steps in the methodology. For example, to assist in risk

Element	Description
Risk Identification (ID) Number	Identifies the risk and is a critical element of information, assuming that a relational database will be used by the PMO. (Construct the ID number to identify the organization responsible for oversight.)
Risk Event	States the risk event and identifies it with a descriptive name. The statement and risk identification number will always be associated in any report.
Priority	Reflects the importance of this risk priority assigned by the PMO compared to all other risks, e.g., a one (1) indicates the highest priority.
Data Submitted	Gives the date that the RIF was submitted.
Major System/ Component	Identifies the major system/component based on the WBS.
Subsystem/ Functional Area	Identifies the pertinent subsystem or component based on the WBS.
Category	Identifies the risk as technical/performance cost or schedule or combination of these.
Statement of Risk	Gives a concise statement (one or two sentences) or the risk.
Description of Risk	Briefly describes the risk. Lists the key processes that are involved in the design, development, and production of the particular system or subsystem. If technical/performance, includes how it is manifested (e.g., design and engineering, manufacturing, etc.).
Key Parameters	Identifies the key parameter, minimum acceptable value, and goal value, if appropriate. Identifies associated subsystem values required to meet the minimum acceptable value and describes the principal events planned to demonstrate that the minimum value has been met.
Assessment	States if an assessment has been done. Cites the Risk Assessment Report, if appropriate.
Analyses	Briefly describes the analysis done to assess the risk. Includes rationale and basis for results.
Probability of Occurrence	States the likelihood of the event occurring, based on definitions in the program's Risk Management Plan.
Consequence	States the consequence of the event, if it occurs, based on definitions in the program's Risk Management Plan.
Time Sensitivity	Estimates the relative urgency for implementing the risk-handling option.
Other Affected Areas	If appropriate, identifies any other subsystem or process that this risk affects.
Risk Handling Plans	Briefly describes plans to mitigate the risk. Refers to any detailed plans that may exist, if appropriate.
Risk Monitoring Activity	Measures using metrics for tracking progress in implementing risk-handling plans and achieving planned results for risk reduction.
Status	Briefly reports the status of the risk-handling activities and outcomes relevant to any risk handling milestones.
Status Due Date	Lists date of the status report.
Assignment	Lists individual assigned responsibility for mitigation activities.
Reported By	Records name and phone number of individual who reported the risk.

Table 5-7. Database Management System Elements

Primary Steps	Secondary Steps	Description
Risk Assessment	Risk Identification	• Produces lists of project specific risk events
	Risk Analysis	• Assesses probability of risk event and consequences • Assesses compound risk resulting from risk event interaction
	Risk Prioritization	• Produces rank-ordered list of identified and analyzed risk events
Risk Control	Risk Management Planning	• Produces plan for addressing each risk event • Integrates individual risk event plans with each other and the overall plan
	Risk Resolution	• Establishes the environment and actions to resolve or eliminate risks • Tracks progress in resolving risks
	Risk Monitoring	• Provides feedback for refining prioritization and plans

Table 5-8. Software Risk Management Steps

Risk	Risk Management Techniques
Personnel Shortfalls	Staffing with top talent; job matching team building; key personnel agreements; cross training
Unrealistic schedules and budgets	Detailed multisource cost and schedule estimation; design-to-cost; incremental development; software reuse; requirements scrubbing
Developing the wrong software functions	Organizational analysis; mission analysis; operations concept formulation; user surveys; prototyping; early users' manuals
Developing wrong user interface	Task analysis; prototyping; scenarios; user characterization (functionality, style, workload)
Goldplating	Requirements scrubbing; prototyping; cost/benefit analysis; design-to-cost
Continuing stream of requirements changes	High change threshold; information hiding; incremental development (defer changes to later increments)
Shortfalls in externally furnished components	Benchmarking; inspections; reference checking; compatibility analysis
Shortfalls in internally performed tasks	Reference checking; pre-award audits; award-fee contracts; competitive design or prototyping; team building
Real-time performance shortfalls	Simulation; benchmarking; modeling; prototyping; instrumentation; tuning
Straining computer science capabilities	Technical analysis; cost-benefit analysis; prototyping; reference checking

Table 5-9. Top 10 Software Risks

Best Practices Initiative Risk Management Method		
Address the Problem	**Practice Essentials**	**Check Status**
• Recognize that all software has risk • Attempt to resolve risk as early as possible when cost impact is less than it will be later in development	• Identify risks • Decriminalize risk • Plan for risk • Formally designate a Risk Officer • Include in budget and schedule a risk reserve buffer of time, money, and other resources • Compile database for all non-negligible risks • Prepare profile for each risk showing probability and consequences • Include all risks over full life cycle • Provide frequent risk status reports that include: – Top 10 risk items – Number of risk items resolved – Number of new risk items – Number of risk items unresolved – Unresolved risk items on critical path • Probably costs for unresolved risks	• Risk Officer appointed? • Risk databases set up? • Risk assessments have clear impact on program plans and decisions? • Frequency and timeliness of risk assessment updates consistent with decision updates? • Objective criteria used to identify, assess, and manage risk? • Information flow patterns and reward criteria support identification of risk by all program personnel? • Risks identified throughout entire life cycle? • Risk management reserve exist? • Risk profile for every risk, and components updated regularly? • Risk management plan has explicit provisions for altering decision makers when risk becomes imminent?

Table 5-10. Best Practices Initiative Risk Management Method

identification, he includes the top 10 top-level software risks, based on surveys of experienced software project managers. These risks are shown in Table 5-9, along with recommended techniques to manage them. Using this list as a starting point, managers and engineers can then develop lists of lower-level risks to be assessed and resolved.

5.9.3 Best Practices Initiative Risk Management Method

The Software Acquisition Best Practices Initiative was instituted in 1994 to improve and restructure the software acquisition management process through the identification of effective practices used in successful software developments. One result of this effort was the publication of the *Program Manager's Guide to Software Acquisition Best Practices* by the Software Program Managers Network (SPMN). This document identified nine principal best practices that are essential to the success of any large-scale software development. The first of these nine is formal risk management. To assist in implementing this top practice, SPMN developed a three-part methodology consisting of the following steps: address the problem; practice essentials; and check status. Specific activities associated with these steps are shown in Table 5-10.

Risk Grouping	Software Risk Issue
Project-Level	1. Excessive, immature, unrealistic or unstable requirements 2. Lack of involvement 3. Underestimation of project complexity or dynamic natures
Project Attributes	4. Performance shortfalls (includes errors and quality) 5. Unrealistic cost or schedule (estimates and/or allocated amounts)
Management	6. Ineffective project management (possible at multiple levels)
Engineering	7. Ineffective integration, assembly and test; quality control; specialty engineering; systems engineering or (possible at multiple levels) 8. Unanticipated difficulties associated with the user interface
Work Environment	9. Immature or untried design, processes or technologies selected 10. Inadequate work plans or configuration control 11. Inappropriate methods or tool selection or inaccurate metrics
Other	12. Poor planning 13. Inadequate or excessive documentation or review process 14. Legal or contractual issues (e.g., litigation, malpractice, ownership) 15. Obsolescence (includes excessive schedule length) 16. Unanticipated difficulties with subcontracted items 17. Unanticipated maintenance and/or support costs

Table 5-11. Software Risk Grouping

SPMN provides PMOs with specialized training programs covering the core disciplines and techniques for implementing this formal risk management practice, as well as the other best practices. SPMN also has available (or under development) a number of guidebooks designed to provide software developers and PMs with practical guidance for planning, implementing, and monitoring their programs. SPMN can be accessed on the Internet at **http://spmn.com/**.

In addition to the studies by Barry Boehm, and information on the SPMN, a survey was conducted by Conrow and Shishido (See Reference) which evaluated 10 prior studies and categorized the resulting risk issues across the studies into six categories and 17 total issues, as shown in Table 5-11. The very high degree of overlap between risk issues identified in the 10 underlying studies suggest that some risk issues are common to many software-intensive projects.

APPENDIX A

DOD RISK MANAGEMENT POLICIES AND PROCEDURES

DoD policies and procedures that address risk management for acquisition programs are contained in five key documents:

1. DoD Directive (DoDD) 5000.1, *The Defense Acquisition System*;

2. DoD Instruction (DoDI) 5000.2, *Operation of the Defense Acquisition System*;

3. DoD Regulation 5000.2-R, *Mandatory Procedures for Major Defense Acquisition (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs*;

4. DoDD 5000.4, *OSD Cost Analysis Improvement Group*; and

5. DoD Manual 5000.4-M, *Cost Analysis Guidance and Procedures*.

The relevant sections of each document are referenced in the *Defense Acquisition Deskbook* under Mandatory Direction and are displayed under DoD-Wide Practices. They present strong statements on the need for risk management but collectively are not sufficient to enable the establishment of an effective risk management program. The following are verbatim extracts of sections of the DoD 5000 series of documents that address risk management as part of acquisition policy and procedures. The reader should be aware that changes to the 5000 series could result in different paragraph numbers.

1. DoDD 5000.1 *The Defense Acquisition System*, 23 October 2000, Change 1, 4 January 2001

Para 4.5.1. **Tailoring**

There is no one best way to structure an acquisition program so that it accomplishes the objectives of the Defense Acquisition System. Decision makers and program managers shall tailor acquisition strategies to fit the particular conditions of an individual program, consistent with common sense, sound business management practice, applicable laws and regulations, and the time-sensitive nature of the user's requirement. Proposed programs may enter the acquisition process at various decision points, depending on concept and technology maturity. Tailoring shall be applied to various aspects of the acquisition system, including program documentation, acquisition phases, the timing and scope of decision reviews, and decision levels. Milestone decision authorities shall promote flexible, tailored approaches to oversight and review based on mutual trust and a program's dollar value, **risk**, and complexity.

Para 4.5.4. **Simulation-Based Acquisition**

Program managers shall plan and budget for effective use of modeling and simulation to reduce the time, resources, and **risk** associated with the entire acquisition process; increase the quality, military worth and supportability of fielded systems; and reduce total ownership costs throughout the system life cycle.

2. DoD Instruction 5000.2. *Operation of the Defense Acquisition System*, 5 April 2002

Para 4.6.2.2.4. Information Superiority

All programs shall be managed and engineered using best processes and practices to reduce security **risks**; ensure programs are synchronized; be designed to be mutually compatible with other electric or electronic equipment and the operational electromagnetic environment; identify Critical Program Information that requires protection to prevent unauthorized disclosure or inadvertent transfer of leading-edge technologies and sensitive data or systems; require hardening, redundancy, or other physical protection against attack; be certified for spectrum supportability; and comply with the provisions of the Clinger-Cohen Act (CCA) (reference (m))….

Para 4.7.1.5. The Defense Acquisition Management Framework – General

…Acquisitions shall be structured in such a way that undue **risk** (such as through the use of firm fixed price options that cover more than five years) is not imposed on contractors, and so that contractor investment (beyond normal working capital and investments for plant, equipment, etc.) is not required….

Para 4.7.1.9. The Defense Acquisition Management Framework – General

…Milestone decision authorities shall promote flexible, tailored approaches to oversight and review based on mutual trust and a program's dollar value, **risk**, and complexity.

Para 4.7.2.3. Technological Opportunity Activities

…The S&T Program is uniquely positioned to reduce the **risks** of promising technologies before they are assumed in the acquisition process….

Para 4.7.2.3.2.4. Technology Transition Objectives

For those technologies with the most promise for application to weapon systems or AISs, be responsible for maturing technology to a readiness level that puts the receiving MDA at low **risk** for systems integration and acceptable to the cognizant MDA, or until the MDA is no longer considering that technology.

Para 4.7.2.4.3.1. Concept Exploration

Concept Exploration typically consists of competitive, parallel, short-term concept studies. The focus of these efforts is to define and evaluate the feasibility of alternative concepts and to provide a basis for assessing the relative merits (i.e., advantages and disadvantages, degree of **risk**, etc.) of these concepts….

Para 4.7.2.4.6. Component Advanced Development

The project shall exit Component Advanced Development when a system architecture has been developed and the component technology has been demonstrated in the relevant environment or the MDA decides to end this effort. This effort is intended to reduce **risk** on components and subsystems that have only been demonstrated in a laboratory environment and to determine the appropriate set of subsystems to be integrated into a full system….

Para 4.7.3.2.1.1. Begin Development and Develop and Demonstrate Systems – General

The purpose of the System Development and Demonstration phase is to develop a system, reduce program **risk**, ensure operational supportability, design for producibility, ensure affordability, ensure protection of Critical

Program Information, and demonstrate system integration, interoperability, and utility….

Para 4.7.3.2.3.1.2. **Milestone Approval Considerations**

…For shipbuilding programs, the lead ship engineering development model shall be authorized at Milestone B. Critical systems for the lead and follow ships shall be demonstrated given the level of technology maturity and the associated **risk** prior to ship installation….

Para 4.7.3.2.3.4.1. **Entry into System Development and Demonstration**

Milestone B approval can lead to System Integration or System Demonstration. Regardless of the approach recommended, PMs and other acquisition managers shall continually assess program **risks**. **Risks** must be well understood, and **risk** management approaches developed, before decision authorities can authorize a program to proceed into the next phase of the acquisition process. **Risk** management is an organized method of identifying and measuring **risk** and developing, selecting, and managing options for handling these **risks**. The types of **risk** include, but are not limited to, schedule, cost, technical feasibility, threat, **risk** of technical obsolescence, security, software management, dependencies between a new program and other programs, and **risk** of creating a monopoly for future procurements.

Para 4.7.3.2.4.2. **System Integration**

This effort is intended to integrate the subsystems and reduce system-level **risk**….

Para 4.7.3.3.2.1. **Entrance Criteria**

Technology maturity (with an independent technology readiness assessment), system and relevant mission area (operational) architectures, mature software capability, demonstrated system integration or demonstrated commercial products in a relevant environment, and no significant manufacturing **risks**.

3. DoD Regulation 5000.2-R. *Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs,* 5 April 2002

Para C1.3.4.2. **Management Incentives**

The PM, via the Contracting Officer, shall structure Requests for Proposal (RFPs) and resulting contracts to provide an incentive to the contractor to meet or beat program objectives. Whenever applicable, **risk** reduction through use of mature processes shall be a significant factor in source selection….

Para C1.4.3.3.2. **Cost**

Cost figures shall reflect realistic estimates of the total program, including a thorough assessment of **risk**….

Para C2.3.1. **Program Structure**

…The acquisition strategy shall specifically address the benefits and **risks** associated with reducing lead-time through concurrency and the **risk** mitigation and tests planned if concurrent development is used….

Para C2.5. **Risk**

The acquisition strategy shall address **risk** management. The PM shall identify the **risk** areas of the program and integrate **risk** management within overall program management. The strategy shall explain how the **risk** management effort shall reduce system-level **risk** to acceptable levels by the interim progress review preceding system demonstration and by Milestone C.

Para C2.6.2. **Information Sharing and DoD Oversight**

…DoD oversight activities (i.e., contract management offices, contracting offices, technical activities, and program management offices) shall consider all relevant and credible information that might mitigate **risk** and reduce the need for DoD oversight before defining and applying direct DoD oversight of contractor operations….

Para C2.8.1. **Support Strategy**

As part of the acquisition strategy, the PM shall develop and document a support strategy for life-cycle sustainment and continuous improvement of product affordability, reliability, and supportability, while sustaining readiness…. The support strategy shall continue to evolve toward greater detail, so that by Milestone C, it contains sufficient detail to define how the program will address the support and fielding requirements that meet readiness and performance objectives, lower TOC, reduce **risks** and avoid harm to the environment and human health. The support strategy shall address all applicable support requirements to include, but not be limited to, the following elements:…

Para C2.8.1.7.3. **Support Strategy**

Contract service **risk** assessments over the life of the system.

Para C2.8.4.2.2. **Supply Source of Support**

The PM shall use a competitive process to select the best value supply support provider. Access to multiple sources of supply is encouraged to reduce the **risks** associated with a single source….

Para C2.8.6. **Environment, Safety, and Occupational Health (ESOH) Considerations**

As part of **risk** reduction, the PM shall prevent ESOH hazards, where possible, and shall manage ESOH hazards where they cannot be avoided. The support strategy shall contain a summary of the Programmatic ESOH Evaluation (PESHE) document, including ESOH **risks**, a strategy for integrating ESOH considerations into the systems engineering process, identification of ESOH responsibilities, a method for tracking progress, and a compliance schedule for National Environmental Policy Act (NEPA) (42 U.S.C. 4321-4370d (reference (x)) and Executive Order (E.O.) 12114 (reference (y))). (See subparagraph C5.2.3.5.10.)

Para C2.8.9. **Post Deployment Evaluation**

The PM shall select the parameters for evaluations based on their relevance to future modifications or evolutionary block upgrades for performance, sustainability, and affordability improvements, or when there is a high level of **risk** that a KPP will not be sustained over the life of the system….

Para C2.9.1.3.2.3 **Sub-Tier Competition**

During early exchanges of information with industry (e.g., the draft request for proposal process), PMs shall identify the critical product and technology areas that the primes plan to provide internally or through exclusive teaming. The PM shall assess the possible competitive effects of these choices. The PM shall take action to mitigate areas of **risk**….

Para C2.9.1.4.2.2 **Commercial and Non-Developmental Items**

…If acquiring products with closed interfaces, the PM shall conduct a business case analysis to

justify acceptance of the associated economic impacts on TOC and **risks** to technology insertion and maturation over the service life of the system.

Para 2.9.1.4.4.1 **Industrial Capability**

The acquisition strategy shall summarize an analysis of the industrial base capability to design, develop, produce, support, and, if appropriate, restart the program (10 U.S.C. 2440 (reference (an))) as appropriate for the next program phase. This analysis (see DoD Directive 5000.60 (reference (ao)) and DoD 5000.60-H (reference (ap))) shall identify DoD investments needed to create or enhance certain industrial capabilities, and the **risk** of industry being unable to provide program design or manufacturing capabilities at planned cost and schedule….

Para 2.9.1.4.4.2 **Industrial Capability**

In many cases, commercial demand now sustains the national and international technology and industrial base. The PM shall structure the acquisition strategy to promote sufficient program stability to encourage industry to invest, plan, and bear **risks**….

Para C2.9.3.2. **Contract Type**

For each major contract, the acquisition strategy shall identify the type of contract planned (e.g., firm fixed-price (FFP); fixed price incentive, firm target; cost plus incentive fee; or cost plus award fee) and the reasons it is suitable, including considerations of **risk** assessment and reasonable **risk**-sharing by the Government and the contractor(s)….

Para C2.9.3.5. **Integrated Baseline Reviews**

PMs and their technical staffs or IPTs shall evaluate contract performance **risks** inherent in the contractor's planning baseline. This evaluation shall be initiated within 6 months after contract award or intra-Government agreement is reached for all contracts requiring EVMS or C/SSR compliance.

Para C2.9.3.8. **Component Breakout**

The PM shall consider component breakout on every program and break out components when there are significant cost savings (inclusive of Government administrative costs), the technical or schedule **risk** of furnishing government items to the prime contractor is manageable, and there are no other overriding Government interests (e.g., industrial capability considerations or dependence on contractor logistics support)….

Para C3.1.1. **Test and Evaluation (T&E) Overview**

…The T&E strategy shall provide information about **risk** and **risk** mitigation, provide empirical data to validate models and simulations, evaluate technical performance and system maturity, and determine whether systems are operationally effective, suitable, and survivable against the threat detailed in the System Threat Assessment. (See paragraph C6.2.4)….

Para C3.2.1.1. **Evaluation Strategy**

…The evaluation strategy shall primarily address M&S, including identifying and managing the associated **risk**, and early T&E strategy to evaluate system concepts against mission requirements….

Para C3.2.3.2.1. **T&E Guidelines**

Early T&E activities shall harmonize MOEs, MOPs, and **risk** with the needs depicted in the MNS, and with the objectives and thresholds addressed in the analysis of alternatives, and defined in the ORD, APB, and TEMP, as these documents become available….

Para C3.2.3.2.2.8. **T&E Guidelines**

The concept of early and integrated T&E shall emphasize prototype testing during system development and demonstration and early OAs to identify technology **risks** and provide operational user impacts….

Para C3.4.1.2. **Developmental Test and Evaluation (DT&E)**

Identify and describe design technical **risks**. Assist in the design of a system at the component, sub-system, and system level by reducing technical **risk** prior to transitioning to the next level;

Para C3.4.1.6. **Developmental Test and Evaluation (DT&E)**

Assess progress toward meeting KPPs and other ORD requirements, COIs, mitigating acquisition technical **risk**, and achieving manufacturing process requirements and system maturity;

Para C3.5.1. **Certification of Readiness for Operational Test & Evaluation (OT&E)**

The developing agencies (i.e., materiel and combat developers) shall complete the following tasks before starting OT&E: Define **risk** management measures and indicators, with associated thresholds, to address performance and technical adequacy of both hardware and software.

Para C3.6.1.3. **Operational Test and Evaluation (OT&E)**

Information assurance testing shall be conducted on information systems to ensure that planned and implemented security measures satisfy ORD and System Security Authorization Agreement (SSAA) requirements when the system is installed and operated in its intended environment. The PM, OT&E test authority, and designated approving authority shall coordinate and determine the level of **risk** associated with operating the system and the extent of security testing required. (See section C6.6.)…

Para C3.6.1.13. **Operational Test and Evaluation (OT&E)**

All weapon, Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR), and information programs that are dependent on external information sources, or that provide information to other DoD systems, shall be assessed for information assurance. The level of information assurance testing depends on the system **risk** and importance. Systems with the highest importance and **risk** shall be subject to penetration-type testing prior to the beyond LRIP decision. Systems with minimal **risk** and importance shall be subject to normal National Security Agency security and developmental testing, but shall not be subject to field penetration testing during OT&E.

Para C4.3. **Analysis of Alternatives**

Analyzing alternatives is part of the CAIV process. Alternatives analysis shall broadly examine multiple elements of project or program alternatives including technical **risk** and maturity, and costs.

Para C4.5.1.2. **Resource Estimates**

The DoD Component cost agency shall prepare an independent LCCE and associated report for the decision authority for all ACAT IC programs, except those reviewed by the CAIG, for all major decision points as specified in enclosure 3 of reference (a), or as directed by the MDA. For programs with significant cost **risk** or high visibility, the CAE may request an additional DoD Component cost analysis estimate.

Para C4.5.2.1. **Life-Cycle Cost Estimates (LCCEs)**

The estimating activity shall explicitly base the LCCE (or EA for ACAT IA programs) on program objectives; operational requirements; contract specifications; careful **risk** assessments; and, for ACAT I programs, a DoD program work breakdown structure (WBS), or, for ACAT IA programs, a life-cycle cost and benefit element structure agreed upon by the IPT….

Para C4.5.4.1.1. **Manpower Considerations**

For all programs regardless of acquisition category, the DoD Components shall determine the source of support for all new, modified, and replacement systems based on the procedures, manpower mix criteria, and **risk** assessment instructions in Deputy Under Secretary of Defense (Program Integration), Office of the Under Secretary of Defense (Personnel & Readiness) (OUSD(P&R)), and Deputy Under Secretary of Defense (Installations), Office of USD(AT&L) annual memo, "DoD Inventory of Commercial and Inherently Governmental Activities Data Call…."

Para C4.5.4.1.2. **Manpower Considerations**

The DoD Components shall determine manpower and contract support based on both peacetime and wartime requirements, and establish manpower authorizations at the minimum necessary to achieve specific vital objectives (DoD Directive 1100.4 (reference (bv))). As part of this process, the DoD Components shall assess the **risks** (DoD Instruction 3020.37 (reference (bw))) involved in contracting support for critical functions in-theater, or in other areas expecting hostile fire. **Risk** mitigation shall take precedence over cost savings in high-risk situations or when there are highly sensitive intelligence or security concerns.

Para C4.5.4.2.4. **Manpower Estimate**

The manpower estimate shall address whether there are any personnel issues that would adversely impact full operational deployment of the system. It shall clearly state the **risks** associated with and the likelihood of achieving manpower numbers reported in the estimate. It shall briefly assess the validity of the manpower numbers, stating whether the DoD Component used validated manpower methodologies and manpower mix criteria, and assessed all **risks**….

Para C5.2.1. **Systems Engineering**

…Systems engineering shall permeate design, manufacturing, T&E, and support of the product. Systems engineering principles shall influence the balance between performance, **risk**, cost, and schedule.

Para C5.2.2.3. **Systems Engineering**

The systems engineering process shall… Characterize and manage technical **risks**.

Para C5.2.2.4. **Systems Engineering**

The systems engineering process shall: … Apply scientific and engineering principles, using the system security engineering process, to identify security vulnerabilities and minimize or contain information assurance and force protection **risks** associated with these vulnerabilities. (See DoD 5200.1-M (reference (bx)).)

Para C5.2.3.2. **Functional Analysis/ Allocation**

…The design approach shall partition a system into self-contained, functionally

cohesive, interchangeable, and adaptable elements to enable ease of change, achieve technology transparency and mitigate **risk** of obsolescence….

Para C5.2.3.4.2. **System Analysis and Control**

The overall **risk** management effort shall include technology transition planning and shall establish transition criteria.

Para C5.2.3.4.3. **System Analysis and Control**

The establishment of a **risk** management process (including planning, assessment (identification and analysis), handling, and monitoring) to be integrated and continuously applied throughout the program, including, but not limited to, the design process. The **risk** management effort shall address **risk** planning, the identification and analysis of potential sources of **risks** including but not limited to cost, performance, and schedule **risks** based on the technology being used and its related design, manufacturing capabilities, potential industry sources, and test and support processes; **risk** handling strategies, and **risk** monitoring approaches. The overall **risk** management effort shall interface with technology transition planning, including the establishment of transition criteria for such technologies.

Para C5.2.3.4.7. **System Analysis and Control**

Performance metrics to measure technical development and design, actual versus planned; and to measure meeting system requirements in terms of performance, cost, schedule, and progress in implementing **risk** handling. Performance metrics shall be traceable to performance parameters identified by the operational user.

Para C5.2.3.5.5.2.10. **Open Systems Design**

PMs shall use an open systems approach to achieve the following objectives:… To mitigate the **risks** associated with technology obsolescence, being locked into proprietary technology, and reliance on a single source of supply over the life of a system;

Para C5.2.3.5.6. **Software Management**

The PM shall manage and engineer software-intensive systems using best processes and practices known to reduce cost, schedule, and performance **risks**.

Para C5.2.3.5.6.1.3. **Software Management**

The PM shall base software systems design and development on systems engineering principles, to include the following: …Select the programming language in context of the systems and software engineering factors that influence overall life-cycle costs, **risks**, and the potential for interoperability;

Para C5.2.3.5.6.1.5. **Software Management**

…However, if the prospective contractor does not meet full compliance, **risk** mitigation planning shall describe, in detail, the schedule and actions that will be taken to remove deficiencies uncovered in the evaluation process. **Risk** mitigation planning shall require PM approval.

Para C5.2.3.5.6.1.7. **Software Management**

Assess information operations **risks** (DoD Directive S-3600.1 (reference (bz))) using techniques such as independent expert reviews;

Para C5.2.3.5.6.2.2.3. **Software Spiral Development**

The PM shall consider the **risks** and extent of change impacts to enable a cost-effective, yet rigorous T&E process.

Para C5.2.3.5.6.4.7. **Software Security Considerations**

When employing COTS software, the contracting process shall give preference during product selection/evaluation to those vendors who can demonstrate that they took efforts to minimize the security **risks** associated with foreign nationals that have developed, modified, or remediated the COTS software being offered.

Para C5.2.3.5.7.2.5. **Commercial, Off-the-Shelf (COTS) Considerations**

The PM shall develop an appropriate T&E strategy for commercial items to include evaluating potential commercial items in a system test bed, when practical; focusing test beds on high-**risk** items; and testing commercial-item upgrades for unanticipated side effects in areas such as security, safety, reliability, and performance.

Para C5.2.3.5.7.2.6. **Commercial, Off-the-Shelf (COTS) Considerations**

Programs are encouraged to use code-scanning tools, within the scope and limitations of the licensing agreements, to ensure both COTS and Government off-the-shelf software do not pose any information assurance or security **risks**.

Para C5.2.3.5.10.2. **Environment, Safety, and Occupational Health (ESOH)**

The PM shall prepare a Programmatic ESOH Evaluation (PESHE) document early in the program life cycle (usually Milestone B). The PESHE shall identify ESOH **risks**, contain a strategy for integrating ESOH considerations into the systems engineering process, delineate ESOH responsibilities, and provide a method for tracking progress, and provide a completion schedule for NEPA (reference (x)) and E.O. 12114 (reference (y))….

Para C5.2.3.5.10.4. **ESOH Compliance**

To minimize the cost and schedule **risks** over the system's life cycle that changing ESOH requirements and regulations represent, the PM shall regularly review ESOH regulatory requirements and evaluate their impact on the program's life-cycle cost, schedule, and performance.

Para C5.2.3.5.10.6.1. **Safety and Health**

The PM shall identify and evaluate safety and health hazards, define **risk** levels, and establish a program that manages the probability and severity of all hazards associated with development, use, and disposal of the system. The PM shall use and require contractors to use the industry and DoD standard practice for system safety, consistent with mission requirements. This standard practice manages **risks** encountered in the acquisition life cycle of systems, subsystems, equipment, and facilities. These **risks** include conditions that create significant **risks** of death, injury, acute or chronic illness, disability, and/or reduced job performance of personnel who produce, test, operate, maintain, support, or dispose of the system.

Para C5.2.3.5.10.6.2. **Safety and Health**

The following policy applies to the acceptance of **risk**: …The PM shall formally document each management decision accepting the **ris**k associated with an identified hazard.

Para C5.2.3.5.10.6.2.2. **Safety and Health**

"High **Risk**" hazards shall require CAE approval (Lead Executive Component authority prevails for joint programs).

Para C5.2.3.5.10.6.2.3. **Safety and Health**

The acceptance of all **risks** involving explosives safety (see subparagraph C5.2.3.5.10.9. below) shall require the appropriate risk acceptance authority to consult with the DoD Component's technical authority managing the explosives safety program.

Para C5.2.3.5.10.6.2.4. **Safety and Health**

"Serious **Risk**" hazards shall require PEO approval.

Para C5.2.3.5.10.6.2.5. **Safety and Health**

"Medium **Risk**" and "Low **Risk**" hazards shall require PEO approval.

Para C5.2.3.5.10.8.1. **Pollution Prevention**

The PM shall identify and evaluate environmental and occupational health hazards and establish a pollution prevention program. The PM shall identify the impacts of the system on the environment during its life (including disposal), the types and amounts of pollution from all sources (air, water, noise, etc.) that will be released to the environment, actions needed to prevent or control the impacts, ESOH **risks** associated with using the new system, and other information needed to identify source reduction, alternative technologies, and recycling opportunities….

Para C5.2.3.5.13 **Mission Assuredness**

…The PM shall include the considerations in the **risk** benefit analysis of system design and cost….

Para C5.2.3.5.15.1. **Anti-Tamper Provisions**

…Because of its function, anti-tamper should not be regarded as an option or a system capability that may later be traded off without a thorough operational and acquisition **risk** analysis. To accomplish this, the PM shall identify critical technologies, identify system vulnerabilities, and, with assistance from counter-intelligence organizations, perform threat analyses to the critical technologies. The PM shall research anti-tamper measures and determine which best fit the performance, cost, schedule, and **risk** of the program.

Para C5.3.1. **Work Breakdown Structure (WBS)**

…The PM shall normally specify contract WBS elements only to level three for prime contractors and key subcontractors. Only low-level elements that address high **risk**, high value, or high technical interest areas of a program shall require detailed reporting below level three….

Para C5.3.2.2.1.5. **Implementing a Performance-Based Business Environment (PBBE)**

The PM shall structure the PBBE to accomplish the following: …Encourage life-cycle **risk** management versus **risk** avoidance;

Para C5.3.2.2.1.6. **Implementing a Performance-Based Business Environment (PBBE)**

The PM shall structure the PBBE to accomplish the following: …Simplify acquisition and support operating methods by transferring tasks to industry where cost effective, **risk**-acceptable, commercial capabilities exist; and

Para C6.2.2. **Intelligence Support**

Users shall assess and evaluate information superiority requirements. They shall determine the vulnerability of IT, including NSS, supporting infrastructures, and the effectiveness of **risk** mitigation methods to reduce vulnerability to an acceptable level.

Para C6.6.1. **Information Assurance**

PMs shall manage and engineer information systems using the best processes and practices known to reduce security **risks**, including the risks to timely accreditation.

Para C6.6.2.1. **Information Assurance**

Accordingly, for each information system development, PMs shall: …Conduct a system **risk** assessment based on system criticality, threat, and vulnerabilities;

Para C6.7.2.4. **Technology Protection**

Technology protection planning and development of the program protection plan shall begin early in the acquisition life cycle. The following considerations apply: …Security organizations shall identify system vulnerabilities and recommend cost-effective security measures using **risk** management evaluations.

Para C7.2. **Decision Points**

There are three types of decision points: milestones, decision reviews, and interim progress reviews. Each decision point results in a decision to initiate, continue, advance, or terminate a project or program work effort or phase. The review associated with each decision point shall typically address program progress and **risk**, affordability, program trade-offs, acquisition strategy updates, and the development of exit criteria for the next phase or effort….

Para C7.3.1.4. **Defense Acquisition Board (DAB) Review**

The PM shall brief the acquisition program to the DAB and specifically emphasize technology maturity, **risk** management, affordability, critical program information, technology protection, and rapid delivery to the user….

Para C7.4.2. **Exit Criteria**

Phase-specific exit criteria normally track progress in important technical, schedule, or management **risk** areas….

Para C7.5.1. **Technology Maturity**

Technology maturity shall measure the degree to which proposed critical technologies meet program objectives. Technology maturity is a principal element of program **risk**. A technology readiness assessment shall examine program concepts, technology requirements, and demonstrated technology capabilities to determine technological maturity.

Para C7.5.4. **Technology Maturity**

TRLs enable consistent, uniform, discussions of technical maturity, across different types of technologies. Decision authorities shall consider the recommended TRLs (or some equivalent assessment methodology, e.g., Willoughby templates) when assessing program **risk**….

Para C7.12.1. **Cost Analysis Improvement Group (CAIG) Procedures**

…The DoD Component responsible for acquisition of a system shall cooperate with the CAIG and provide the cost, programmatic, and

technical information required to estimate costs and appraise cost **risks**….

Para C7.15.7. **Contract Management Reports**

…Except for high-cost or high-**risk** elements, the required level of reporting detail shall be limited to level three of the contract WBS.

Para C7.15.7.1.2. **Contractor Cost Data Reporting (CCDR)**

…CCDR reporting is not required for contracts priced below $6.5 million. The CCDR requirement on high-**risk** or high-technical-interest contracts priced between $6.5 and $42 million is left to the discretion of the Cost WIPT.

Para C7.15.7.1.8.1. **Level of Cost Reporting**

Routine reporting shall be at the contract WBS level three for prime contractors and key subcontractors. Only low-level elements that address high-**risk**, high-value, or high-technical-interest areas of a program shall require detailed reporting below level three….

4. DoD Directive (DoDD) 5000.4. *OSD Cost Analysis Improvement Group (CAIG),* November 24, 1992

Para 4.1.8 **Risk Assessment**

The CAIG Chair report, in support of a milestone review, shall include quantitative assessments of the **risk** in the estimate of life-cycle costs. In developing an assessment of cost **risk**, the CAIG shall consider the validity of such programmatic assumptions of the CARDs as EMD schedules, rates of utilization of test assets, production ramp rates, and buy rates, consistent with historical information. The CAIG shall also consider uncertainties in inputs to any cost estimating relationships used in its estimates, as well as the uncertainties inherent in the calibration of the CERs, and shall consider uncertainties in the factors used in making any estimates by analogy. The CAIG shall consider cost and schedule **risk** implications of available assessments of the program's technical **risks**, and may include the results in its cost-**risk** assessments. The CAIG may consider information on **risk** provided by any source, although primary reliance will be on the technical **risk** assessments that are the responsibility of the sponsoring DoD components, and of other OSD offices, in accordance with their functional responsibilities.

5. DoD 5000.4-M. Cost Analysis Guidance and Procedures, December 1992

Chapter 1:
(Outline of CARD Basic Structure)

Para 1.2.1.x (..x..) **Subsystem Description**

This series of paragraphs (repeated for each subsystem) describes the major equipment (hardware/software) WBS components of the system. The discussion should identify which items are off-the-shelf. The technical and **risk** issues associated with development and production of individual subsystems also must be addressed.

Para 2.0 **Technical and Physical Description**

This section identifies the program manager's assessment of the program and the measures being taken or planned to reduce those **risks**. Relevant sources of **risk** include: design concept, technology development, test requirements, schedule, acquisition strategy, funding availability, contract stability, or any other aspect that might cause a significant deviation from the

planned program. Any related external technology programs (planned or on-going) should be identified, their potential contribution to the program described, and their funding prospects and potential for success assessed. This section should identify these **risks** for each acquisition phase (DEM/VAL, EMD, productions and deployment, and O&S). (Phase terminology changed in DoD 5000.2-R, 2 April 2002.)

Chapter 2:
(Presentation of Cost Analysis to OSD CAIG)

Para C2.2.9. **Sensitivity Analysis**

The sensitivity of projected costs to critical program assumptions shall be examined. Aspects of the program to be subjected to sensitivity analysis shall be identified in the DoD CCA of program assumptions. The analysis shall include factors such as learning curve assumptions; technical **risk**, i.e., the **risk** of more development and/or production effort, changes in performance characteristics, schedule alterations, and variations in testing requirements; and acquisition strategy (multiyear procurement, dual sourcing, etc.).

Para C2.3.3 **PM Presentation**

The Program Manager's designated representative shall present the CAIG with the POE for each alternative under construction and explain how each is derived. This presentation shall cover the estimates and estimating procedures at the major subcomponent level (e.g., airframe, engine, major avionics subsystem, etc.). The presentation should focus on the items that are cost drivers and/or elements of high cost **risk**.

APPENDIX B

GENERIC RISK MANAGEMENT PLAN

SAMPLE RISK MANAGEMENT PLAN

PREFACE

DoDI 5000.2 requires that "PMs and other acquisition managers shall continually assess program risks." Further, DoD 5000.2-R states that for ACAT I Programs, "The PM shall identify the risk areas of the program and integrate risk management within overall program management." Although the need for a risk management program and a risk management process are addressed throughout this regulation, there is no requirement for a formal Risk Management Plan (RMP). However, Program Managers (PMs) have found such a plan necessary to focus properly on the assessment and handling of program risk, a core acquisition management issue that Milestone Decision Authorities (MDAs) must rigorously address at appropriate milestones before making program decisions.

Attached is a sample format for a RMP that is a compilation of several good risk plans and the results of the DoD Risk Management Working Group Study. It represents the types of information and considerations that a plan, tailored to a specific program, might contain. There are also two examples of Risk Management Plans—one for an ACAT I or II Program, the other for an ACAT III or IV Program. The *Defense Acquisition Deskbook*, Section 2.5.2, has general guidance and advice in all areas of risk management. Section 2.5.2.4 of the *Defense Acquisition Deskbook* contains information concerning the development of a risk management plan. The information in this *Guide* is consistent with, and in most cases identical to, the *Defense Acquisition Deskbook*.

There is a danger in providing a sample document. First of all, because it is written as a guide for a general audience, it does not satisfy all of the needs of any particular program. Second, there is the possibility that some prospective user will simply adopt the plan as written, despite the fact that it does not fit his or her program. We discourage this.

The reason for providing this sample format is to give PMs and their staffs a starting point for their own planning process. It should stimulate thought about what has to be done and give some ideas on how to begin writing a plan. The sample plan contains more information than most program offices should need. Few PMs have the resources for a dedicated risk management effort as depicted in the plan. The key to using the sample plan is to keep things simple and tailor the plan to suit your needs, focusing on the management of risk in the key critical areas of your program.

The following text reflects the outline of a risk management plan found in the *Defense Acquisition Deskbook* section 2.5.2.4, Figure 2.5.2.4-2.

SAMPLE FORMAT FOR RISK MANAGEMENT PLAN

Introduction. This section should address the purpose and objective of the plan, and provide a brief summary of the program, to include the approach being used to manage the program, and the acquisition strategy.

Program Summary. This section contains a brief description of the program, including the acquisition strategy and the program management approach. The acquisition strategy should address its linkage to the risk management strategy.

Definitions. Definitions used by the program office should be consistent with DoD definitions for ease of understanding and consistency. However, the DoD definitions allow program managers flexibility in constructing their risk management programs. Therefore, each program's risk management plan may include definitions that expand the DoD definitions to fit its particular needs. For example, each plan should include, among other things, definitions for the ratings used for technical, schedule and cost risk. (Discussion of risk rating is contained in the *Defense Acquisition Deskbook* Section 2.5.2.1.)

Risk Management Strategy and Approach. Provide an overview of the risk management approach, to include the status of the risk management effort to date, and a description of the program risk management strategy. See the *Defense Acquisition Deskbook* Sections 2.5.2.1 and 2.5.2.3.

Organization. Describe the risk management organization of the program office and list the responsibilities of each of the risk management participants. See the *Defense Acquisition Deskbook* Section 2.5.2.3.

Risk Management Process and Procedures. Describe the program risk management process to be employed; i.e., risk planning, assessment, handling, monitoring and documentation, and a basic explanation of these components. See the *Defense Acquisition Deskbook* Section 2.5.2.1. Also provide application guidance for each of the risk management functions in the process. If possible, the guidance should be as general as possible to allow the program's risk management organization (e.g., IPTs) flexibility in managing the program risk, yet specific enough to ensure a common and coordinated approach to risk management. It should address how the in-formation associated with each element of the risk management process will be documented and made available to all participants in the pro-cess, and how risks will be tracked, to include the identification of specific metrics if possible.

Risk Planning. This section describes the risk planning process and provides guidance on how it will be accomplished, and the relationship between continuous risk planning and this RMP. Guidance on updates of the RMP and the approval process to be followed should also be included. See Section 2.5.2.1 of the *Defense Acquisition Deskbook* for information on risk planning.

Risk Assessment. This section of the plan describes the assessment process and procedures for examining the critical risk areas and processes to identify and document the associated risks. It also summarizes the analyses process for each of the risk areas leading to the determination of a risk rating. This rating is a reflection of the potential impact of the risk in terms of its variance from known Best Practices or probability of occurrence, its consequence/impact, and its relationship to other risk areas or processes. This section may include:

- Overview and scope of the assessment process;
- Sources of information;
- Information to be reported and formats;
- Description of how risk information is documented; and
- Assessment techniques and tools (see Section 2.5.2.4 of the *Defense Acquisition Deskbook*).

Risk Handling. This section describes the procedures that can be used to determine and evaluate various risk-handling options, and identifies tools that can assist in implementing the risk-handling process. It also provides guidance on the use of the various handling options for specific risks.

Risk Monitoring. This section describes the process and procedures that will be followed to monitor the status of the various risk events identified. It should provide criteria for the selection of risks to be reported on, and the frequency of reporting. Guidance on the selection of metrics should also be included.

Risk Management Information System, Documentation and Reports. This section describes the MIS structure, rules, and procedures that will be used to document the results of the risk management process. It also identifies the risk management documentation and reports that will be prepared; specifies the format and frequency of the reports; and assigns responsibility for their preparation.

SAMPLE RISK MANAGEMENT PLAN FOR THE XYZ PROGRAM (ACAT I, II)

1.0 INTRODUCTION

1.1 PURPOSE

This Risk Management Plan (RMP) presents the process for implementing proactive risk management as part of the overall management of the XYZ program. Risk management is a program management tool to assess and mitigate events that might adversely impact the program. Therefore, risk management increases the probability/likelihood of program success. This RMP will:

- Serve as a basis for identifying alternatives to achieve cost, schedule, and performance goals,
- Assist in making decisions on budget and funding priorities,
- Provide risk information for Milestone decisions, and
- Allow monitoring the health of the program as it proceeds.

The RMP describes methods for identifying, analyzing, prioritizing, and tracking risk drivers; developing risk-handling plans; and planning for adequate resources to handle risk. It assigns specific responsibilities for the management of risk and prescribes the documenting, monitoring, and reporting processes to be followed.

This is the second edition of the Risk Management Plan for the XYZ program. The initial plan concentrated on the tasks and the Concept and Technology Development (CTD) Phase leading to Milestone B; this plan concentrates on the tasks and activities of the System Integration part of the System Development and Demonstration (SDD) Phase. Subsequent updates to this RMP will shift focus to the later acquisition phases. There are changes in every area of the plan; they include refinement of the risk identification process. The PMO Risk Management Coordinator has been identified and training of IPT members has commenced.

1.2 PROGRAM SUMMARY

The XYZ program was initiated in response to Mission Need Statement (MNS) XXX, dated DD-MM-YYYY and Operational Requirements Document (ORD), dated DD-MM-YYYY. It is required to support the fundamental objective of U.S. defense policy as stated in Defense Planning Guidance (DPG) and the National Military Strategy. The XYZ system is based on the need for an integrated combat system to link battlefield decision makers. The XYZ mission areas are: (Delineate applicable areas).

The XYZ program will develop and procure 120 advanced platforms to replace the aging ABC platforms currently in the inventory. In order to meet force structure objectives, the XYZ system must reach Initial Operational Capability (IOC) (four platforms) by FY-07. The program is commencing an eight-year EMD phase that will be followed by a five-year procurement phase. The objectives of the EMD phase are to (discuss the specific objectives of this phase). The program has Congressional interest and is restricted to a research and development funding ceiling of $300 million.

1.2.1 System Description

The XYZ will be an affordable, yet capable, platform taking advantage of technological simplification and advancements. The XYZ integrated Combat System includes all non-propulsion electronics and weapons. Subsystems provide capabilities in combat control, electronic warfare support measures (ESM), defensive warfare, navigation, radar, interior communications, monitoring, data transfer, tactical support device, exterior communications, and Identification Friend or Foe (IFF). Weapons systems are to be provided by the program offices that are responsible for their development. The Mechanical and Electrical (M&E) system comprises.... The Combat System, M&E systems, and subsystems provide the XYZ system with the capability and connectivity to accomplish the broad range of missions defined in the MNS and ORD.

1.2.2 Acquisition Strategy

The XYZ program initial strategy is to contract with one prime contractor in the System Integration part of the System Development and Demonstration Phase for development of two prototype systems for test and design validation. Due to the technical complexity of achieving the performance levels of the power generation systems, the prime will use two subcontractors for the engine development and down select to one producer prior to low rate initial production, which is scheduled for FY-04. Various organizations, such as the Government Research Laboratory will be funded to provide experts for assessment of specific areas of risk. The program has exit criteria, included in the list of Critical Program Attributes in Annex A, that must be met before progressing to the next phase.

1.2.3 Program Management Approach

The XYZ program is managed using the IPPD concept, with program integrated product teams (PIPTs) established largely along the hierarchy of the product work breakdown structure (WBS). There are also cost-performance and test Working IPTs (WIPTs) established for vertical coordination up the chain of command. The PM chairs a program level IPT (PLIPT) that addresses issues that are not resolved at the WIPT or PIPT level.

1.3 DEFINITIONS

1.3.1 Risk

Risk is a measure of the inability to achieve overall program objectives within defined cost, schedule, and technical constraints and has two components: (1) the *probability* of failing to achieve a particular outcome and (2) the *consequences/impacts* of failing to achieve that outcome. For processes, risk is a measure of the difference between actual performance of a process and the known best practice for performing that process.

1.3.2 Risk Event

Risk events are those events within the XYZ program that, if they go wrong, could result in problems in the development, production, and fielding of the system. Risk events should be defined to a level such that the risk and causes are understandable and can be accurately assessed in terms of probability/likelihood and consequence/impact to establish the level of risk. For processes, risk events are assessed in terms of process variance from known best practices and potential consequences/impacts of the variance.

1.3.3 Technical Risk

This is the risk associated with the evolution of the design and the production of the XYZ system affecting the level of performance necessary to meet the operational requirements. The contractor's and subcontractors' design, test, and production processes (process risk) influence the technical risk and the nature of the product as depicted in the various levels of the Work Breakdown Structure (product risk).

1.3.4 Cost Risk

This is the risk associated with the ability of the program to achieve its life-cycle cost objectives. Two risk areas bearing on cost are (1) the risk that the cost estimates and objectives are accurate and reasonable and (2) the risk that program execution will not meet the cost objectives as a result of a failure to handle cost, schedule, and performance risks.

1.3.5 Schedule Risk

These risks are those associated with the adequacy of the time estimated and allocated for the development, production, and fielding of the system. Two risk areas bearing on schedule risk are (1) the risk that the schedule estimates and objectives are realistic and reasonable and (2) the risk that program execution will fall short of the schedule objectives as a result of failure to handle cost, schedule, or performance risks.

1.3.6 Risk Ratings

This is the value that is given to a risk event (or the program overall) based on the analysis of the probability/likelihood and consequences/impacts of the event. For the XYZ program, risk ratings of Low, Moderate, or High will be assigned based on the following criteria. See Section 3.3.2 of this appendix for guidance on determining probability/likelihood and consequences/impacts. When rating process variance from best practices, there is no rating of probability/likelihood, rather the level would be a measure of the variance from best practices (see Paragraph 3.3.2.3).

- **Low Risk:** Has little or no potential for increase in cost, disruption of schedule, or degradation of performance. Actions within the scope of the planned program and normal management attention should result in controlling acceptable risk.

- **Moderate Risk:** May cause some increase in cost, disruption of schedule, or degradation of performance. Special action and management attention may be required to handle risk.

- **High Risk:** Likely to cause significant increase in cost, disruption of schedule, or degradation of performance. Significant additional action and high priority management attention will be required to handle risk.

1.3.7 Independent Risk Assessor

An independent risk assessor is a person who is not in the management chain or directly involved in performing the tasks being assessed. Use of independent risk assessors is a valid technique to ensure that all risk areas are identified and that the consequence/impact and probability/likelihood (or process variance) are properly understood. The technique can be used at different program levels, e.g., Program Office, Service Field Activities, Contractors, etc. The Program Manager will approve the use of independent assessors, as needed.

1.3.8 Templates and Best Practices

A "template" is a disciplined approach for the application of critical engineering and manufacturing processes that are essential to the

success of most programs. DoD 4245.7-M, *Transition from Development to Production Solving the Risk Equation*, provides a number of such templates. For each template process described in DoD 4245.7-M, Best Practice Information is described in NAVSO P-6071. These documents outline the ideal or low risk approach and thus serve as a baseline from which risk for some XYZ processes can be assessed.

1.3.9 Metrics

There are measures used to indicate progress or achievement.

1.3.10 Critical Program Attributes

Critical Program Attributes are performance, cost, and schedule properties or values that are vital to the success of the program. They are derived from various sources, such as the Acquisition Program Baseline, exit criteria for the next program phase, Key Performance Parameters, test plans, the judgment of program experts, etc. The XYZ program will track these attributes to determine the progress in achieving the final required value. See Annex A for a list of the XYZ Critical Program Attributes.

2.0 RISK MANAGEMENT APPROACH

2.1 GENERAL APPROACH AND STATUS

DoDI 5000.2 states: "Risks must be well understood, and risk management approaches developed, before decision authorities can authorize a program to proceed into the next phase of the acquisition process." This policy is implemented in DoD Regulation 5000.2-R, with more detailed guidance provided in the individual Service regulation. The *Defense Acquisition Deskbook* (Section 2.5.2) provides additional guidance, advice, and wisdom on the management of risk. Figure B-1 shows how the XYZ program risk management fits into the phases and milestones of the acquisition process.

The XYZ program will use a centrally developed risk management strategy throughout the acquisition process and decentralized risk planning, assessment, handling, and monitoring. XYZ risk management is applicable to all acquisition functional areas.

The results of the Concept Exploration Phase of the program identified potential risk events and the Acquisition Strategy reflects the program's risk-handling approach. Overall, the risk of the XYZ program for Milestone B was assessed as moderate, but acceptable. Moderate risk functional areas were threat, manufacturing, cost, funding, and schedule. The remaining functional areas of technology, design and engineering (hardware and software), support, (schedule) concurrency, human systems integration, and environmental impact were assessed as low risk.

2.2 RISK MANAGEMENT STRATEGY

The basic risk management strategy is intended to identify critical areas and risk events, both technical and non-technical, and take necessary action to handle them before they can become problems, causing serious cost, schedule, or performance impacts. This program will make extensive use of modeling and simulation, technology demonstrations, and prototype testing in handling risk.

Risk management will be accomplished using the integrated Government-Contractor IPT organization. These IPTs will use a structured assessment approach to identify and analyze those processes and products that are critical to meeting the program objectives. They will then develop risk-handling options to mitigate the risks and monitor the effectiveness of the selected

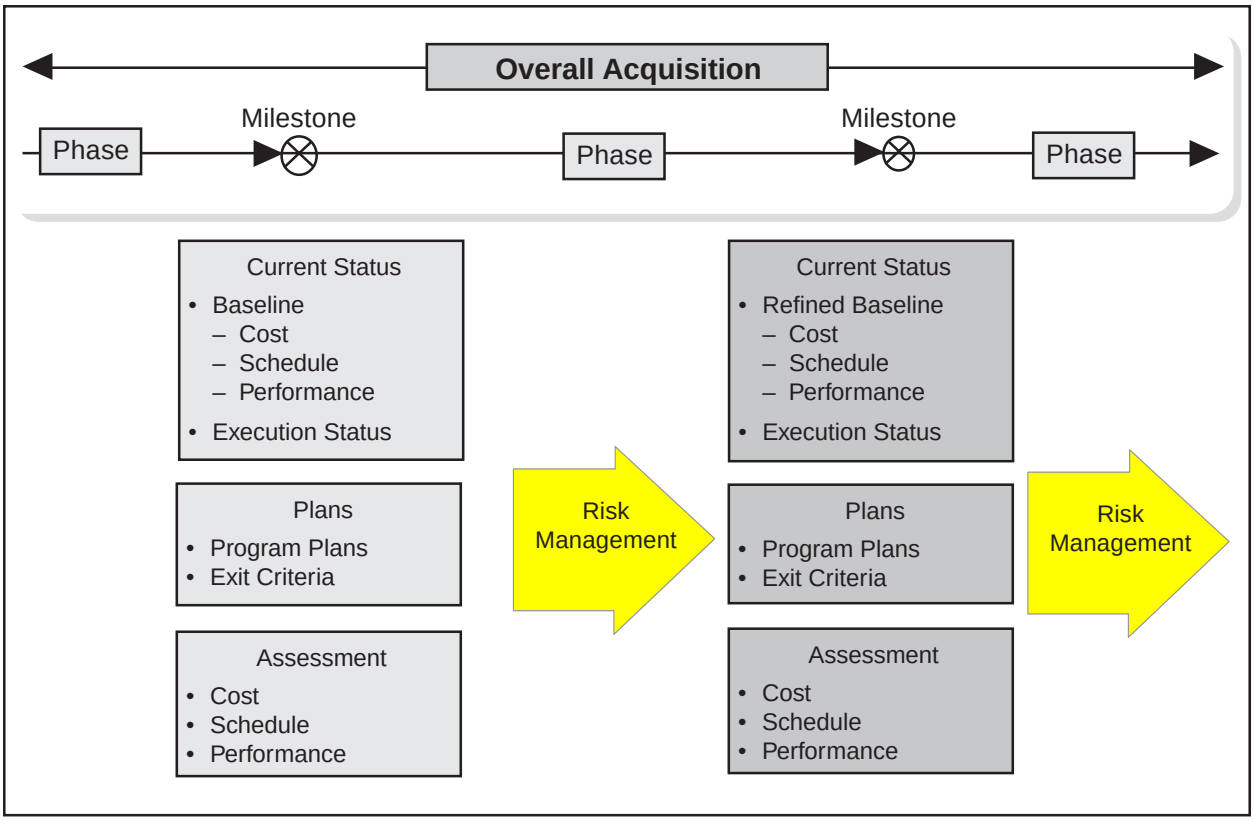

Figure B-1. Risk Management and the Acquisition Process

handling options. Key to the success of the risk management effort is the identification of the resources required to implement the developed risk-handling options.

Risk information will be captured by the IPTs in a risk management information system (RMIS) using a standard Risk Information Form (RIF). The RMIS will provide standard reports, and is capable of preparing *ad hoc* tailored reports. See Annex B for a description of the RMIS and RIF.

Risk information will be included in all program reviews, and as new information becomes available, the PMO and contractor will conduct additional reviews to ascertain if new risks exist. The goal is to be continuously looking to the future for areas that may severely impact the program.

2.3 ORGANIZATION

The risk organization for the XYZ program is shown in Figure B-2. This is *not* a separate organization, but rather shows how risk is integrated into the program's existing organization and shows risk relationships among members of the program team.

2.3.1 Risk Management Coordinator

The Risk Management Coordinator, the XYZ Technology Assessment and R&D Manager, is overall coordinator of the Risk Management Program. The Risk Management Coordinator is responsible for:

- Maintaining this Risk Management Plan;
- Maintaining the Risk Management Database;

- Briefing the PM on the status of XYZ program risk;
- Tracking efforts to reduce moderate and high risk to acceptable levels;
- Providing risk management training;
- Facilitating risk assessments; and
- Preparing risk briefings, reports, and documents required for Program Reviews and the acquisition Milestone decision processes.

2.3.2 Program Level Integrated Product Team (PLIPT)

The PLIPT is responsible for complying with the DoD risk management policy and for structuring an efficient and useful XYZ risk management approach. The Program Manager is the Chair of the PLIPT. The PLIPT membership may be adjusted but is initially established as the chairs of the Program IPTs, designated sub-tier IPTs, and the Heads of PMO Functional Offices.

2.3.3 PIPTs

The Program IPTs are responsible for implementing risk management tasks per this plan. This includes the following responsibilities:

- Review and recommend to the Risk Management Coordinator changes on the overall risk management approach based on lessons learned.
- Quarterly, or as directed, update the program risk assessments made during the System Integration (SI) part of the System Development and Demonstration (SDD) Phase.

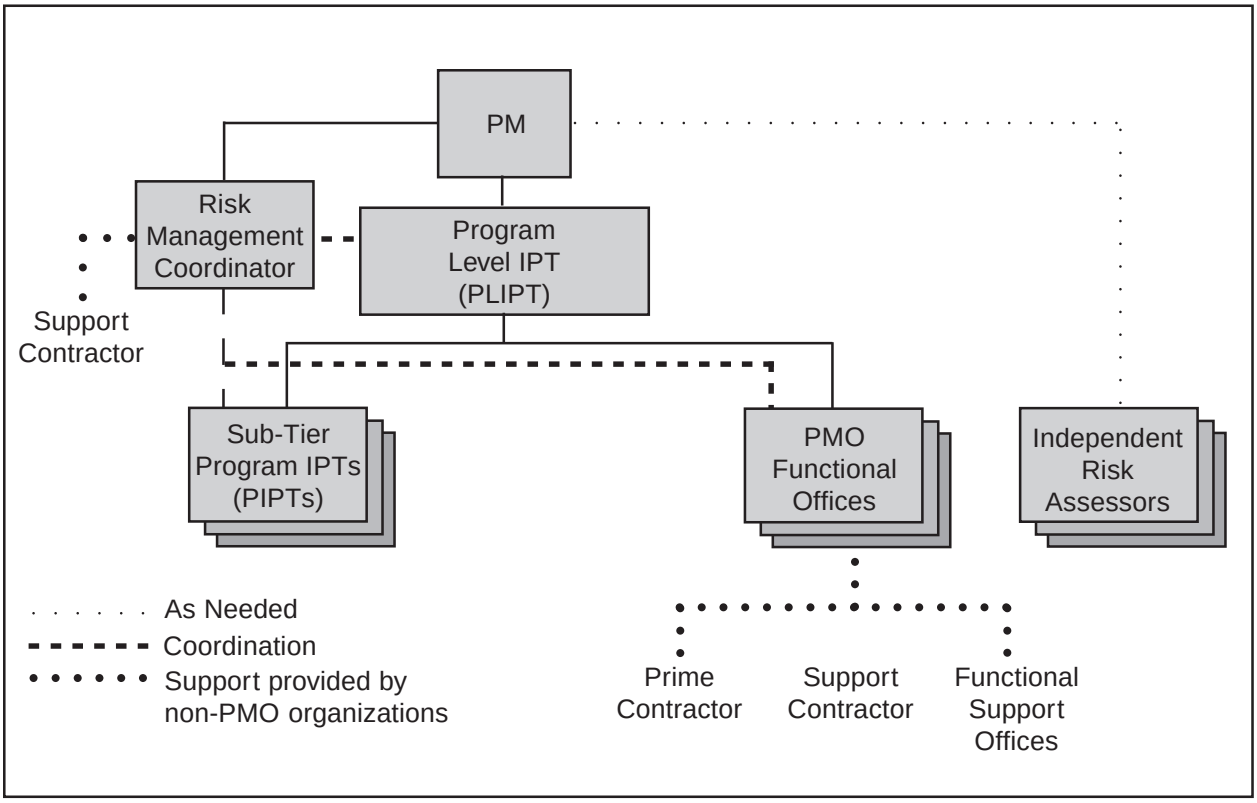

Figure B-2. XYZ Risk Management Organization

- Review and be prepared to justify the risk assessments made and the risk handling plan proposed.

- Report risk to the Program Manager/Program Director, with information to the Risk Management Coordinator via Risk Information Forms (RIFs).

- Ensure that risk is a consideration at each Program and Design Review.

- Ensure Design/Build Team responsibilities incorporate appropriate risk management tasks.

2.3.4 XYZ Independent Risk Assessors

Independent Assessors made a significant contribution to the XYZ Milestone B risk assessments. The use of independent assessments as a means of ensuring that all risk areas are identified will continue, when necessary.

2.3.5 Other Risk Assessment Responsibilities

The Risk Assessment responsibilities of other Systems Command codes, Service Field Activities, Design/Build Teams, and Contractors will be as described in Memoranda of Agreement (MOAs), Memoranda of Understanding (MOUs), Systems Command Tasking, or contracts. This RMP should be used as a guide for XYZ risk management efforts.

2.3.6 User Participation

The Requirements Organization (specific code) is the focal point for providing the Program Executive Officer or the Project Manager with user identified risk assessments.

2.3.7 Risk Training

The key to the success of the risk efforts is the degree to which all members of the team, both Government and contractor are properly trained. The XYZ Program Office will provide risk training, or assign members to training classes, during the SDD Phase. Key personnel with XYZ management or assessment responsibilities are required to attend. All members of the team will receive, at a minimum, basic risk management training. XYZ sponsored training is planned to be presented according to the schedule provided in Annex X (not provided).

3.0 RISK MANAGEMENT PROCESS AND PROCEDURES

3.1 OVERVIEW

This section describes XYZ program's risk management process and provides an overview of the XYZ risk management approach. The *Defense Acquisition Deskbook* defines risk management as "the act or practice of controlling risk. It includes risk planning, assessing risk areas, developing risk-handling options, monitoring risks to determine how risks have changed, and documenting the overall risk management program." Figure B-3 shows, in general terms, the overall risk management process that will be followed in the XYZ program. This process follows DoD and Service policies and guidelines and incorporates ideas found in other sources. Each of the risk management functions shown in Figure B-3 is discussed in the following paragraphs, along with specific procedures for executing them.

3.2 RISK PLANNING

3.2.1 Process

Risk planning consists of the up-front activities necessary to execute a successful risk

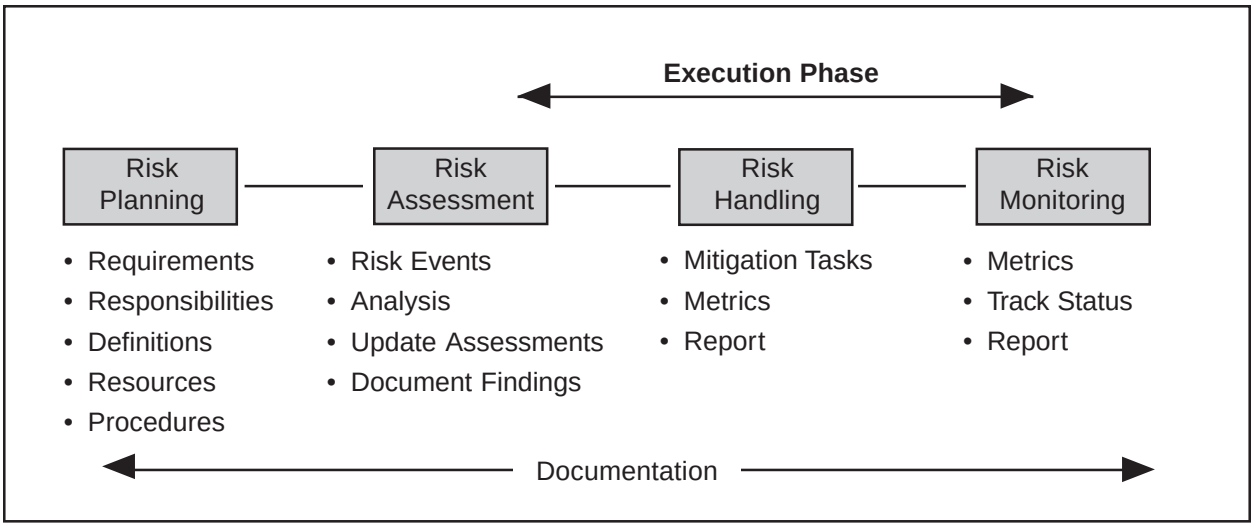

Figure B-3. Risk Management Structure (also referred to as the Risk Management Process Model)

management program. It is an integral part of normal program planning and management. The planning should address each of the other risk management functions, resulting in an organized and thorough approach to assess, handle, and monitor risks. It should also assign responsibilities for specific risk management actions and establish risk reporting and documentation requirements. This RMP serves as the basis for all detailed risk planning, which must be continuous.

3.2.2 Procedures

3.2.2.1 Responsibilities. Each IPT is responsible for conducting risk planning, using this RMP as the basis. The planning will cover all aspects of risk management to include assessment, handling options, and monitoring of risk handling activities. The Program Risk Management Coordinator will monitor the planning activities of the IPTs to ensure that they are consistent with this RMP and that appropriate revisions to this plan are made when required to reflect significant changes resulting from the IPT planning efforts.

Each person involved in the design, production, operation, support, and eventual disposal of the XYZ system or any of its systems or components is a part of the risk management process. This involvement is continuous and should be considered a part of the normal management process.

3.2.2.2 Resources and Training. An effective risk management program requires resources. As part of its planning process, each IPT will identify the resources required to implement the risk management actions. These resources include time, material, personnel, and cost. Training is major consideration. All IPT members should receive instruction on the fundamentals of risk management and special training in their area of responsibility, if necessary.

3.2.2.3 Documentation and Reporting. This RMP establishes the basic documentation and reporting requirements for the program. IPTs should identify any additional requirements that might be needed to effectively manage risk at their level. Any such additional requirements must not conflict with the basic requirements in this RMP.

3.2.2.4 Metrics. Each IPT should establish metrics that will measure the effectiveness of their planned risk-handling options. See Annex C for an example of metrics that may be used.

3.2.2.5 Risk Planning Tools. The following tools can be useful in risk planning. It may be useful to provide this information to the contractors to help them understand the XYZ program's approach to managing risk. This list is not meant to be exclusive.

- DoD Manual 4245.7-M, a DoD guide for assessing process technical risk.
- The Navy's *Best Practices Manual*, NAVSO P-6071, provides additional insight into each of the Templates in DoD 4245.7-M and a checklist for each template.
- Program Manager's Work Station (PMWS) software, may be useful to some risk assessors. PMWS has a Risk Assessment module based on the Template Manual and Best Practices Manual.
- Commercial and Government developed risk management software.

The latter includes Government software, such as *Risk Matrix* developed by Mitre Corporation for the Air Force and the New Attack Submarine Program's *On-Line Risk Data Base (OLRDB)*.

3.2.2.6 Plan Update. This RMP will be updated, if necessary, on the following occasions: (1) whenever the acquisition strategy changes, or there is a major change in program emphasis; (2) in preparation for major decision points; (3) in preparation for and immediately following technical audits and reviews; (4) concurrent with the review and update of other program plans; and (5) in preparation for a POM submission.

3.3 RISK ASSESSMENT

The risk assessment process includes the identification of critical risk events/processes, which could have an adverse impact on the program, and the analyses of these events/processes to determine the probability/likelihood of occurrence/process variance and consequences/impacts. It is the most demanding and time-consuming activity in the risk management process.

3.3.1 Process

3.3.1.1 Identification. Risk identification is the first step in the assessment process. The basic process involves searching through the entire XYZ program to determine those critical events that would prevent the program from achieving its objectives. All identified risks will be documented in the RMIS, with a statement of the risk and a description of the conditions or situations causing concern and the context of the risk.

Risks will be identified by all Program IPTs and by any individual in the program. The lower-level IPTs can identify significant concerns earlier than otherwise might be the case and identify those events in critical areas that must be dealt with to avoid adverse consequences/impacts. Likewise, individuals involved in the detailed and day-to-day technical, cost, and scheduling aspects of the program are most aware of the potential problems (risks) that need to be managed.

3.3.1.2 Analysis. This process involves:

- Identification of WBS elements
- Evaluation of the WBS elements using the risk areas to determine risk events

- Assignment of probability/likelihood and consequence/impact to each risk event to establish a risk rating

- Prioritization of each risk event relative to other risks.

Risk analysis should be supported by a study, test results, modeling and simulation, trade study, the opinion of a qualified expert (to include justification of his or her judgment), or any other accepted analysis technique. The *Defense Acquisition Deskbook*, Section 2524.2 describes a number of analysis techniques that may be useful. Evaluators should identify all assumptions made in assessing risk. When appropriate, a sensitivity analysis should be done on assumptions.

Systems engineering analysis, risk assessments, and manpower risk assessments provide additional information that must be considered. This includes, among other things, environmental impact, system safety and health analysis, and security considerations. Classified programs may experience difficulties in access, facilities, and visitor control that can introduce risk and must be considered.

The analysis of individual risk will be the responsibility of the IPT identifying the risk, or the IPT to which the risk has been assigned. They may use external resources for assistance, such as field activities, Service laboratories, and contractors. The results of the analysis of all identified risks must be documented in the RMIS.

3.3.2 Procedures

3.3.2.1 Assessments – General. Risk assessment is an iterative process, with each assessment building on the results of previous assessments. The current baseline assessment is a combination of the risk assessment delivered by the contractors as part of the Concept and Technology Development (CTD) Phase, the program office risk assessment done before Milestone B, and the post-award Integrated Baseline Review (IBR) performed in the SI part of SDD.

For the program office, unless otherwise directed in individual tasking, program level risk assessments will be presented at each Program Review meeting with a final update not later than 6 months before the next scheduled Milestone decision. The primary source of information for the next assessment will be the current assessment baseline, and existing documentation such as, Concept and Technology Development (CTD) Phase study results, the design mission profile that was done as part of the CTD Phase, the IBR, which will be conducted immediately after the System Integration (SI) Part of the System Development and Demonstration (SDD) Phase contract award, the contract WBS that is part of the IBR, industry best practices as described in the PMWS Knowledge base, the ORD, the Acquisition Program Baseline (APB), and any contractor design documents.

IPTs should continually assess the risks in their areas, reviewing risk-handling actions and the critical risk areas whenever necessary to assess progress. For contractors, risk assessment updates should be made as necessary.

The risk assessment process is intended to be flexible enough so that field activities, service laboratories, and contractors may use their judgment in structuring procedures considered most successful in identifying and analyzing all risk areas.

3.3.2.2 Identification. Following is a description of step-by-step procedures that evaluators may use as a guide to identify program risks.

- **Step One** – Understand the requirements and the program performance goals, which are

defined as thresholds and objectives (see 5000.2-R). Describe the operational (functional and environmental) conditions under which the values must be achieved by referring or relating to design documents. The ORD and APB contain Key Performance Parameters (KPPs).

- **Step Two** – Determine the engineering and manufacturing processes that are needed to design, develop, produce, and support the system. Obtain industry best practices for these processes.

- **Step Three** – Identify contract WBS elements (to include products and processes).

- **Step Four** – Evaluate each WBS element against sources/areas of risk described in Table 4-2 of the DSMC *Risk Management Guide*, plus other sources/areas as appropriate.

- **Step Five** – Assign a probability and consequence/impact to each risk event

- **Step Six** – Prioritize the risk events.

Following are indicators that IPTs may find helpful in identifying and assessing risk:

- **Lack of Stability, Clarity, or Understanding of Requirements:** Requirements drive the design of the system. Changing or poorly stated requirements guarantees the introduction of performance, cost, and schedule problems.

- **Failure to Use Best Practices** virtually assures that the program will experience some risk. The further a contractor deviates from best practices, the higher the risk.

- **New Processes** should always be suspect, whether they are related to design, analysis, or production. Until they are validated, and until the people who implement them have been trained and have experience in successfully using the process, there is risk.

- **Any Process Lacking Rigor** should also be suspect; it is inherently risky. To have rigor, a process should be mature and documented, it should have been validated, and it should be strictly followed.

- **Insufficient Resources:** People, funds, schedule, and tools are necessary ingredients for successfully implementing a process. If any are inadequate, to include the qualifications of the people, there is risk.

- **Test Failure** may indicate corrective action is necessary. Some corrective actions may not fit available resources, or the schedule, and (for other reasons as well) may contain risk.

- **Qualified Supplier Availability:** A supplier not experienced with the processes for designing and producing a specific product is not a qualified supplier and is a source of risk.

- **Negative Trends or Forecasts** are cause for concern (risk) and may require specific actions to turn around.

There are a number of techniques and tools available for identifying risks. Among them are:

- **Best Judgment:** The knowledge and experience of the collective, multi-disciplined Integrated Project Team (IPT) members and the opinion of subject-matter experts (SMEs) are the most common source of risk identification.

- **Lessons Learned** from similar processes can serve as a baseline for the successful way to

achieve requirements. If there is a departure from the successful way, there may be risk.

- **DoD 4245.7-M, *Transition from Development to Production,*** is often called the "Templates" book because it identifies technical risk areas and provides, in "bullet" form, suggestions for avoiding those risks. It focuses on the technical details of product design, test, and production to help managers proactively manage risk. It also includes chapters on facilities, logistics, and management, which make this a useful tool in identifying weak areas of XYZ planned processes early enough to implement actions needed to avoid adverse consequences/impacts. A copy of this manual is available at: **http://www.dtic.mil/whs/directives**.

- The **NAVSO P-6071 *Best Practices Manual*** was developed by the Navy to add depth to the Template Book, DoD 4245.7-M.

- **Critical Program Attributes** are metrics that the program office developed to measure progress toward meeting our objectives. Team members, IPTs, functional managers, contractors, etc., may develop their own metrics to support these measurements. The attributes may be specification requirements, contract requirements, or measurable parameters from any agreement or tasking. The idea is to provide a means to measure whether we are on track in achieving our objectives.

- **Methods and Metrics for Product Success** is a manual published by the Office of the Assistant Secretary of the Navy (RDA) Product Integrity Directorate. It highlights areas related to design, test, and production processes where problems are most often found and metrics for the measurement of effectiveness of the processes. It also describes the software tool, Program Manager's Work Station (PMWS). (See next paragraph.)

- **PMWS** contains risk management software, "Technical Risk Identification and Mitigation System (TRIMS) and Knowledgebase." They provide a tailorable management system based on NAVSO P-6071 and DoD 4245.7-M. The PMWS provides a compact disk (CD) that contains the necessary programs for assessing a program's risk and software for program management. PMWS can be obtained by calling the Best Manufacturing Program (BMP) Office at (301) 403-8100.

- **New Nuclear Submarine (NSSN) On-Line Risk Database (ONLRB)** is a software tool may be used to support the XYZ Risk Management Process. The tool helps IPTs in the identification and assessment of risk and management of handling efforts.

- **Risk Matrix** is another candidate for use by the PMO. It is an automated tool, developed by Mitre Corporation, that supports a structured approach for identifying risk and assessing its potential program impact. It is especially helpful for prioritizing risks.

- **Requirements Documents** describe the output of our efforts. IPT efforts need to be monitored continuously to ensure requirements are met on time and within budget. When they aren't, there is risk.

- **Contracting for Risk Management** helps ensure the people involved with the details of the technical processes of design, test, and production are involved with managing risk. The principle here is that those performing the technical details are normally the first ones to know when risks exist.

- **Quality Standards, such as ISO9000, ANSI/ASQC Q 9000, MIL-HDBK 9000**, and others describe processes for developing and producing quality products. Comparing our processes with these standards can

highlight areas we may want to change to avoid risk.

- Use of **Independent Risk Assessors** is a method to help ensure all risk is identified. The knowledgeable, experienced people are independent from the management and execution of the processes and procedures being reviewed. Independent assessment promotes questions and observations not otherwise achievable.

3.3.2.3 Analysis. Risk analysis is an evaluation of the identified risk events to determine possible outcomes, critical process variance from known best practices, the probability/likelihood of those events occurring, and the consequences/impacts of the outcomes. Once this information has been determined, the risk event may be rated against the program's criteria and an overall assessment of low, moderate, or high assigned. Figure B-4 depicts the risk analysis process and procedures.

Critical Process Variance. For each process risk related event identified, the variance of the process from known standards or best practices must be determined. As shown in Figure B-4, there are five levels (a-e) in the XYZ risk assessment process, with the corresponding criteria of *Minimal, Small, Acceptable, Large, and Significant.* If there is no variance then there is no risk.

Probability/Likelihood. For each risk area identified, the probability/likelihood the risk will happen must be determined. As shown in Figure B-4, there are five levels (a-e) in the XYZ risk assessment process, with the corresponding subjective criteria of *Remote, Unlikely, Likely, Highly Likely,* and *Near Certainty.* If there is zero probability/likelihood of an event, there is no risk per our definition.

Consequence/impact. For each risk area identified, the following question must be answered: *Given the event occurs, what is the magnitude of the consequence/impact?* As shown in the figure, there are five levels of consequence/impact (a-e). "Consequence/impact" is a multifaceted issue. For this program, there are four areas that we will evaluate when determining consequence/impact: technical performance, schedule, cost, and impact on other teams. At least one of the four consequence/impact areas needs to apply for there to be risk; if there is no adverse consequence/impact in any of the areas, there is no risk.

- **Technical Performance:** This category includes all requirements that are not included in the other three metrics of the Consequence/Impact table. The wording of each level is oriented toward design processes, production processes, life cycle support, and to retirement of the system. For example, the word "margin" could apply to weight margin during design, safety margin during testing, or machine performance margin during production.

- **Schedule:** The words used in the Schedule column, as in all columns of the Consequence /Impact table, are meant to be universally applied. Avoid excluding a consequence/impact level from consideration just because it doesn't match your team's specific definitions. In other words, phrases such as need dates, key milestones, critical path, and key team milestones are meant to apply to all IPTs.

- **Cost:** Since costs vary from component to component and process to process, the percentage criteria shown in the figure may not strictly apply at the lower levels of the WBS. These team leaders can set the percentage criteria that best reflects their situation. However, when costs are rolled up at higher levels

Level	What is the Likelihood the Risk Event Will Happen?
a	Remote
b	Unlikely
c	Likely
d	Highly likely
e	Near certainty

Process Variance refers to deviation from best practices. Likelihood/Probability refers to risk events.

ASSESSMENT GUIDE

Likelihood	a	b	c	d	e
e	L	M	H	H	H
d	L	M	M	H	H
c	L	M	M	M	H
b	L	L	L	M	M
a	L	L	L	L	M

Consequence

RISK ASSESSMENT

- **R** **HIGH—**Unacceptable. Major disruption likely. Different approach required. Priority management attention required.
- **Y** **MODERATE—**Some disruption. Different approach may be required. Additional management attention may be needed.
- **G** **LOW—**Minimum impact. Minimum oversight needed to ensure risk remains low.

Level	Technical Performance	and/ or	Schedule	and/ or	Cost	and/ or	Impact on Other Teams
a	Minimal or no impact		Minimal or no impact		Minimal or no impact		None
b	Acceptable with some reduction in margin need dates		Additional resources required; able to meet		<5%		Some impact
c	Acceptable with significant reduction in margin		Minor slip in key milestones; not able to meet need date		5-7%		Moderate impact
d	Acceptable; no remaining margin		Major slip in key milestone or critical path impacted		7-10%		Major impact
e	Unacceptable major program milestone		Can't achieve key team or		>10%		Unacceptable

Figure B-4. Risk Assessment Process

(e.g., Program), the following definitions will be used: Level 1—no change, Level 2—<5%, Level 3—5-7%, Level 4—7-10%, and Level 5—>10%.

- **Impact on Other Teams:** Both the consequence/impact of a risk and the mitigation actions associated with reducing the risk may impact another team. This may involve additional coordination or management attention (resources) and may therefore increase the level of risk. This is especially true of common technical processes.

Risk Rating. Probability and consequence/impact should not always be considered equally; for example, there may be consequences/impacts so severe that it is considered high risk even though the probability to achieve a particular outcome is low. After deciding a level of process variance/probability/likelihood (a through e) and a level of consequence/impact (a through e), enter the *Assessment Guide* portion of Figure B-4 to obtain a risk rating (green = LOW, yellow = MOD, and red = HIGH). For example; consequence/impact/process variance/probability/likelihood level 2b corresponds to LOW risk, level 3d corresponds to MOD risk, level 5c corresponds to HIGH risk. After obtaining the risk rating, make a subjective comparison of the risk event with the applicable rating definition in Figure B-4 (e.g., High= unacceptable, major disruptions, etc.). There should be a close match. If there isn't, consider reevaluating the level of

probability/likelihood or consequence/impact. Those risk events that are assessed as moderate or high should be submitted to the XYZ Risk Management Coordinator on a RIF.

Figure B-4 is useful to convey information to decision makers and will be used primarily for that purpose. The PMO will use the Risk Tracking Report and Watch List. (See Annex D.)

3.4 RISK HANDLING

3.4.1 Process

After the program's risks have been identified and assessed, the approach to handling each significant risk must be developed. There are essentially four techniques or options for handling risks: avoidance, control, transfer, and assumption. For all identified risks, the various handling techniques should be evaluated in terms of feasibility, expected effectiveness, cost and schedule implications, and the effect on the system's technical performance, and the most suitable technique selected. Section 2524.3 of the *Defense Acquisition Deskbook* contains information on the risk-handling techniques and various actions that can be used to implement them. The results of the evaluation and selection will be included and documented in the RMIS using the RIF. This documentation will include: what must be done, the level of effort and materials required, the estimated cost to implement the plan, a proposed schedule showing the proposed start date, the time phasing of significant risk reduction activities, the completion date, and their relationship to significant Program activities/milestones (an example is provided in Annex B), recommended metrics for tracking the action, a list of all assumptions, and the person responsible for implementing and tracking the selected option.

3.4.2 Procedures

The IPT that assessed the risk is responsible for evaluating and recommending to the PM the risk-handling options that are best fitted to the program's circumstances. Once approved, these are included in the program's acquisition strategy or management plans, as appropriate.

For each selected handling option, the responsible IPT will develop specific tasks that, when implemented, will handle the risk. The task descriptions should explain what has to be done, the level of effort, and identify necessary resources. It should also provide a proposed schedule to accomplish the actions including the start date, the time phasing of significant risk reduction activities, the completion date, and their relationship to significant Program activities/milestones (an example is provided in Annex B), and a cost estimate. The description of the handling options should list all assumptions used in the development of the handling tasks. Assumptions should be included in the RIF. Recommended actions that require resources outside the scope of a contract or official tasking should be clearly identified, and the IPTs, the risk area, or other handling plans that may be impacted should be listed.

Reducing requirements as a risk avoidance technique will be used only as a last resort, and then only with the participation and approval of the user's representative.

DoD 4245.7-M Templates and NAVSO P-6071 *Best Practices Manual*, are useful in developing risk-handling actions for design, test, or manufacturing process risks.

3.5 RISK MONITORING

3.5.1 Process

Risk monitoring systematically tracks and evaluates the performance of risk-handling actions. It is part of the PMO function and responsibility and will not become a separate discipline. Essentially, it compares predicted results of planned actions with the results actually achieved to determine status and the need for any change in risk-handling actions. The effectiveness of the risk-monitoring process depends on the establishment of a management indicator system (metrics) that provides accurate, timely, and relevant risk information in a clear, easily understood manner. (See Annex D.) The metrics selected to monitor program status must adequately portray the true state of the risk events and handling actions. Otherwise, indicators of risks that are about to become problems will go undetected.

To ensure that significant risks are effectively monitored, risk-handling actions (which include specific events, schedules, and "success" criteria) will be reflected in integrated program planning and scheduling. Identifying these risk handling actions and events in the context of Work Breakdown Structure (WBS) elements establishes a linkage between them and specific work packages, making it easier to determine the impact of actions on cost, schedule, and performance. The detailed information on risk-handling actions and events will be included in the RIF for each identified risk, and thus be resident in the RMIS.

3.5.2 Procedures

The functioning of IPTs is crucial to effective risk monitoring. They are the "front line" for obtaining indications that risk-handling efforts are achieving their desired effects. Each IPT is responsible for monitoring and reporting the effectiveness of the handling actions for the risks assigned. Overall XYZ program risk assessment reports will be prepared by the XYZ Risk Management Coordinator working with the cognizant IPT.

Many techniques and tools are available for monitoring the effectiveness of risk-handling actions, and IPTs must ensure that they select those that best suit their needs. No single technique or tool is capable of providing a complete answer—a combination must be used. At a minimum, each IPT will maintain a watch list of identified high priority risks. See Section 2524.4 of the *Defense Acquisition Deskbook* for information on specific techniques.

Risks rated as Moderate or High risk will be reported to the XYZ Risk Management Coordinator, who will also track them, using information provided by the appropriate IPT, until the risk is considered Low and recommended for "Close Out." The IPT that initially reported the risk retains ownership and cognizance for reporting status and keeping the database current. Ownership means implementing handling plans and providing periodic status of the risk and of the handling plans. Risk will be made an agenda item at each management or design review, providing an opportunity for all concerned to offer suggestions for the best approach to managing risk. Communicating risk increases the program's credibility and allows early actions to minimize adverse consequences/impacts.

The risk management process is continuous. Information obtained from the monitoring process is fed back for reassessment and evaluations of handling actions. When a risk area is changed to Low, it is put into a "Historical File" by the Risk Management Coordinator and it is no longer tracked by the XYZ PMO. The "owners" of all Low risk areas will continue monitoring Low risks to ensure they stay Low.

The status of the risks and the effectiveness of the risk-handling actions will be reported to the Risk Management Coordinator:

- Quarterly;
- When the IPT determines that the status of the risk area has changed significantly (as a minimum when the risk changes from high to moderate to low, or vice versa); and
- When requested by the Program Manager.

4.0 RISK MANAGEMENT INFORMATION SYSTEM AND DOCUMENTATION

The XYZ program will use the XXX database management system as its RMIS. The system will contain all of the information necessary to satisfy the program documentation and reporting requirements.

4.1 RISK MANAGEMENT INFORMATION SYSTEM (RMIS)

The RMIS stores and allows retrieval of risk-related data. It provides data for creating reports and serves as the repository for all current and historical information related to risk. This information will include risk assessment documents, contract deliverables, if appropriate, and any other risk-related reports. The PMO will use data from the RMIS to create reports for senior management and retrieve data for day-to-day management of the program. The program produces a set of standard reports for periodic reporting and has the ability to create ad hoc reports in response to special queries. See Annex D for a detailed discussion of the RMIS.

Data are entered into the RMIS using the Risk Information Form (RIF). The RIF gives members of the project team, both Government and contractors, a standard format for reporting risk-related information. The RIF should be used when a potential risk event is identified and will be updated as information becomes available as the assessment, handling, and monitoring functions are executed.

4.2 RISK DOCUMENTATION

All program risk management information will be documented, using the RIF as the standard RMIS data entry form. The following paragraphs provide guidance on documentation requirements for the various risk management functions.

4.2.1 Risk Assessment Documentation

Risk assessments form the basis for many program decisions. From time to time, the PM will need a detailed report of any assessment of a risk event. It is critical that all aspects of the risk management process are documented.

4.2.2 Risk Handling Documentation

Risk-handling documentation will be used to provide the PM with the information he needs to choose the preferred mitigation option.

4.2.3 Risk Monitoring Documentation

The PM needs a summary document that tracks the status of high and moderate risks. The Risk Management Coordinator will produce a risk tracking list, for example, that uses information that has been entered from the RMIS. This document will be produced on a monthly basis.

4.3 REPORTS

Reports are used to convey information to decision makers and team members on the status of the program and the effectiveness of the risk management program. Every effort will

be made to generate reports using the data resident in the RMIS.

4.3.1 Standard Reports

The RMIS will have a set of standard reports. If IPTs or functional managers need additional reports, they should work with the Risk Management Coordinator to create them. Access to the reporting system will be controlled; however, any member of the Government or contractor team may obtain a password to gain access to the information. See Annex B for a description of the XYZ program reports.

4.3.2 *Ad Hoc* Reports

In addition to standard reports, the PMO will need to create *ad hoc* reports in response to special queries. The Risk Management Coordinator will be responsible for these reports.

ANNEX A
TO XYZ RISK MANAGEMENT PLAN
- CRITICAL PROGRAM ATTRIBUTES -

Category	Description	Responsible IPT	Remarks
Performance/Physical	Speed		
	Weight		
	Endurance		
	Crew Size		
	Survivability		
	Maneuverability		
	Size		
	Receiver Range		
	Transmitter Range		
	Data Link Operations		
	Recovery Time		
	Initial Setup		
	Identification Time		
	Accuracy Location		
	Probability of Accurate ID		
	Reliability		
	Maintainability		
	Availability		
	Etc.		
Cost	Operating and Support Costs		
	Etc.		
Processes	Requirements Stable		
	Test Plan Approved		
Exit Criteria	Engine Bench Test		
	Accuracy Verified by Test Data and Analysis		
	Toolproofing Completed		
	Logistics Support Reviewed by User		

Table B-1. Critical Program Attributes

ANNEX B
TO XYZ RISK MANAGEMENT PLAN
- PROGRAM RISK REDUCTION SCHEDULE -
(EXAMPLE OF RISK HANDLING PLAN SCHEDULE)

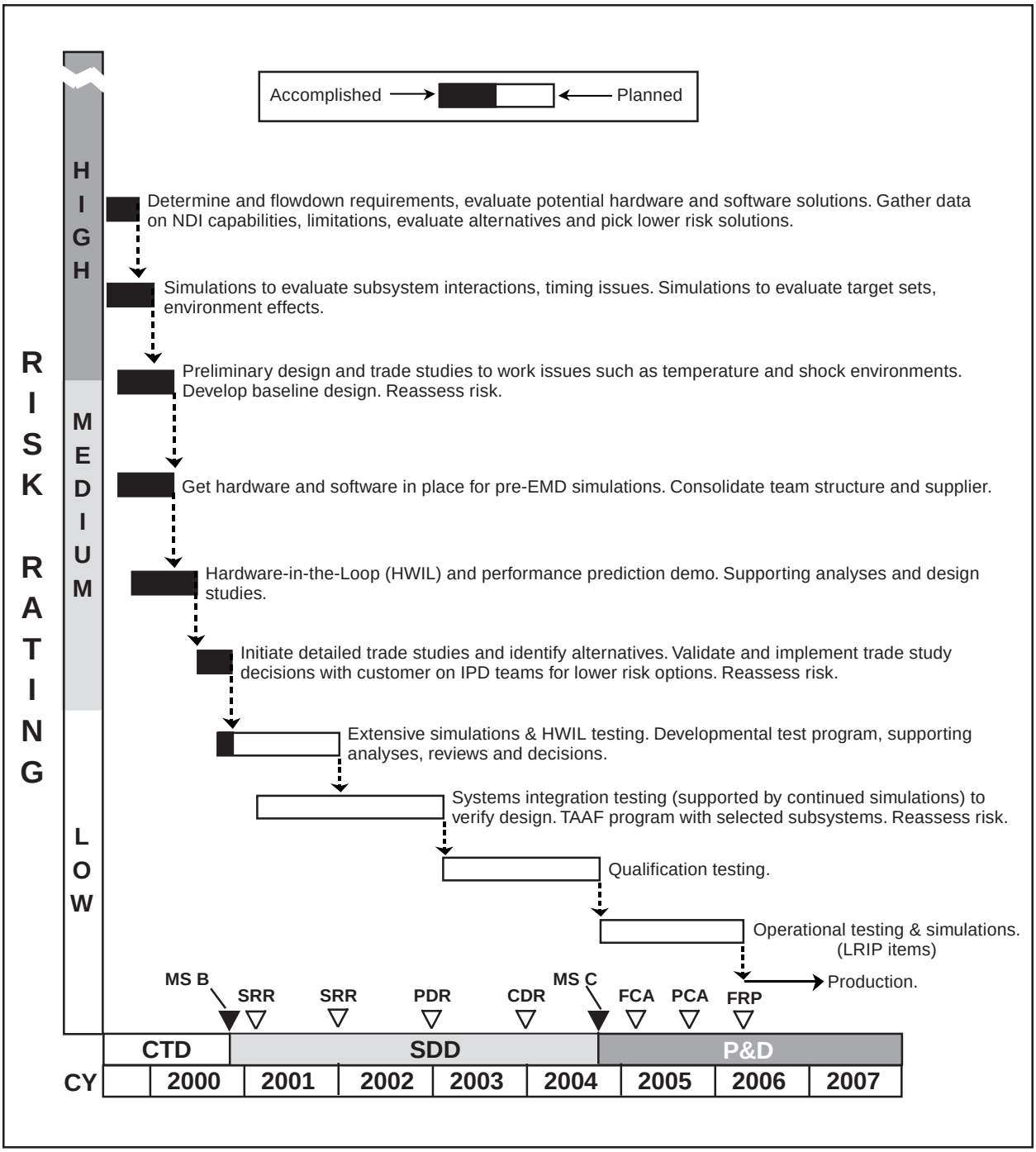

Figure B-5. XYZ Program Risk Handling Plan Schedule (Example)

ANNEX C
TO XYZ RISK MANAGEMENT PLAN
- PROGRAM METRIC EXAMPLES -

Engineering	Requirements	Production	Support
Key Design Parameters • Weight • Size • Endurance • Range Design Maturity • Open problems reports • Number of engineering change proposals • Number of drawings released • Failure activities Computer Resource Utilization Etc.	Requirements Traceability Requirements Stability Threat Stability Design Mission Profile	Manufacturing Yields Incoming Material Yields Delinquent Requisitions Unit Production Cost Process Proofing Waste Personnel Stability	Special Tools and Test Equipment Support Infrastructure Footprint Manpower Estimates

Table B-2. Examples of Product-Related Metrics

Design Requirements	Trade Studies	Design Process	Integrated Test Plan	Failure Reporting System	Manufacturing Plan
Development of requirements traceability plan Development of specification tree Specifications reviewed for: • Definition of all use environments • Definition of all functional requirements for each mission performed	Users needs prioritized Alternative system configurations selected Test methods selected	Design requirements stability Producibility analysis conducted Design analyzed for: • Cost • Parts reduction • Manufacturability • Testability	All developmental tests at system and subsystem level identified Identification of who will do test (Government, contractor, supplier)	Contractor corporate-level management involved in failure reporting and corrective action process Responsibility for analysis and corrective action assigned to specific individual with close-out date	Plan documents methods by which design to be built Plan contains sequence and schedule of events at contractor and subcontractor levels that defines use of materials, fabrication flow, test equipment, tools, facilities, and personnel Reflects manufacturing inclusion in design process. Includes identification and assessment of design facilities

Table B-3. Examples of Process Metrics

Cost	Schedule
Cost variance	Schedule variance
Cost performance index	Schedule performance index
Estimate at completion	Design schedule performance
Management reserve	Manufacturing schedule performance
	Test schedule performance

Table B-4. Examples of Cost and Schedule Metrics

ANNEX D
TO XYZ RISK MANAGEMENT PLAN
- MANAGEMENT INFORMATION SYSTEM AND DOCUMENTATION -

1.0 DESCRIPTION

In order to manage risk, we need a database management system that stores and allows retrieval of risk-related data. The Risk Management Information System provides data for creating reports and serves as the repository for all current and historical information related to risk. This information may include risk assessment documents, contract deliverables, if appropriate, and any other risk-related reports. The Risk Management Coordinator is responsible for the overall maintenance of the RMIS, and he or his designee are the only persons who may enter data into the database.

The RMIS will have a set of standard reports. If IPTs or functional managers need additional reports, they should work with the Risk Management Coordinator to create them. Access to the reporting system will be controlled; however, any member of the Government or contractor team may obtain a password to gain access to the information.

In addition to standard reports, the PMO will need to create ad hoc reports in response to special queries etc. The Risk Management Coordinator will be responsible for these reports. Figure B-6 shows a concept for a management and reporting system.

2.0 RISK MANAGEMENT REPORTS—XYZ PROGRAM

The following are examples of basic reports that a PMO may use to manage its risk program. Each office should coordinate with the Risk Management Coordinator to tailor and amplify them, if necessary, to meets its specific needs.

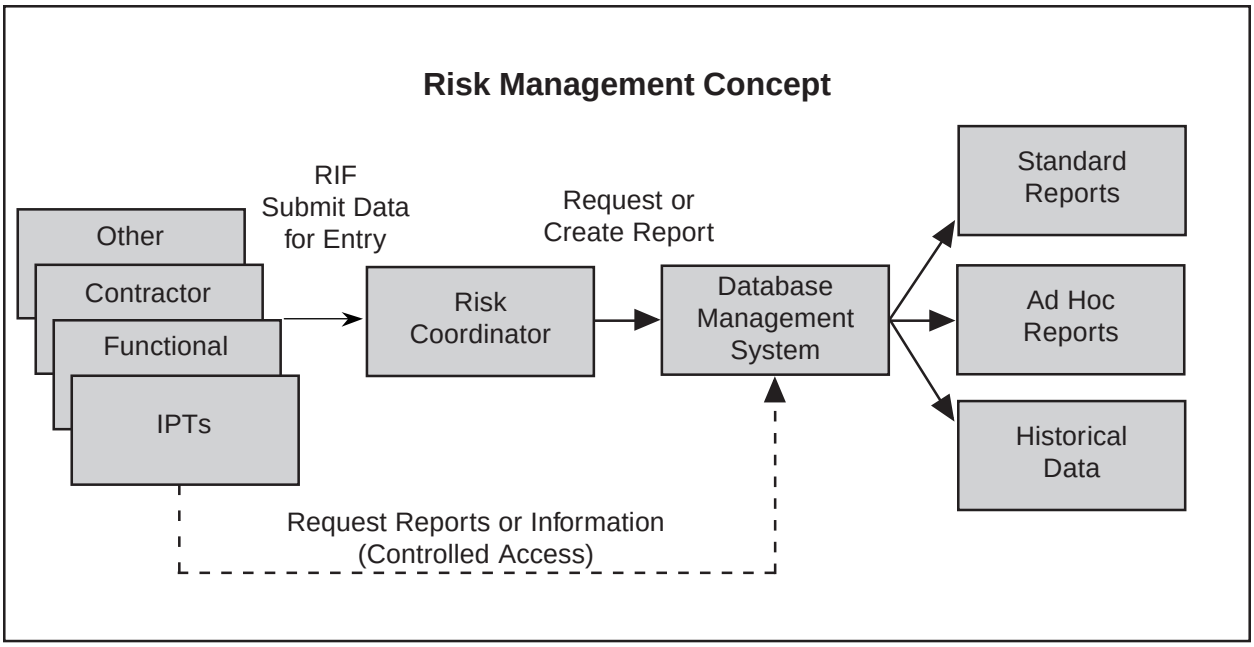

Figure B-6. Conceptual Risk Management and Reporting System

2.1 RISK INFORMATION FORM

The PMO needs a document that serves the dual purpose of a *source* of data entry information and a *report* of basic information for the IPTs, etc. The Risk Information Form (RIF) serves this purpose. It gives members of the project team, both Government and contractors, a format for reporting risk-related information. The RIF should be used when a potential risk event is identified and updated over time as information becomes available and the status changes. As a source of data entry, the RIF allows the database administrator to control entries. The format for a RIF is included on page B-29.

2.2 RISK ASSESSMENT REPORT

Risk assessments form the basis for many program decisions, and the PM may need a detailed report of assessments of a risk event that has been done. A Risk Assessment Report (RAR) is prepared by the team that assessed a risk event and amplifies the information in the RIF. It documents the identification, analysis, and handling processes and results. The RAR amplifies the summary contained in the RIF, is the basis for developing risk-handling plans, and serves as a historical recording of program risk assessment. Since RARs may be large documents, they may be stored as files. RARs should include information that links it to the appropriate RIF.

2.3 RISK-HANDLING DOCUMENTATION

Risk-handling documentation may be used to provide the PM with information he needs to choose the preferred mitigation option and is the basis for the handling plan summary contained in the RIF. This document describes the examination process for risk-handling options and gives the basis for the selection of the recommended choice. After the PM chooses an option, the rationale for that choice may be included. There should be a time-phased plan for each risk-handling task. Risk-handling plans are based on results of the risk assessment. This document should include information that links it to the appropriate RIF.

2.4 RISK MONITORING DOCUMENTATION

The PM needs a summary document that tracks the status of high and moderate risks. The XYZ program will use a risk-tracking list that contains information that has been entered from the RIF. An example of the tracking report/list is shown on page B-30.

3.0 DATABASE MANAGEMENT SYSTEM (DBMS)

The XYZ Risk Management Information System (RMIS) provides the means to enter and access data, control access, and create reports. Key to the MIS are the data elements that reside in the database. Listed below are the types of risk information that will be included in the database. “Element” is the title of the database field; “Description” is a summary of the field contents. The Risk Management Coordinator will create the standard reports such as, the RIF, Risk Monitoring, etc. The RMIS also has the ability to create “ad hoc” reports, which can be designed by users and the Risk Management Coordinator.

Element	Description
Risk Identification (ID) Number	Identifies the risk and is a critical element of information, assuming that a relational database will be used by the PMO. (Construct the ID number to identify the organization responsible for oversight.)
Risk Event	States the risk event and identifies it with a descriptive name. The statement and risk identification number will always be associated in any report.
Priority	Reflects the importance of this risk priority assigned by the PMO compared to all other risks, e.g., a one (1) indicates the highest priority.
Data Submitted	Gives the date that the RIF was submitted.
Major System/ Component	Identifies the major system/component based on the WBS.
Subsystem/ Functional Area	Identifies the pertinent subsystem or component based on the WBS.
Category	Identifies the risk as technical/performance cost or schedule or combination of these.
Statement of Risk	Gives a concise statement (one or two sentences) or the risk.
Description of Risk	Briefly describes the risk. Lists the key processes that are involved in the design, development, and production of the particular system or subsystem. If technical/performance, includes how it is manifested (e.g., design and engineering, manufacturing, etc.)
Key Parameters	Identifies the key parameter, minimum acceptable value, and goal value, if appropriate. Identifies associated subsystem values required to meet the minimum acceptable value and describes the principal events planned to demonstrate that the minimum value has been met.
Assessment	States if an assessment has been done. Cites the Risk Assessment Report, if appropriate.
Analyses	Briefly describes the analysis done to assess the risk. Includes rationale and basis for results.
Probability of Occurrence	States the likelihood of the event occurring, based on definitions in the program's Risk Management Plan.
Consequence	States the consequence of the event, if it occurs, based on definitions in the program's Risk Management Plan.
Time Sensitivity	Estimates the relative urgency for implementing the risk-handling option.
Other Affected Areas	If appropriate, identifies any other subsystem or process that this risk affects.
Risk Handling Plans	Briefly describes plans to mitigate the risk. Refers to any detailed plans that may exist, if appropriate.
Risk Monitoring Activity	Measures using metrics for tracking progress in implementing risk handling plans and achieving planned results for risk reduction.
Status	Briefly reports the status of the risk-handling activities and outcomes relevant to any risk handling milestones.
Status Due Date	Lists date of the status report.
Assignment	Lists individual assigned responsibility for mitigation activities.
Reported By	Records name and phone number of individual who reported the risk.

Table B-5. DBMS Elements

Risk Information Form

Risk Identification Number Date
Risk Event:
Priority

Major System/Component/Functional Area:

Category:

Statement of Risk:
Description of Risk:

Key Parameters:
Assessment:

Analysis:

Process Variance
Probability of Occurrence:
Consequence:

Time Sensitivity:
Other Affected Areas:

Risk Handling Plans:

Risk Monitoring Activity:

Status
Status Date:

Assignment: Reported By:

Figure B-7. Risk Information Form

Risk Tracking Report
(Example Report)

I. Risk Area Status: Design P_F: Hi C_F: Hi

Significant Design Risks:

1. Title: System Weight P_F: Hi C_F: Hi

Risk Event: Exceed system weight by 10%; decreasing the range and increasing fuel consumption.

Action: Examining subsystems to determine areas where weight may be reduced. Reviewing the requirement. Closely watching the effect on reliability and survivability.

2. Title: Design Analysis P_F: Hi C_F: Hi

Risk Event: Failure Modes, Effects and Criticality Analysis (FMECA) is planned too late to identify and correct any critical single-point failure points prior to design freeze.

Action: Additional resources are being sought to expedite performance of FMECA.

II. Risk Area Status: Supportability P_F: Hi C_F: Mod/Hi

1. Title: Operational Support P_F: Hi C_F: Mod/Hi

Risk Event: Power supply subcontractor is in financial trouble and may go out of business. No other known sources exist.

Action: Doing trade study to see if alternative designs have a broader power supply vendor base. Prime contractor is negotiating with the subcontractor to buy drawings for development of second source.

Figure B-8. Risk Tracking Report Example

Potential Risk Area	Risk Reduction Actions	Action Code	Due Date	Date Completed	Explanation
• Accurately predicting shock environment shipboard equipment will experience.	• Use multiple finite element codes & simplified numerical models for early assessments. • Shock test simple isolated deck, and proposed isolated structure to improve confidence in predictions.	SE03 SE03	31 Aug 01 31 Aug 02		
• Evaluating acoustic impact of the ship systems that are not similar to previous designs.	• Concentrate on acoustic modeling and scale testing of technologies not demonstrated successfully in large-scale tests or full-scale trials. • Factor acoustic signature mitigation from isolated modular decks into system requirements. Continue model tests to validate predictions for isolated decks.	SE031 SE032	31 Aug 01 31 Aug 02		

Table B-6. Watch List Example

SAMPLE RISK MANAGEMENT PLAN FOR THE ABC PROGRAM (ACAT III, IV)

1.0 INTRODUCTION

1.1 PURPOSE

This Risk Management Plan (RMP) presents the process for implementing the comprehensive and proactive management of risk as part of the overall management of the *ABC* Program. Risk management is a program management tool to handle events that might adversely impact the program, thereby increasing the probability/likelihood of success. This RMP describes a management tool that will:

- Serve as a basis for identifying alternatives to achieve cost, schedule, and performance goals,
- Assist in making decisions on budget and funding priorities,
- Provide risk information for Milestone decisions, and
- Allow monitoring the health of the program as it proceeds.

The RMP describes methods for assessing (identifying and analyzing), prioritizing, and monitoring risk drivers; developing risk-handling approaches, and applying adequate resources to handle risk. It assigns specific responsibilities for these functions, and prescribes the documenting, monitoring, and reporting processes to be followed.

If necessary, this RMP will be updated on the following occasions: (1) whenever the acquisition strategy changes, or there is a major change in program emphasis; (2) in preparation for major decision points; (3) in preparation for, and immediately following, technical audits and reviews; (4) concurrent with the review and update of other program plans; and (5) in preparation for a POM submission.

2.0 PROGRAM SUMMARY

2.1 DESCRIPTION

The *ABC* Program is an ACAT III level program that was initiated in response to the NEW COM Operational Requirements Document (ORD) XXX, dated DD-MM-YYYY. The program will provide an ABC communications system that will be the common system (transmitter/receiver/controller) for all DoD components for UHF satellite communications. All DoD systems requiring UHF satellite communications procured subsequent to Initial Operational Capability (IOC) of the *ABC* system will incorporate it to meet their needs. The Bx Unmanned Air Vehicle is the lead system for integration. The program has completed the Systems Integration part of the System Development and Demonstration (SDD) Phase and is preparing for an Interim Progress Review.

The system will be acquired using off-the-shelf UHF satellite communications systems. During the System Integration (SI) part of the System Development and Demonstration (SDD) Phase of the program, two contractors delivered prototypes of their systems. One is a ruggedized commercial product and the other is built to military specifications. The Government tested both systems against functional and performance requirements and some environmental extremes. Although, each failed portions of the tests, both were evaluated as mature enough to represent an acceptable risk for proceeding to the System Demonstration part of the SDD Phase of the program.

2.2 ACQUISITION STRATEGY

The Government will invite the contractors that participated in System Integration (SI) Part of the System Development and Demonstration (SDD) Phase of the program to submit proposals to refine their approached into a stable, interoperable, producible, supportable, and cost-effective design; validate the manufacturing or production process; and demonstrate system capabilities through testing. The Government will select one of the two proposals for the System Demonstration part of the SDD Phase of the program. The contractor, upon demonstration of exit criteria (See Annex A), will proceed with a Low Rate Initial Production (LRIP) of the system.

The IOC (20 systems) for the *ABC* system is required by FY-02 to support the fielding of the Bx UAV. Production capacity for the *ABC* system at IOC is expected to be 20 units per month to meet the demand of new systems.

2.3 PROGRAM MANAGEMENT APPROACH

The *ABC* Program Manager (PM) reports to the Program Director, Satellite Communications who has responsibility for all satellite communications systems. The *ABC* Program Office (PO) is composed of the PM and one assistant, with matrix support from the systems command organizations, and program management support from an external contractor. An integrated management approach will be used for this program. The government and selected contractor will have representation on Integrated Product Teams (IPTs) that will focus on cost, design, test, manufacturing, and support of the system. The PM chairs the government IPT that develops strategies for acquisition and contracts.

3.0 RISK-RELATED DEFINITIONS

The *Defense Acquisition Deskbook,* Section 2521 contains the definitions for risk, risk management, risk events, and the terms associated with risk management that will be used by the *ABC* PO. Variation and clarification of definitions that appear in the *Defense Acquisition Deskbook*, as they are used in the *ABC* program are described below.

3.1 TECHNICAL RISK

This is the risk associated with the evolution of the design, production, and supportability of the *ABC* system affecting the level of performance necessary to meet the operational requirements. The contractor and subcontractors' design, test, and production processes (process risk) influence the technical risk and the nature of the product as depicted in the various levels of the Work Breakdown Structure (product risk). Process risks are assessed in terms of process variance fro known best practices and potential consequences/impacts of the variance. Product risks are assessed in terms of technical performance measures and observed variances from established profiles.

3.2 COST RISK

The risk associated with the ability of the program to achieve its life-cycle cost objectives. Two risk areas bearing on cost are (1) the risk that the cost estimates and objectives are accurate and reasonable and (2) the risk that program execution will not meet the cost objectives as a result of a failure to mitigate technical risks.

3.3 RISK RATINGS

This is the value that is given to a risk event (or the program overall) based on the analysis of the probability/likelihood and consequences/

impacts of the event. For the *ABC* program, risk ratings of low, moderate, or high will be assigned based on the criteria in Section 6.2.

4.0 RISK MANAGEMENT STATUS AND STRATEGY

4.1 RISK MANAGEMENT STATUS

As a result of the Program Definition and Risk Reduction Phase, the overall risk of the *ABC* Program for Milestone C is assessed as moderate, but acceptable. Moderate risk functional areas are environmental requirements; form, fit and function; integration; manufacturing; and cost.

4.2 RISK MANAGEMENT STRATEGY

The *ABC* Program risk management strategy is to handle program risks, both technical and non-technical, before they become problems, causing serious cost, schedule, or performance impacts. This strategy is an integral part of the Acquisition Strategy and the program management approach, and will be executed primarily through the Government-Contractor PIPT organization. The PIPTs will continuously and proactively assess critical areas (especially those listed in the previous paragraph) to identify and analyze specific risks and will develop options to mitigate all risks designated as moderate and high. The PIPTs will also identify the resources required to implement the developed risk-handling options. The PM, through the Program Level Integrated Product Team (PLIPT), will review and approve the PIPT options. Once approved, the options will be incorporated into the program integrated master plan (IMP) and integrated master schedule (IMS). The PIPTs will monitor the effectiveness of the selected handling options, and adjust the risk handling approach as necessary.

IPTs will keep risk information current by using the risk management information system described in paragraph 6.5. Risk status will be reported at all program reviews. As new information becomes available, the PO and contractor will conduct additional reviews to ascertain if new risks exit. The goal is to be continuously looking to the future for areas that may severely impact the program.

5.0 RISK MANAGEMENT ORGANIZATION

5.1 PROGRAM OFFICE

The *ABC* Program risk management organization is shown in Figure B-9. This structure is integrated into the contractor and Government's existing organizations. Program Integrated Product Teams (PIPTs) will be formed for the functional areas that are critical to the success of the program. All functional areas not covered by a PIPT will be assessed and reviewed by the PLIPT co-chaired by the *ABC* PM and contractor PM, to ensure adequate vigilance against emerging risk areas. Independent risk assessors amy conduct reviews, when directed by the PM, to ensure the interface requirements of user systems are being met by the *ABC* system design.

The PM the is overall coordinator of Risk Management Program and is responsible for:

- Maintaining this Risk Management Plan;
- Maintaining the Risk Management Database;
- Approving risk-handling options;
- Incorporating risk-handling actions into the program master plan and schedule;
- Briefing the decision makers on the status of *ABC* Program risk efforts; and

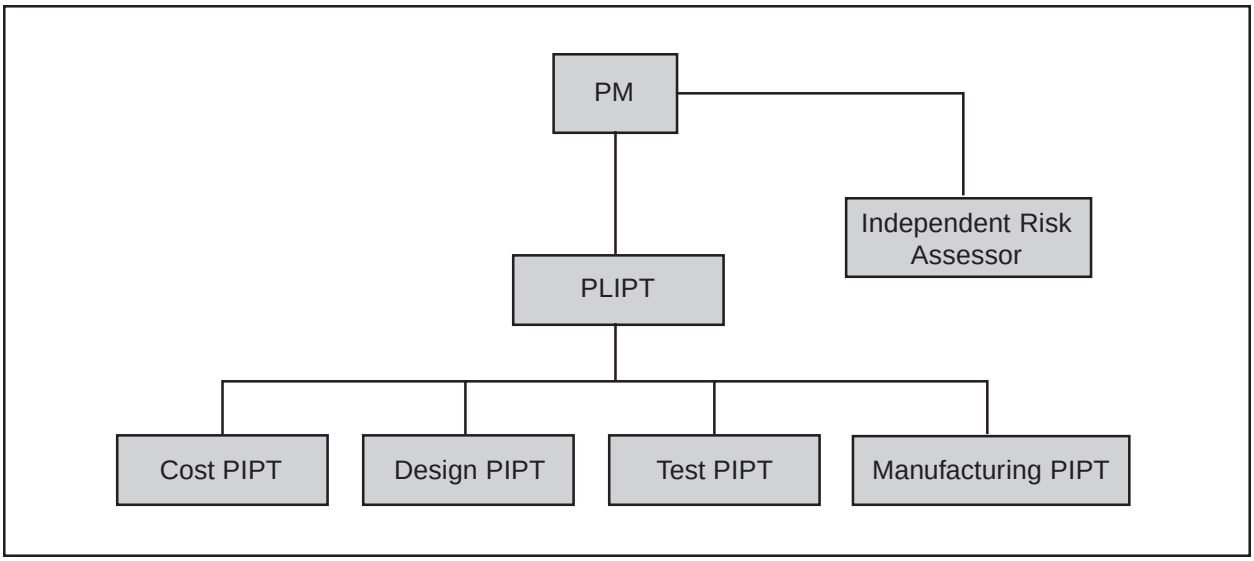

Figure B-9. ABC Risk Management Organization

- Preparing risk briefings, reports, and documents required for Program Reviews and the acquisition Milestone decision processes.

PLIPT

The PLIPT is responsible for complying with the DoD risk management policy and for structuring an efficient and useful *ABC* risk management approach and supporting the Risk Management Coordinator/PM in carrying out his responsibilities. The PM and contractor PM Co-Chair the PLIPT. The PLIPT membership may be adjusted, but is initially established as the chairs of the PIPTs, a representative from the joint requirements and users' office, and a representative from the contractor. It's main effort is integration of risk assessments performed by various program IPTs.

PIPTs

The program IPTs, or PIPTs, are the backbone of the program risk management efforts. They will execute the following responsibilities relative to their functional areas:

- Conduct risk assessments and develop risk-handling options, to include mitigation plans and resources required.
- Monitor effectiveness of risk-handling actions.
- Review and recommend to the PM changes in the overall risk management approach based on lessons learned.
- Update the risk assessments quarterly, or as directed.
- Ensure information in the Risk Management Database is current.
- Prepare risk status reports in their areas for all Program and Design Reviews.
- Ensure Design/Build Team responsibilities incorporate appropriate risk management tasks.
- Coordinate PIPT risk management activities with the PLIPT.

6.0 RISK MANAGEMENT STRUCTURE AND PROCEDURES

The *ABC* program will use a structured risk management approach consisting of four elements: planning, assessment, handling, and monitoring. These elements and the general procedures to be used for each of them are described in subsequent paragraphs of this section. A number of guidance documents are useful in addressing these risk management elements, and should be used as appropriate by each PIPT. Some of these documents are listed below. (This list is not meant to be complete.)

- *Defense Acquisition Deskbook*, Section 2.5.2, Risk Management,

- DSMC, *Risk Management Guide*, June 2002,

- AFMC Pamphlet 63-101, *Risk Management*, 9 July 1997, and

- *The Navy's Best Practices Manual*, NAVSO P-6071, and *Top Eleven Ways to Manage Technical Risk*, NAVSO P-3686, provide insight into best practices within the Naval Service.

6.1 RISK PLANNING

Risk planning is essential for the execution of a successful risk management program. It will be done continuously by all PIPTs as an integral part of normal *ABC* program management. This RMP serves as the basis for all detailed risk planning, which must be continuous. The following paragraphs provide direction for the PIPTs on the conduct of risk planning for this program.

- PIPTs will develop an organized and thorough approach to assess, handle, and monitor risks. It will assign responsibilities for specific risk management actions and establish internal risk reporting and documentation requirements. The PLIPT will monitor the planning activities of the PIPTs to ensure that they are consistent with this RMP and that appropriate revisions to this plan are made when required to reflect significant changes resulting from the PIPT planning efforts.

- Each PIPT will establish metrics that will measure the effectiveness of their planned risk-handling options. See Annex C for an example of metrics that may be used.

- Each PIPT will identify the resources required to implement the risk management actions. These resources include time, material, personnel, and cost. Training is a major consideration. All PIPT members should receive instruction on the fundamentals of risk management and special training in their areas of responsibility, if necessary. General risk management training will be arranged by the PO; PIPT leaders will identify any specialized training needs.

- This RMP establishes the basic documentation and reporting requirements for the program. PIPTs should identify any additional requirements, consistent with this RMP, that might be needed to effectively manage risk at their level.

6.2 RISK ASSESSMENT

The risk assessment process includes the identification of critical risk events/processes, the analyses of these events/processes to determine the probability/likelihood of occurrence/process variance and consequences/impacts, and the priority of the risks. The output of this process provides the foundation for all the program risk-handling actions. Therefore, it is essential that all members of the *ABC* program team be as thorough as possible when identifying and analyzing risks. In addition to the normal areas

of design , test, manufacturing, etc., PIPTs must identify and analyze the risks associated with such areas as manpower, environmental impact, system safety and health analysis, and security considerations. The *Defense Acquisition Deskbook*, Section 2524, provides information on various risk assessment techniques.

Risk assessments should be done by the PIPTs and the PLIPT with active participation of both Government and contractor personnel. When necessary or appropriate, the PIPTs and the PLIPT can direct a contractor-only assessment, or conduct a Government assessment. PIPTs and the PLIPT should continually assess the risks in their areas, reviewing critical risk areas, risk ratings and prioritization, and the effectiveness of risk-handling actions whenever necessary to assess progress. The assessment process will be iterative, with each assessment building on the results of previous assessments. PIPTs and the PLIPT will use the current assessment baseline as the starting point for their initial assessment during this phase. This baseline is a combination of the risk assessment delivered by the contractors as part of the Concept and Technology Development (CTD) Phase, the PMO process risk assessment done before Milestone B, and the post award Integrated Baseline Review (IBR). Risk assessments will be updated and the results presented at all functional and program reviews, with a final update for this phase prepared not later than six months prior to the next scheduled Milestone decision.

6.2.1 Risk Identification

Each PIPT will review all aspects of their functional areas to determine the critical events that would prevent the program from achieving its objectives. They should apply the knowledge, best judgment and experience of the PIPT members, lessons learned from similar programs, and the opinion of subject-matter experts (SMEs) to identify these risk events. PIPTs should follow these general procedures to identify risk events:

- Understand the requirements and the program performance goals, which are defined as thresholds and objectives (see DoD 5000.2-R). Understand the operational (functional and environmental) conditions under which the values must be achieved as described in the Design Reference Mission Profile. The ORD and Acquisition Program Baseline (APB) contain Key Performance Parameters (KPPs).

- Determine technical/performance risks related to engineering and manufacturing processes. Identify those processes that are planned or needed to design, develop, produce, and support the system. Compare these processes with industry best practices and identify any variances or new, untried processes. These variances or untried practices are sources of risk. The contractor should review the processes to be used by its subcontractors to ensure they are consistent with best industry practices. Table 4-2 of the DSMC *Risk Management Guide* shows some of the specific of sources of process risk, and should be used by the PIPTs. NAVSO P-6071, *Best Practices Manual*, which describes risks associated with design, test, production, facilities, logistics, management, and funding, should also be used by the PIPTs to identify risks.

- Determine technical/performance risks associated with the product (the ABC communications system) in the following critical risk areas: design and engineering, technology, logistics, concurrency, and manufacturing. The design and manufacturing PIPTs will identify the contract WBS elements down to level 3, and evaluate each of these elements to identify risk events. They will

use a variety of methods to accomplish this: review of similar programs, existing program plans, expert opinion, etc.

- Identify schedule risk. Each PIPT will determine the schedule risk associated with its functional area. When identifying this schedule risk, they will consider the risk that the schedule estimate is accurate, and the risk that the established schedule can be met. The PLIPT will monitor the development of the schedule risk in each PIPT, and consolidate these risks to identify overall program schedule risk.

- Identify cost risk. Each PIPT will determine the cost risk associated with its functional area. They will identify risks associated with the accuracy of the cost estimates developed for their areas, and the risk that the established cost objectives will be met. The Cost PIPT will monitor the development of the other PIPT cost risk efforts, and consolidate their risks into a set of overall program cost risks.

- All identified risks will be documented in the RMIS, with a statement of the risk and a description of the conditions or situations causing concern and the context of the risk. See Paragraph 6.4 for guidance on documenting identified risks.

In identifying risks, PIPTs should be particularly alert for the following indicators. They are common sources of risk for all programs, and will be applicable to the *ABC* program.

- Requirements that are not clearly stated or stable,

- Failure to use Best Practices,

- Use of new processes materials, or applications of existing technologies,

- Use of processes lacking rigor in terms of maturity, documentation of established procedures, and validation,

- Insufficient resources—the people, funds, schedule, and tools, necessary for successful development, test, production and support of the *ABC* program,

- Lack of a formalized failure, reporting, analyze, and corrective action (FRACAS) system,

- Use of suppliers or subcontractors who are inexperienced in the processes for designing and producing required products,

- Failure of prime contractor to effectively monitor processes and establish quality requirements for suppliers and subcontractors.

6.2.2 Risk Analysis

Risk Analysis is an evaluation of the identified risk events to determine the probability/likelihood of the events occurring and their consequences/impacts, to assign a risk rating based on the program criteria, and to prioritize the risks. Each PIPT and the PLIPT are responsible for analyzing those risk events they identify. They may use subject matter experts for assistance, such as Field Activities, Service Laboratories, contractors, or outside consultants. The use of external assets will be coordinated through the PMO. The results of the analysis of all identified risks must be documented in the RMIS.

There are a number of techniques available to support risk analysis, to include studies, test results, modeling and simulation, and the opinions of qualified experts (to include justification of their judgment). The *Defense Acquisition Deskbook*, Section 2524.2 describes a number of analysis techniques that may be

useful. Regardless of the technique used, PIPTs and the PLIPT will identify all assumptions made in analyzing risk and, where appropriate, conduct a sensitivity analysis of assumptions.

For each risk event, the following risk analysis guidelines will be used:

- **Probability/Likelihood**

For each risk identified, determine the probability/likelihood that the event will occur. Five levels of probability/likelihood will be used for the *ABC* program. Table B-7 shows these levels and their definitions. PIPTs and the PLIPT will assign one of these values to each identified risk event based on their analysis of the event. For example, if it is known that there will be a variance between the soldering process to be used for component *X* and the industry standard, this process variance risk event will be assigned a probability/likelihood value of "e"—near certainty. Similarly, if the Manufacturing PIPT determines that the schedule estimate for the fabrication of component *Y* is overly optimistic, and will probably not be attained, it would assign a probability/likelihood level of *"c"* or *"d"* depending on its analysis of the schedule estimate.

- **Consequence/Impact**

For each risk identified, the following question must be answered: *Given the event occurs, what is the magnitude of the consequence/impact?* For the *ABC* program, consequence/impact will be determined in each of four areas: technical performance, schedule, cost, and impact on other teams.

Technical Performance: This category relates to the risks associated with the processes to be used in the development, testing, and manufacturing of the ABC system, and the nature of the ABC communications system. It includes the form, fit, function, manufacturability, supportability, etc. Essentially, technical risk includes all requirements that are not part of cost and schedule. The wording of each consequence/impact level is oriented toward design and production processes, life cycle support, and retirement of the system. For example, the word "margin" could apply to weight margin during design, safety margin during testing, or machine performance margin during production.

Schedule: The description in the Schedule is self-explanatory. The need dates, key milestones, critical path, and key team milestones are meant to apply to all program areas and PIPTs.

Level	Likelihood of Occurrence
a	Remote
b	Unlikely
c	Likely
d	Highly likely
e	Near certainty

Table B-7. Likelihood Levels

Cost: Since costs vary from component to component and process to process, the percentage criteria shown in the figure may not strictly apply at the lower levels of the WBS. PIPT and PLIPT leaders may set the percentage criteria that best reflect their situation. However, when costs are rolled up at higher levels (e.g., Program), the definitions shown will be used.

Impact on Other Teams: Both the consequences/impacts of a risk and the mitigation actions associated with handling the risk may impact another team. This may involve additional coordination or management attention (resources), and may therefore increase the level of risk. This is especially true of mitigation actions that involve the use of common manufacturing processes and/or equipment.

PIPTs and the PLIPT will evaluate each risk event in terms of these areas, and assign a level of consequence/impact (1-5). Table B-8 shows these 5 levels of consequence/impact, and defines the levels for each area. This table will be used when assigning the consequence/impact magnitude.

6.2.3 Risk Rating

Each identified risk will be assigned a risk rating based on the joint consideration of event probability/likelihood and consequence/impact. This rating is a reflection of the severity of the risk and provides a starting point for the development of options to handle the risk. It is important to consider both the probability/likelihood and consequences/impacts in establishing the rating, for there may be risk events that have a low probability/likelihood, but whose consequences/impacts are so severe that the occurrence of the event would be disastrous to the program.

Figure B-10 describes the risk rating process that will be used in this program. PIPTs and the PLIPT will analyze each risk event to determine the probability/likelihood and consequence/impact values using the definitions in Tables B-7 and B-8; they will determine the consequence/impact for each of the four areas (technical performance, schedule, cost, and team impact). The values will be used to determine the risk rating using the Assessment Guide in Figure B-10. The Assessment Guide defines the risk rating associated with each combination of probability/likelihood and consequence/impact values, and will be used throughout the program. For example, consequence/impact/probability/likelihood level 1b corresponds to a risk rating of (L) LOW, level 4b corresponds to MODERATE risk, and level 5c corresponds to HIGH risk.

Those risk events that are assessed as MODERATE or HIGH will be submitted to the *ABC* PM on a Risk Identification Form (RIF). See Appendix B for the RIF format. PIPTs and the PLIPT must actively manage these MODERATE and HIGH risks. They must also continuously assess the other identified risks in their areas to see if their ratings have become MODERATE or HIGH.

6.2.4 Risk Prioritization

PIPTs and the PLIPT will prioritize the MODERATE and HIGH risks in their areas. This prioritization will provide the basis for the development of risk handling plans and the allocation of risk management resources. Prioritization will be accomplished using expert opinion within the PIPTs, and will be based on the following criteria:

- Risk Rating – Obviously HIGH-MODERATE.

- Consequence/Impact – Within each rating, the highest value of consequence/impact, e.g., “e.”

Level	Technical Performance	Schedule	Cost	Impact on Other Teams
a	Minimal or no impact	Minimal or no impact	Minimal or no impact	None
b	Acceptable with some reduction in margin	Additional resources required. Able to meet need dates	<5%	Some impact
c	Acceptable with significant reduction in margin	Minor slip in key milestone. Not able to meet need dates	5-7%	Moderate impact
d	Acceptable—no remaining margin	Major slip in key milestone or critical path impacted	7-10%	Major impact
e	Unacceptable	Can't achieve key team or major program milestone	>10%	Unacceptable

Table B-8. Risk Consequence

Level	What is the Likelihood the Risk Event Will Happen?
a	Remote
b	Unlikely
c	Likely
d	Highly likely
e	Near certainty

Process Variance refers to deviation from best practices. Likelihood/Probability refers to risk events.

ASSESSMENT GUIDE

Likelihood	a	b	c	d	e
e	L	M	H	H	H
d	L	M	M	H	H
c	L	M	M	M	H
b	L	L	L	M	M
a	L	L	L	L	M

Consequence

RISK ASSESSMENT

R **HIGH—**Unacceptable. Major disruption likely. Different approach required. Priority management attention required.

Y **MODERATE—**Some disruption. Different approach may be required. Additional management attention may be needed.

G **LOW—**Minimum impact. Minimum oversight needed to ensure risk remains low.

Level	Technical Performance	and/ or	Schedule	and/ or	Cost	and/ or	Impact on Other Teams
a	Minimal or no impact		Minimal or no impact		Minimal or no impact		None
b	Acceptable with some reduction in margin need dates		Additional resources required; able to meet		<5%		Some impact
c	Acceptable with significant reduction in margin		Minor slip in key milestones; not able to meet need date		5-7%		Moderate impact
d	Acceptable; no remaining margin		Major slip in key milestone or critical path impacted		7-10%		Major impact
e	Unacceptable major program milestone		Can't achieve key team or		>10%		Unacceptable

Figure B-10. Risk Assessment Process

- Urgency – How much time is available before risk-handling actions must be initiated.

- Probability/Likelihood – Within each rating, the highest value, e.g., "e."

The PLIPT will review the prioritized list of PIPT-developed risks, and integrate them into a single list of prioritized program risks, using the same criteria.

6.3 RISK HANDLING

After the program's risks have been identified, analyzed, and prioritized, PIPTs and the PLIPT must develop an approach for handling each MODERATE and HIGH risk. For all such risks, the various handling techniques should be evaluated in terms of feasibility, expected effectiveness, cost and schedule implications, and the effect on the system's technical performance, and the most suitable technique selected. The *Defense Acquisition Deskbook,* Section 2524.3 contains information on the risk-handling techniques and various actions that can be used to implement them. Reducing requirements as a risk avoidance technique will be used only as a last resort, and then only with the participation and approval of the user's representative at the PLIPT level.

The results of the evaluation and selection will be included and documented in the RMIS using the RIF. This documentation will include the following elements:

- What must be done,

- List of all assumptions,

- Level of effort and materials required,

- Resources needed that are outside the scope of the contract or official tasking,

- Estimated cost to implement the plan,

- Proposed schedule showing the proposed start date, the time phasing of significant risk reduction activities, the completion date, and their relationship to significant Program activities/milestones,

- Recommended metrics for tracking risk-handling activity,

- Other PIPTs, risk areas, or other handling plans which may be impacted, and

- Person responsible for implementing and tracking the selected option.

Risk handling actions will be integrated into program planning and scheduling, and incorporated into the IMP and IMS. PIPTs and the PLIPT will develop these risk-handling actions and events in the context of Work Breakdown Structure (WBS) elements, establishing a linkage between them and specific work packages that makes it easier to determine the impact of actions on cost, schedule, and performance. The detailed information on risk-handling actions and events will be included in the RIF for each identified risk, and thus be resident in the RMIS.

6.4 RISK MONITORING

Risk monitoring is the systematic tracking and evaluation of the progress and effectiveness of risk-handling actions by the comparison of predicted results of planned actions with the results actually achieved to determine status and the need for any change in risk-handling actions. The PIPTs and the PLIPT will monitor all identified risks in their areas, with particular attention to those rated as HIGH or MODERATE. There are a number of techniques and tools available for monitoring the effectiveness of risk-handling actions. (See the *Defense Acquisition Deskbook,* Section 2524.4 for information

on specific techniques.) PIPTs and the PLIPT must select those that best suit their needs. No single technique or tool is capable of providing a complete answer—a combination must be used. At a minimum, each PIPT and the PLIPT will use the Risk Tracking Report (RTR) and Watch List for day-to-day management and monitoring of risks. See Annex B for examples of an RTR and Watch List. The status of risk-handling actions for all MODERATE and HIGH risks will be an agenda item at each program or functional area review.

For each identified risk, the PIPTs and PLIPT will establish a management indicator system (metrics) that provides accurate, timely, and relevant risk monitoring information in a clear, easily understood manner. PIPTs and the PLIPT should select metrics that portray the true state of the risk events and handling actions. See Annex C for an example of metrics that may be used.

MODERATE or HIGH risks will also be monitored by the *ABC* PM through the PLIPT, using information provided by the appropriate PIPT, until the risk is considered LOW and recommended for "Close Out." PIPTs and the PLIPT will continue to monitor LOW risk events in their areas to ensure that appropriate risk-handling action can be initiated if there are indications that the rating may change.

The status of the risks and the effectiveness of the risk-handling actions will be agenda items for all functional area and program reviews, and will be reported to the PM on the following occasions:

- Quarterly,
- When the IPT determines that the status of the risk area has changed significantly (as a minimum when the risk changes from high to moderate to low, or vice versa),
- When requested by the Program Manager.

6.5 RISK MANAGEMENT INFORMATION SYSTEM (RMIS), DOCUMENTATION, AND REPORTS

The *ABC* Program uses a modified version of Risk Matrix as its RMIS. The Risk Matrix database will contain all of the information necessary to satisfy the program documentation and reporting requirements. This information will include risk assessment documents, risk-handling plans, contract deliverables, if appropriate, and any other risk-related reports. The program office will use data from the RMIS to create reports for senior management and for day-to-day management of the program. The program produces a set of standard reports for periodic reporting and has the ability to create ad hoc reports in response to special queries.

Each PIPT and the PLIPT are responsible for entering and maintaining accurate risk management data in the RMIS. A standard format Risk Information Form (RIF) Data will be used for data entry. A RIF will be completed and submitted when a potential risk event is identified, and will be updated as information becomes available as the assessment, handling, and monitoring functions are executed. See Annex B for a sample of the RIF. Annex B also contains examples of reports to be used in the *ABC* Program.

ANNEX A
TO ABC RISK MANAGEMENT PLAN
- CRITICAL PROGRAM ATTRIBUTES -

Category	Description	Responsible IPT	Remarks
Performance/Physical	Transmitter Power		
	Weight		
	MTBF		
	Receiver Gain		
	EMP Survivability		
	Heat Dissipation		
	Size		
	Receiver Range		
	Transmitter Range		
	Data Link Operations		
	Interface Commonality		
	Initial Setup		
	Identification Time		
	Accuracy Location		
	Bandwidth		
	Reliability		
	Maintainability		
	Availability		
	Etc.		
Cost	Operating and Support Costs		
	Etc.		
Processes	Requirements Stable		
	Test Plan Approved		
Exit Criteria	Bench Test		
	Accuracy Verified by Test Data and Analysis		
	Toolproofing Completed		
	Logistics Support Reviewed by User		

Table B-9. Critical Program Attributes

ANNEX B
TO ABC RISK MANAGEMENT PLAN
- MANAGEMENT INFORMATION SYSTEM AND DOCUMENTATION -

1.0 DESCRIPTION

In order to manage risk, we need a database management system that stores and allows retrieval of risk-related data. The Risk Management Information System provides data for creating reports and serves as the repository for all current and historical information related to risk. The PM is responsible for the overall maintenance of the RMIS, and he/she or his/her designee are the only persons who may enter data into the database.

The RMIS has a set of standard reports. If PIPTs or functional managers need additional reports, they should work with the PM to create them. Access to the reporting system will be controlled, however any member of the Government or contractor team may obtain a password to gain access to the information.

In addition to standard reports, the PO will need to create *ad hoc* reports in response to special queries, etc. The PM will be responsible for these reports.

2.0 RISK MANAGEMENT FORMS AND REPORTS

The following are examples of basic reports and forms that are used in the *ABC* Program.

2.1 RISK INFORMATION FORM

The PO needs a document that serves the dual purpose of a source of data entry information and a report of basic information for the PIPTs, etc. The Risk Information Form (RIF) serves this purpose. It gives members of the project team, both Government and contractors, a format for reporting risk-related information. The RIF will be used when a potential risk event is identified and updated over time as information becomes available and the status changes. As a source of data entry, the RIF allows the database administrator to control entries. The format and information required in a RIF is detailed in the following table.

2.2 RISK MONITORING DOCUMENTATION

The PM needs a summary document that tracks the status of HIGH and MODERATE risks. The *ABC* program will use a Risk-Tracking Report (RTR) that contains information that has been entered from the RIF. An example of the RTR is shown in Figure B-11. The PM and PIPTs must also be aware of upcoming deadlines and events to ensure they are not caught unprepared for a result. A Watch List will be used to track upcoming events and activities. A sample Watch List is contained in Table B-11.

2.3 PIPT RISK SUMMARY REPORT

In addition to the RTRs for individual HIGH and MODERATE risks, PIPTs will prepare a periodic summary of the ratings for all the risks in their areas. Figure B-12 provides an example of this report. The format for this summary is based on the Risk Assessment Guide shown in Figure B-10. The entries in each cell of the matrix represent the number of identified risks with the corresponding probability/likelihood and consequence/impact values.

Element	Description
Risk Identification (ID) Number	Identifies the risk and is a critical element of information, assuming that a relational database will be used by the PO. (Construct the ID number to identify the organization responsible for oversight.)
Risk Event	States the risk event and identifies it with a descriptive name. The statement and risk identification number will always be associated in any report.
Priority	Reflects the importance of this risk priority assigned by the PO compared to all other risks, e.g., a one (1) indicates the highest priority.
Data Submitted	Gives the date that the RIF was submitted.
Major System/Component or Process	Identifies the major system/component based on the WBS, or the process in which the risk event occurs.
Subsystem/ Functional Area	Identifies the pertinent subsystem or component based on the WBS.
Category	Identifies the risk as technical/performance cost or schedule or combination of these.
Statement of Risk	Gives a concise statement (one or two sentences) or the risk.
Description of Risk	Briefly describes the risk; lists the key processes that are involved in the design, development, and production of the particular system or subsystem. If technical/ performance, include how it is manifested (e.g., design and engineering, manufacturing, etc.).
Key parameters	Identifies the key parameter, minimum acceptable value, and goal value, if appropriate. Identifies associated subsystem values required to meet the minimum acceptable value and describes the principal events planned to demonstrate that the minimum value has been met.
Assessment	States if an assessment has been done. Cites the Risk Assessment Report (see next paragraph), if appropriate.
Analysis	Briefly describes the analysis done to assess the risk; includes rationale and basis for results.
Process Variance	States the variance of critical technical processes from known standards or best practices, based on definitions in the program's risk management plan.
Probability of Occurrence	States the likelihood of the event occurring, based on definitions in the program's Risk Management Plan.
Consequence	States the consequence of the event, if it occurs, based on definitions in the program's Risk Management Plan.
Risk Rating	Identifies the rating assigned to the risk based on the criteria established by the program.
Time Sensitivity	Estimates the relative urgency for implement the risk-handling option. If appropriate, identifies any other subsystem or process that this risk affects.
Other Affected Areas	If appropriate, identifies any other subsystem or process that this risk affects.
Risk Handling Plans	Briefly describes plans to mitigate the risk. Refers to any detailed plans that may exist, if appropriate.
Risk Monitoring Activity	Measurement and metrics for tracking progress in implementing risk-handling plans and achieving planned results for risk reduction.
Status	Briefly reports the status of the risk-handling activities and outcomes relevant to any risk handling milestones.
Status Due Date	Lists date of the status report.
Assignment	Lists individual assigned responsibility for mitigation activities.
Reported By	Records name and phone number of individual who reported the risk.

Table B-10. DBMS Elements

Risk Tracking Report
(Example Report)

I. Risk Area Status: Design **P_F:** High **C_F:** High

Significant Design Risks:

1. Title: System Weight **P_F:** High **C_F:** High

Risk Event: Exceed system weight by 10%; decreasing the range and increasing fuel consumption.

Action: Examining subsystems to determine areas where weight may be reduced. Reviewing the requirement. Closely watching the effect on reliability and interoperability.

2. Title: Design Analysis **P_F:** High **C_F:** High

Risk Event: Failure Modes, Effects and Criticality Analysis (FMECA) is planned too late to identify and correct any critical single-point failure points prior to design freeze.

Action: Additional resources are being sought to expedite performance of FMECA.

II. Risk Area Status: Supportability **P_F:** High **C_F:** Moderate/High

1. Title: Operational Support **P_F:** High **C_F:** Moderate/High

Risk Event: Power supply subcontractor is in financial trouble and may go out of business. No other known sources exist.

Action: Doing trade study to see if alternative designs have a broader power supply vendor base. Prime contractor is negotiating with the subcontractor to buy drawings for development of second source.

Figure B-11. Example Risk Tracking Report

Potential Risk Area	Risk Handling Actions	Action Code	Due Date	Date Completed	Explanation
• Accurately predicting shock environment shipboard equipment will experience.	• Use multiple finite element codes & simplified numerical models for early assessments. • Shock test simple isolated deck, and proposed isolated structure to improve confidence in predictions.	SE03 SE03	31 Aug 01 31 Aug 02		
• Evaluating acoustic impact of the ship systems that are not similar to previous designs.	• Concentrate on acoustic modeling and scale testing of technologies not demonstrated successfully in large-scale tests or full-scale trials. • Factor acoustic signature mitigation from isolated modular decks into system requirements. Continue model tests to validate predictions for isolated decks.	SE031 SE032	31 Apr 01 31 Aug 02		

Table B-11. Sample Watch List

Likelihood	a	b	c	d	e
e	0	1	0	1	0
d	0	0	1	1	2
c	3	2	1	0	0
b	4	3	5	2	1
a	5	3	1	1	2

Consequence

Figure B-12. Example PIPT Risk Summary Report

Design Requirements	Trade Studies	Design Process	Integrated Test Plan	Failure Reporting System	Manufacturing Plan
Development of requirements traceability plan Development of specification tree Specifications reviewed for: • Definition of all use environments • Definition of all functional requirements for each mission performed	Users needs prioritized Alternative system configurations selected Test methods selected	Design requirements stability Producibility analysis conducted Design analyzed for: • Cost • Parts reduction • Manufacturability • Testability	All developmental tests at system and subsystem level identified Identification of who will to test (Government, contractor, supplier) of requirements traceability plan Development of specification tree Specifications reviewed for: • Definition of all use environments • Definition of all functional requirements for each mission performed	Contractor corporate-level management involved in failure reporting and corrective action process Responsibility for analysis and corrective action assigned to specific individual with close-out date	Plan documents methods by which design to be built Plan contains sequence and schedule of events at contractor and sub-contractor levels that defines use of materials, fabrication flow, test equipment, tools, facilities, and personnel Reflects manufacturing inclusion in design process. Includes identification and assessment of design facilities

Table B-13. Examples of Process Metrics

Cost	Schedule
Cost variance	Schedule variance
Cost performance index	Schedule performance index
Estimate at completion	Design schedule performance
Management reserve	Manufacturing schedule performance
	Test schedule performance

Table B-14. Example of Cost and Schedule Metrics

APPENDIX C
GLOSSARY

ACAT – Acquisition Category
AHP – Analytical Hierarchy Process
AMSAA – Army Materiel System Analysis Activity
APB – Acquisition Program Baseline
API/PM – Acquisition Program Integration/Program Management
ASP – Acquisition System Protection

BCS – Baseline Comparison System
BIT – Built-in Test
BMP – Best Manufacturing Program

CAIG – Cost Analysis Improvement Group
CAIV – Cost As an Independent Variable
CARD – Cost Analysis Requirements Description
CCA – Component Cost Analysis
CCDR – Contractor Cost Data Reporting
CDF – Cumulative Distribution Function
CDR – Critical Design Review
CER – Cost Estimating Relationship
CPM – Critical Path Method
CTD – Concept and Technology Development
CWBS – Contract Work Breakdown Structure

DAD – Defense Acquisition Deskbook
DAU – Defense Acquisition University
DBMS – Database Management System
DCMA – Defense Contract Management Agency
DFARS – Defense Federal Acquisition Regulation Supplement
DoD – Department of Defense
DoDD – DoD Directive
DoDI – DoD Instruction

DPG – Defense Planning Guidance
DR – Decision Review
DSMC – Defense Systems Management College
DT&E – Development, Test and Evaluation
DTSE&E – Director, Test, Systems Engineering, and Evaluation

EAC – Estimate At Completion
EMP – Electromagnetic Pulse
ESC – Electronic Systems Center
ESM – Electronic Warfare Support Measures
ESS – Environmental Stress Screening
EV – Earned Value

FMECA – Failure Mode, Effects and Criticality Analysis
FRACAS – Failure, Reporting, Analyze, and Corrective Action

GAO – Government Accounting Office
GFE – Government Furnished Equipment

HWIL – Hardware-in-the-Loop

IBR – Integrated Baseline Review
IFF – Identification Friend or Foe
IIPT – Integrating Integrated Product Teams
IMP – Integrated Master Plan
IMS – Integrated Master Schedule
IOC – Initial Operational Capability
IPD – Integrated Product Development
IPPD – Integrated Product and Process Development
IPR – Interim Progress Review
IPT – Integrated Product Teams

KPP – Key Performance Parameters

LCC – Life-Cycle Cost
LFT&E – Live-Fire Test and Evaluation
LRIP – Low Rate Initial Production

M&E – Mechanical and Electrical
M&S – Modeling and Simulation
MAIS – Major Automated Information System
MDA – Milestone Decision Authority
MDAPs – Major Defense Acquisition Programs
MIS – Management Information System
MNS – Mission Need Statement
MOA – Memoranda of Agreement
MOU – Memoranda of Understanding
MS – Milestone
MTBF – Mean Time Between Failure

NDI – Non-Developmental Item
NSSN – New Nuclear Submarine

O&M – Operations and Maintenance
OIPT – Overarching Integrated Product Team
OLRDB – On-Line Risk Data Base
ORD – Operational Requirement Document
OSD – Office of the Secretary of Defense
OT&E – Operational Test and Evaluation

P&D – Production and Deployment
PDF – Probability Density Function
PIPT – Program Integrated Product Team
PLIPT – Program Level Integrated Product Team
PM – Program Manager
PMI – Project Management Institute
PMO – Program Management Office
PMWS – Program Manager's Work Station
POE – Program Office Estimate
POM – Program Objective Memorandum
PRAG – Performance Risk Assessment Group
PRR – Production Readiness Review
PSR – Program Status Report

R&D – Research and Development
R&M – Repairability and Maintainability
RD&A – Research, Development and Acquisition
RAR – Risk Assessment Report
RFP – Request for Proposal
RIF – Risk Information Form
RMIS – Risk Management Information System
RMP – Risk Management Plan
RTR – Risk Tracking Report

SDD – System Development and Demonstration
SEI – Software Engineering Institute
SI – System Integration
SME – Subject-Matter Expert
SOW – Statement of Work
SPMN – Software Program Managers Network
SRE – Software Risk Evaluation
SRR – System Requirements Review
STA – Special Threat Assessment
STAR – Special Threat Assessment Report

T&E – Test and Evaluation
TAAF – Test, Analyze, and Fix
TEMP – Test and Evaluation Master Plan
TPM – Technical Performance Measurement
TRIMS – Technical Risk Identification and Mitigation Software

UAV – Unmanned Aerial Vehicle
UHF – Ultra-High Frequency
USC – United States Code
USD(AT&L) – Under Secretary of Defense, Acquisition, Technology, and Logistics

WBS – Work Breakdown Structure

APPENDIX D

QUANTIFYING EXPERT JUDGMENT

I. GENERAL

Most quantitative risk analysis techniques share a common need, and that is the estimation of a probability of occurrence associated with a risk event. Often the estimation of probability data requires expert judgement, and inherent in judgement is a degree of uncertainty.

The challenge for the analyst is to obtain estimates in the areas of cost, schedule, and/or technical/performance. These estimates often begin as qualitative information which must then be converted to quantitative probability data so that the results can be represented as a probability density function (PDF), which is a key input to a number of different types of models (e.g., Monte Carlo simulations).

There are a number of methods which can be used to convert qualitative estimates into quantitative probability distributions. The remainder of this appendix will focus on a few of the most popular, practical, and accurate techniques for doing so. The techniques discussed were selected because they are relatively simple and easy to master. This factor is of paramount importance, because in most cases the analyst and those being interviewed will have neither the time nor the knowledge of more advanced techniques to accurately implement them. Finally, the use of these techniques does not preclude generating uncertain and/or erroneous PDFs — the quality of the resulting probability distributions will be no better than the interviewing technique used by the analyst, the level of knowledge of the experts interviewed, and the ability of the analyst to convert the information gleaned from participants into probability distributions.

The following techniques will be discussed in this appendix:

1. Diagrammatic
2. Direct
3. Betting
4. Modified Churchman/Ackoff technique
5. Delphi Approach

II. DESCRIPTION OF TECHNIQUES

1. Diagrammatic

Many analysts prefer the diagrammatic method as a way of capturing and representing an expert's judgement. This method is a simple way of describing an expert's uncertainty by presenting him with a range of PDF diagrams and having the expert select the shape of the PDF which is considered to reflect most accurately the schedule, cost, or technical parameter in question. Using this method, the analyst can ascertain whether the PDF is symmetric or skewed, the degree of variability, etc. For example, if the expert feels that there is a great amount of risk associated with completing an activity within a certain period of time, a PDF skewed to the right may be selected. Likewise,

activities with little risk may be skewed to the left. If the expert feels that each value over a given range is equally likely to occur, a uniform distribution may be most appropriate. The analyst and the expert, working together, can select the PDF which most accurately reflect the schedule, cost, or technical item under question.

The diagrammatic method of obtaining PDFs is applicable when the expert has a sound understanding of probability concepts and can merge that understanding with his understanding of the parameters under question. In this way the expert can accurately identify the appropriate PDFs.

2. Direct

The direct method is a relatively simple technique which can be used to obtain subjective probability distributions by asking the expert to assign probabilities to a given range of values.

The direct method of obtaining PDFs is applicable, 1) when questions can be phrased to the respondents in such a way that there is no confusion likely to exist in the respondents mind, and 2) when the results will not violate the axioms of probability. This method is applicable when time/resource constraints do not allow for more complex, resource intensive methods.

The application of the direct method is quite simple. The analyst would define a relevant range and discrete intervals for the parameter for which the PDF is to be constructed. For example, the analyst might define the relevant time duration for a program activity (test of a piece of equipment) to be between 0 and 27 days. The analyst would then break this relevant range down into intervals, say intervals of three days, the resulting formulation would look as follows:

0 – 3 days	16 – 19 days
4 – 7 days	20 – 23 days
8 – 11 days	24 – 27 days
12 – 15 days	

Given these intervals over the relevant range, the analyst would then query the expert to assign relative probabilities to each range. From this, the form of the PDF could be identified. It is imperative that the axioms of probability not be violated.

Besides the application already described, the analyst could request the expert to provide a lowest possible value, a most likely value, and a highest possible value. The analyst then makes an assumption about the form of the density function. That is, is the PDF uniform, normal, beta, triangular, etc.?

3. Betting

One method of phrasing questions to experts in order to obtain probabilities for ranges of values (cost/schedule) states the problem in terms of betting. A form of this method, which was described by Winkler (1967), helps the expert (assessor) assess probabilities of events which are in accordance with his judgement. The assumption with this method is that the judgement of the expert may be fully represented by a probability distribution, $f(x)$ of a random variable x. This method offers the expert a series of bets.

Under ideal circumstances, the bets are actual, not hypothetical. That is, in each case the winner of the bet is determined and the amount of money involved actually changes hands. However, under our circumstances, this is not feasible (or legal!). In each case, the expert must choose between two bets (the expert is not allowed to refrain from betting). The expert

must choose between a bet with a fixed probability q of winning and $1–q$ of losing, and a bet dependent on whether or not some event E (a particular program activity duration range, or cost range) occurs. The bet can be depicted as follows:

Bet 1*a* – win \$A if the event E occurs
– lose \$B if event E does not occur

Bet 1*b* – win \$A with probability of q
– lose \$B with probability of $1–q$.

The expected values of bets 1a and 1b to the expert are respectively $Ap + Bp – B$ and $Aq + Bq – B$, where P is the probability of event E occurring. The following inferences may be drawn from the experts decision: if bet 1a is chosen, $Ap + Bp – B > Aq + Bq – B$, so $p > q$; likewise if 1*b* is selected $p < q$.

By repeating the procedure, varying the value of q, the probability of event e can be ascertained. It is the point at which the expert is indifferent between bets 1*a* and 1*b*, where $p = q$. The degree of precision is dependent on the number of bets and the incremental changes of the value of q.

A way of avoiding the problem of a large number of bets to obtain p would be to assess the probabilities through the use of direct interrogation, and then to use the betting situation as a check on the assumed probabilities.

To complete a PDF, the analyst repeats this procedure over a relevant range of interval values. The analyst then plots the points at the center of the range for each event and smoothes in a curve, so that the area under it equals one, as in Figure D-1. The analyst must ensure that all of the relevant axioms of probability are maintained.

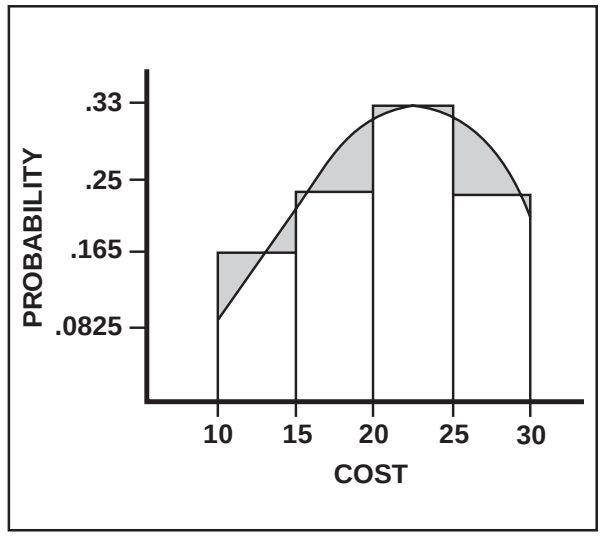

Figure D-1.
Fitting a Curve to Expert Judgment

Many people, when questioned one way, are likely to make probability statements that are inconsistent with what they will say when questioned in another equivalent way, especially when they are asked for direct assignment of probabilities. As the number of events increases, so does the difficulty of assigning direct probabilities. Therefore, when this is a problem, the betting method is most appropriate.

To apply the betting technique, we will select one interval for the relevant range to demonstrate how this method can be used to obtain probability estimates and, hence, PDFs. The bet is established as follows:

Bet 1*a* – win \$10,000 if cost is between \$15,000 and \$20,000
– lost \$5,000 if cost in not between \$25,000 and \$20,000

Bet 1*b* – win \$10,000 with probability of q
– lose \$5,000 with probability of $1–q$

The value of q is established initially, and the expert is asked which of the two bets he would take.

The value of *q* is then varied systematically, either increased or decreased. The point at which the expert is indifferent between the two bets (with the associated q value) provides the probability of the cost being between $15,000 and $20,000. This process is repeated for each interval, and the results used create the PDF associated with the cost of that particular program event.

4. Modified Churchman/Ackoff Technique

Another method, which can be used to ascertain PDFs for cost, schedule, or performance parameters, is the "Modified Churchman/Ackoff method." This technique builds upon procedures which were presented by Churchman and Ackoff in 1954. This technique was developed as a means to order events in terms of likelihood. The modification to the technique was performed so that once the order of event likelihoods had been accomplished, relative probabilities could be assigned to the events and finally probability density functions developed. So as to be relevant for our purposes, events are defined as range values for cost, schedule, or performance (activity durations) relating to the outcome of a specific activity in a program.

The modified Churchman/Ackoff technique is most appropriate when there is one expert, and that expert has a thorough understanding of the relative ranking of cost/schedule ranges and a limited understanding or probability concepts. The remainder of this section was extracted and modified from the Compendium on Risk Analysis Techniques (1972, see references). Note that while the mathematical calculations appear to make this a very precise technique, it is still an approximation of an expert's judgement and should not be interpreted to be more exact than other similar techniques.

The first step in applying the modified Churchman/Ackoff technique is to define the relevant range of values. That is, the end points, along a range of values with zero probability of occurrence must be specified. These values need only be any low and high values which the expert specifies as having zero probability of occurrence. Next, ranges of individual values within the relevant range must be determined. These ranges of values which will form the set of comparative values for this technique are specified by the following approach:

(1) Start with the low value in the relevant range.

(2) Progress upward on the scale of values until the expert is able to state a simple preference regarding the relative probabilities of occurrence of the two characteristic values. If he is able to say that he believes one value has either a greater chance or a lesser change of occurring than the other of the two values, then it is inferred that the expert is able to discriminate between the two values.

(3) Using the higher of the two previously specified scale values as a new basis, repeat step (2) to determine the next value on the scale.

(4) Repeat steps (2) and (3) until the high end point value of the range of parameters values is approached.

Employing this procedure for the duration required to successfully test a piece of equipment, may yield the results show in Table D-1.

0_1	=	0	–	3 days
0_2	=	4	–	7 days
0_3	=	8	–	11 days
0_4	=	12	–	15 days
0_5	=	16	–	19 days
0_6	=	20	–	23 days
0_7	=	24	–	27 days

Table D-1. Characteristic Values for Equipment Test Durations

The descending order of probability or occurrence can be determined by applying the following paired comparison method.

Ask the expert to compare, one at a time, the first interval value (0_1) of the set to each of the other values (0_2, 0_3, etc.), stating a preference for that value in each group of two values that he believes has the greater change of occurring (denoting a greater probability of occurrence by >, and equal chance by =, and a lesser change by <). The following hypothetical preference relationships could result for a set of seven values ($0_1 < 0_2$, $0_1 < 0_3$, $0_1 < 0_4$, $0_1 < 0_5$, $0_1 < 0_6$, $0_1 < 0_7$).

Next, ask the expert to compare, one at a time, the second interval values (0_2) of the set to each of the other interval values succeeding it in the set (i.e., 0_3, 0_4, etc.). The following preference relationships might result ($0_2 < 0_3$, $0_2 < 0_4$, $0_2 < 0_5$, $0_2 < 0_6$, $0_2 < 0_7$). Continue this process until all values (0_i) have been compared.

Now total the number of times (0_i) value was preferred over other values. The results for this procedure are listed in Table D-2.

0_4	=	6 times
0_3	=	5 times
0_5	=	4 times
0_2	=	3 times
0_6	=	2 times
0_1	=	0 times
0_7	=	0 times

Table D-2.
Summary of Preference Relationships

List the values in descending order of simple ordinal probability preference and change the symbols for each value from 0_i to X_j as shown in Table D-3.

Arbitrarily assign a rating of 100 points to the characteristic value with the highest subjective probability (e.g., X_1). Then, as in the first step, question the expert regarding the relative chance of occurrence of each of the other values on the ordinal scale in Table D-3 with respect to the value at the top of the scale. Assigning X_1 a rating of 100 points, the expert is first interrogated as to his feeling of the relative chance of occurrence of the second highest scale value (e.g., X_2), with respect to X_1. Does it have 25 percent chance? 60 percent? 70 percent? 80 percent? As much chance of realization as X_1? The relative probability rating, based on 100 points (i.e., 100 percent as much chance), will then be posted for X_2.

Characteristic Value (Days)		Preference Rank	New Symbol
0 – 3	0_4	1	X1
4 – 7	0_3	2	X2
8 – 11	0_5	3	X3
12 – 15	0_2	4	X4
16 – 19	0_6	5	X5
20 – 23	0_1	6	X6
24 – 27	0_7	7	X7

Table D-3.
Transformation

Next, question the expert about the relative chance of occurrence of the next highest scale (e.g., X_3) first with respect to the most preferred value (X1), and then with respect to the second most preferred scale value (X_2). The resulting numerical ratings should concur. For example, if the expert decides that X_2 has 8/10 as much chance of occurring as does X_1, and that X_3 has 1/2 as much chance as X_1, and 5/8 as much chance as X_2, the ratings become X_1 = 100 points, X_2 = 80 points, and X_3 = 50 points.

This process continues for each successively lower interval value on the ordinal scale as shown in Table D-3. Determine the relative number of points to be accorded each value with

respect to the top scale and with respect to all other values on down the scale which are above the characteristic value in question.

In the event of minor disparities between relative probability ratings for a given value, the average of all such ratings for that characteristic value might be computed. For example, X_4 might be determined to be 3/10 as probable as X_1, 1/4 as probable as X_2, and 1/2 as probable as X_3. The three absolute ratings for X_4 are thus inferred to be 30, 20, and 25 points, respectively. The average of these ratings is 25. However, before averaging such figures, it might be beneficial to have the expert revaluate his relative ratings for X_4 with respect to X_1, X_2, and X_5.

As a result of the above process, the relative probability values shown in Table D-4 might be attained.

RX_1	**=**	**100**	**Probability points**
RX_2	**=**	**80**	**Probability points**
RX_3	**=**	**50**	**Probability points**
RX_4	**=**	**25**	**Probability points**
RX_5	**=**	**10**	**Probability points**
RX_6	**=**	**0**	**Probability points**
RX_7	**=**	**0**	**Probability points**

Table D-4.
Relative Probability Ratings

Finally, the scale of relative probability values can be converted directly into a scale of actual probability density values by letting $P(X_1)$ equal the actual subjective probability or occurrence of the highest value. Then, $P(X_2)$ is then defined as:

$$\frac{R(X_2)}{R(X_1)} \quad [P(X_1)]$$

Similarly P(Xi) is defined as:

$$\frac{R(X_i)}{R(X_1)} \quad [P(X_1)]$$

for i = 2, 3, …7.

Assuming that the independent characteristic values evaluated represent all possible values attainable by the component characteristic, the respective probabilities must sum to 1.0 (i.e., $P(X_1) + P(X_2) + P(X_3) + P(X_4) + P(X_5) + P(X_6) + P(X_7) = 1.0$). Substituting the expressions for $P(X_i)$, i = 2, …7, it follows that:

$$[P(X_1)]+\frac{R(X_i)}{R(X_1)}[P(X_1)]+\frac{R(X_3)}{R(X_1)}[P(X_1)]+\frac{R(X_4)}{R(X_1)}[P(X_1)]$$

$$+\frac{R(X_5)}{R(X_1)}[P(X_1)]+\frac{R(X_6)}{R(X_1)}[P(X_1)]+\frac{R(X_7)}{R(X_1)}[P(X_1)] = 1.$$

Solving this equation for $P(X_1)$, the remaining $P(X_i)$, i = 2, …7 can be determined using the relationship:

$$P(X_1) = \frac{R(X_i)}{R(X_1)} \quad [P(X_1)].$$

As an illustration, consider the relative probability ratings in Table D-4. Using the values, the preceding equation is given by:

$$P(X_1) + \frac{80}{100}P(X_1) + \frac{50}{100}P(X_1) +$$

$$\frac{25}{100}P(X_1) + \frac{10}{100}P(X_1) = 1.$$

Solving this equation, $P(X_1) = 0.377$.

This value can be used to determine the remaining probabilities as follows:

$$P(X_2) + \frac{RX_2}{RX_1} P(X_1) = 0.80\ (0.377) = 0.301$$

$$P(X_3) + \frac{RX_3}{RX_1} P(X_1) = 0.50\ (0.377) = 0.189$$

$$P(X_4) + \frac{RX_4}{RX_1} P(X_1) = 0.25\ (0.377) = 0.095$$

$$P(X_5) + \frac{RX_5}{RX_1} P(X_1) = 0.10\ (0.377) = 0.038$$

$$P(X_6) + \frac{RX_6}{RX_1} P(X_1) = 0.0\ (0.377) = 0.000$$

$$P(X_7) + \frac{RX_7}{RX_1} P(X_1) = 0.0\ (0.377) = 0.000$$

The resulting probability density appears in Table D-5.

Component Characteristic Value	Probability
X_1	0.377
X_2	0.301
X_3	0.189
X_4	0.095
X_5	0.038
X_6	0.000
X_7	0.000
Total	1.000

Table D-5. Probability Density

5. Delphi Approach

In many cases, expert judgement does not reside solely with one individual, but is spread among multiple experts. Committee approaches to obtaining a group assessment have been found to contain problems relating to interpersonal pressures to a degree that caused researchers at the RAND Corporation to devise a method known as the Delphi to avoid the pressures.

The Delphi technique has become well known in management circles, but is subject to misconception. Too often the term is used to identify a committee or multiple interview process, and these do not share the advantages of the Delphi technique.

The Delphi technique has been extended in recent years to cover a wide variety of types of group interaction. The technique can be used for group estimation, that is, the use of a group of knowledgeable individuals to arrive at an estimate of an uncertain quantity. The quantity can be a cost, a time period associated with an event, or a performance level.

The Delphi technique is most appropriate when:

- The problem does not lend itself to precise analytical techniques but can benefit from subjective judgements on a collective basis.
- The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise.
- More individuals are needed than can effectively interact in a face-to-face exchange.
- Time and cost make frequent group meetings unfeasible.
- The efficiency of face-to-face meetings can be increased by a supplemental group communication process.
- Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured.

- The heterogeneity of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality ("bandwagon effect").

The Delphi technique differs from other methods of obtaining a group opinion, because it physically separates the group's members from one another in order to reduce irrelevant interpersonal influences. Properly carried out, the technique is facilitated by an analyst obtaining each panel member's reason for the opinion. The analyst then reduces the opinions and reasons to standard statements in order to preserve anonymity. The analyst then shows the panel member the aggregated opinions of the other panel members in statistical terms. The analyst provides each panel member with the reasons justifying the opinions that differ with the member, and requests revaluation and further substantiation. This iterative feeding back continues until no further substantial change results. At this point, the moderator takes the final individual opinions and computes a set of median values to represent the group opinion. The median value, rather than the average, is used as a central estimate to prevent the estimate from being overly influenced by extreme individual values.

One technique which holds much promise for the future as a means of capturing expert judgement is "expert support systems". Ideally, the expert support system would lead the expert(s) through a series of parameter specific questions (cost and schedule, possible performance) and generate PDFs based on the responses.

III. RELIABILITY

The reliability of the PDFs obtained through these techniques is affected by a number of factors. Foremost is the degree to which the so called "expert" is in fact an expert. The better understanding the expert has of the parameter being modeled, the more reliable the resulting PDFs will be. The burden also falls on the analyst to select the technique most appropriate for obtaining PDFs. For example, if expertise resides with more than one expert, a Delphi technique would result in much more reliable PDFs than would a direct method of asking only one expert. Likewise, if the expert has very little understanding of probability concepts, it would be inappropriate to ask him to select a PDF from a visual list of options. Under these circumstances, the modified Churchman-Ackoff method or a betting technique would most likely result in more reliable PDFs.

In summary, much of the reliability of the PDFs is predicated on the techniques selected by the analyst for constructing them. Therefore, it is important that the analyst know when each technique is most appropriate, given the unique circumstances of that specific program office.

APPENDIX E

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TECHNOLOGY READINESS LEVELS

A White Paper
April 6, 1995

John C. Mankins
Advanced Concepts Office
Office of Space Access and Technology
NASA

Introduction

Technology Readiness Levels (TRLs) are a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology. The TRL approach has been used on and off in NASA space technology planning for many years and was recently incorporated in the NASA Management Instruction (NMI 7100) addressing integrated technology planning at NASA. Figure 1 (attached) provides a summary view of the technology maturation process model for NASA space activities for which the TRL's were originally conceived; other process models may be used. However, to be most useful the general model must include: (a) 'basic' research in new technologies and concepts (targeting identified goals, but not necessary specific systems), (b) focused technology development addressing specific technologies for one or more potential identified applications, (c) technology development and demonstration for each specific application before the beginning of full system development of that application, (d) system development (through first unit fabrication), and (e) system 'launch' and operations.

Technology Readiness Levels Summary

TRL 1 Basic principles observed and reported

TRL 2 Technology concept and/or application formulated

TRL 3 Analytical and experimental critical function and/or characteristic proof-of-concept

TRL 4 Component and/or breadboard validation in laboratory environment

TRL 5 Component and/or breadboard validation in relevant environment

TRL 6 System/subsystem model or prototype demonstration in a relevant environment (ground or space)

TRL 7 System prototype demonstration in a space environment

TRL 8 Actual system completed and "flight qualified" through test and demonstration (ground or space)

TRL 9 Actual system "flight proven" through successful mission operations

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Discussion of Each Level

The following paragraphs provide a descriptive discussion of each technology readiness level, including an example of the type of activities that would characterize each TRL.

TRL 1
Basic principles observed and reported

This is the lowest "level" of technology maturation. At this level, scientific research begins to be translated into applied research and development. Examples might include studies of basic properties of materials (e.g., tensile strength as a function of temperature for a new fiber).

Cost to Achieve: Very Low 'Unique' Cost
(investment cost is borne by scientific research programs)

TRL 2
Technology concept and/or application formulated

Once basic physical principles are observed, then at the next level of maturation, practical applications of those characteristics can be 'invented' or identified. For example, following the observation of high critical temperature (Htc) superconductivity, potential applications of the new material for thin film devices (e.g., SIS mixers) and in instrument systems (e.g., telescope sensors) can be defined. At this level, the application is still speculative: there is not experimental proof or detailed analysis to support the conjecture.

Cost to Achieve: Very Low 'Unique' Cost
(investment cost is borne by scientific research programs)

TRL 3
Analytical and experimental critical function and/or characteristic proof-of-concept

At this step in the maturation process, active research and development (R&D) is initiated. This must include both analytical studies to set the technology into an appropriate context and laboratory-based studies to physically validate that the analytical predictions are correct. These studies and experiments should constitute "proof-of-concept" validation of the applications/concepts formulated at TRL 2. For example, a concept for High Energy Density Matter (HEDM) propulsion might depend on slush or super-cooled hydrogen as a propellant: TRL 3 might be attained when the concept-enabling phase/temperature/pressure for the fluid was achieved in a laboratory.

Cost to Achieve: Low 'Unique' Cost
(technology specific)

TRL 4

Component and/or breadboard validation in laboratory environment

Following successful "proof-of-concept" work, basic technological elements must be integrated to establish that the "pieces" will work together to achieve concept-enabling levels of performance for a component and/or breadboard. This validation must devised to support the concept that was formulated earlier, and should also be consistent with the requirements of potential system applications. The validation is relatively "low-fidelity" compared to the eventual system: it could be composed of ad hoc discrete components in a laboratory. For example, a TRL 4 demonstration of a new 'fuzzy logic' approach to avionics might consist of testing the algorithms in a partially computer-based, partially bench-top component (e.g., fiber optic gyros) demonstration in a controls lab using simulated vehicle inputs.

Cost to Achieve: Low-to-moderate 'Unique' Cost
(investment will be technology specific, but probably several factors greater than investment required for TRL 3)

TRL 5

Component and/or breadboard validation in relevant environment

At this, the fidelity of the component and/or breadboard being tested has to increase significantly. The basic technological elements must be integrated with reasonably realistic supporting elements so that the total applications (component-level, sub-system level, or system-level) can be tested in a 'simulated' or somewhat realistic environment. From one-to-several new technologies might be involved in the demonstration. For example, a new type of solar photovoltaic material promising higher efficiencies would at this level be used in an actual fabricated solar array 'blanket' that would be integrated with power supplies, supporting structure, etc., and tested in a thermal vacuum chamber with solar simulation capability.

Cost to Achieve: Moderate 'Unique' Cost
(investment cost will be technology dependent, but likely to be several factors greater that cost to achieve TRL 4)

TRL 6

System/subsystem model or prototype demonstration in a relevant environment (ground or space)

A major step in the level of fidelity of the technology demonstration follows the completion of TRL 5. At TRL 6, a representative model or prototype system or system — which would go well beyond ad hoc, 'patch-cord' or discrete component level breadboarding — would be tested in a relevant environment. At this level, if the only 'relevant environment' is the environment of space, then the model/prototype must be demonstrated in space. Of

course, the demonstration should be successful to represent a true TRL 6. Not all technologies will undergo a TRL 6 demonstration: at this point the maturation step is driven more by assuring management confidence than by R&D requirements. The demonstration might represent an actual system application, or it might only be similar to the planned application, but using the same technologies. At this level, several-to-many new technologies might be integrated into the demonstration. For example, a innovative approach to high temperature/low mass radiators, involving liquid droplets and composite materials, would be demonstrated to TRL 6 by actually flying a working, sub-scale (but scaleable) model of the system on a Space Shuttle or International Space Station 'pallet'. In this example, the reason space is the 'relevant' environment is that microgravity plus vacuum plus thermal environment effects will dictate the success/failure of the system — and the only way to validate the technology is in space.

Cost to Achieve: Technology and demonstration specific; a fraction of TRL 7 if on ground; nearly the same if space is required

TRL 7

System prototype demonstration in a space environment

TRL 7 is a significant step beyond TRL 6, requiring an actual system prototype demonstration in a space environment. It has not always been implemented in the past. In this case, the prototype should be near or at the scale of the planned operational system and the demonstration must take place in space. The driving purposes for achieving this level of maturity are to assure system engineering and development management confidence (more than for purposes of technology R&D). Therefore, the demonstration must be of a prototype of that application. Not all technologies in all systems will go to this level. TRL 7 would normally only be performed in cases where the technology and/or subsystem application is mission critical and relatively high risk. Example: the Mars Pathfinder Rover is a TRL 7 technology demonstration for future Mars micro-rovers based on that system design. Example: X-vehicles are TRL 7, as are the demonstration projects planned in the New Millennium spacecraft program.

Cost to Achieve: Technology and demonstration specific, but a significant fraction of the cost of TRL 8 (investment = "Phase C/D to TFU" for demonstration system)

TRL 8

Actual system completed and "flight qualified" through test and demonstration (ground or space)

By definition, all technologies being applied in actual systems go through TRL 8. In almost all cases, this level is the end of true 'system development' for most technology elements. Example: this would include DDT&E through Theoretical First Unit (TFU) for a new reusable launch vehicle. This might include integration of new technology into an existing system. Example: loading and testing successfully a new control algorithm into the onboard computer on Hubble Space Telescope while in orbit.

Cost to Achieve: Mission specific; typically highest unique cost for a new technology (investment = "Phase C/D to TFU" for actual system)

TRL 9

Actual system "flight proven" through successful mission operations

By definition, all technologies being applied in actual systems go through TRL 9. In almost all cases, the end of last 'bug fixing' aspects of true 'system development'. For example, small fixes/changes to address problems found following launch (through '30 days' or some related date). This might include integration of new technology into an existing system (such operating a new artificial intelligence tool into operational mission control at JSC). This TRL does not include planned product improvement of ongoing or reusable systems. For example, a new engine for an existing RLV would not start at TRL 9: such 'technology' upgrades would start over at the appropriate level in the TRL system.

Cost to Achieve: Mission Specific; less than cost of TRL 8
(e.g., cost of launch plus 30 days of mission operations)

[9] Office of the Director of Defense Research and Engineering (DDRE) OSD Memorandum, Subject: Interim Guidance for Implementing Technology Readiness Levels, dated 12 July 2001.

OFFICE OF THE DIRECTOR OF
DEFENSE RESEARCH AND ENGINEERING

JUL 12 2001

MEMORANDUM FOR OSD/S&T) DIRECTORS

SUBJECT: Interim Guidance for Implementing Technology Readiness Levels

The new June 10, 2001 updated Department of Defense Regulation 5000.2R, Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs reflects the Science and Technology (S&T) role in the acquisition process. The S&T community must be actively engaged in enabling the rapid transition of mature technologies to product developers and actively participate in acquisition system integrated product teams. The regulation requires that the Component Science and Technology Executives conduct a technology readiness level (TRL) assessment (or some equivalent assessment) for critical technologies identified in ACAT ID and ACAT IAM programs prior to Milestone B and C. In cooperation with the Component S&T Executive and program office, the DUSD (S&T) must evaluate this assessment (including the Technology Readiness Level for each critical technology) and forward a concurrence with these findings to the Overarching Integrated Product Team Leader and the Defense Acquisition Board. It should be noted that TRL assessments are the preferred approach for all new programs unless DUSD (S&T) approves an equivalent assessment method.

The DSTAG recommended that a TRL IPT be established to define the guidelines and framework for implementing and applying TRLs in a consistent manner throughout the Department. The IPT developed guidelines for the S&T community to use in implementing TRL during the process. The attached interim guidelines include:

Technology Readiness Assessment Process (Attachment 1)
Definitions of Technology Readiness Levels (Attachment 2)
Elements for a Technology Readiness Agreement (including a sample (not mandatory)) (Attachment 3)

Your active leadership and participation in your technical area plays a significant role in the implementation of TRLs across the Department. As shown in the TRL Process chart, we will be required to validate TRL assessments conducted by the Component S&T Executives. Attachment 4 is an example of a format that can be used in reviewing the TRL assessment of an acquisition

OFFICE OF THE DIRECTOR OF
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WASHINGTON, D.C. 20301-3040

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program. Note that our review needs to be signed by both the technical action offices and his/her director. As a recognized partner in the acquisition process, we must insert ourselves much earlier in the process. I personally encourage each of you and your staffs to be actively involved during the identification of critical technologies process and in the Working Integrated Product Teams (WIPTs) for ACAT ID and ACAT IAM programs.

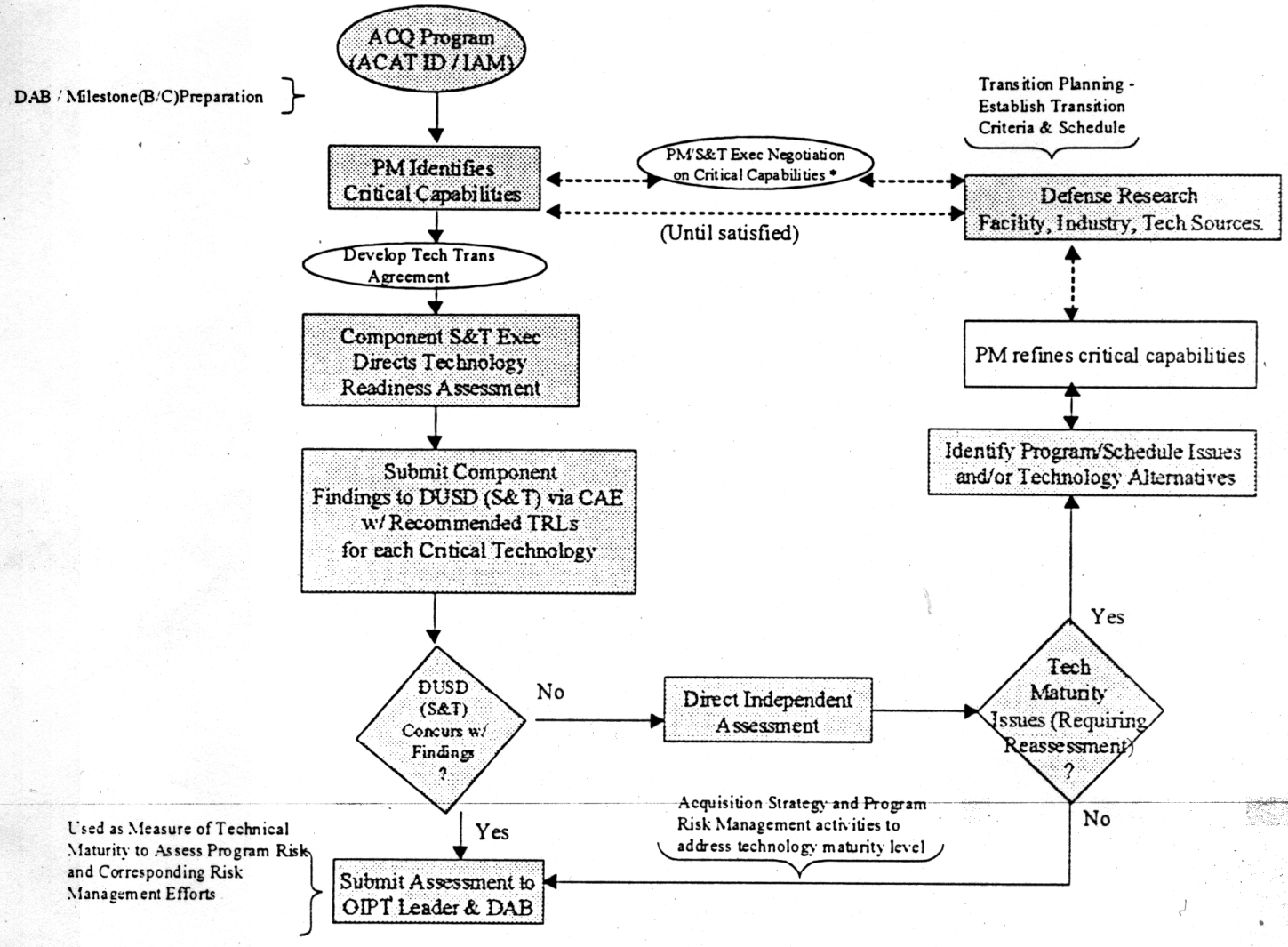
The S&T Plans and Programs office is responsible for maintaining a list of all ACAT ID AND acat iam programs requiring technology assessments and maintaining a copy of DUSD(S&T)'S review of TRL assessments. If you have any questions or comments, please contact Mr. Al Shaffer, Director, S&T Plans and Programs at (703) 695-9604.

Delores M. Etter

Delores M. Etter
Deputy Under Secretary of Defense
(Science and Technology)

Attachments:
As stated.

TECHNOLOGY READINESS ASSESSMENT PROCESS



* NO NEGOTIATION ON TRL ASSESSMENT

Attachment 1

DEFINITIONS OF TECHNOLOGY READINESS LEVEL

The following table lists the various technology readiness levels and descriptions from a systems approach for both HARDWARE and SOFTWARE.(Components may provide additional clarifications for Software)

Technology Readiness Level	Description
1. Basic principles observed and reported.	Lowest Level of Technology Readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.
2. Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there is no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
3. Analytical and experimental critical functions and/or characteristic proof of concept.	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Component and/or breadboard validation in laboratory environment.	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.
5. Component and/or breadboard validation in relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that it can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.
6. System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment, or in a simulated operational environment.
7. System prototype demonstration in an operational environment.	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment, such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
8. Actual system completed and "flight qualified" through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9. Actual system "flight proven" though successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of system development. Examples include using the system under operational mission conditions.

DEFINITIONS:

BREADBOARD: Integrated components that provide a representation of a system/subsystem and which can be used to determine concept feasibility and to develop technical data. Typically configured for laboratory use to demonstrate the technical principles of immediate interest. May resemble final system/subsystem in function only.

"HIGH FIDELITY": Addresses form, fit and function. High fidelity laboratory environment would involve testing with equipment that can simulate and validate all system specifications within a laboratory setting.

"LOW FIDELITY": A representative of the component or system that has limited ability to provide anything but first order information about the end product. Low fidelity assessments are used to provide trend analysis.

MODEL: A reduced scale, functional form of a system, near or at operational specification. Models will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.

OPERATIONAL ENVIRONMENT: Environment that addresses all of the operational requirements and specifications required of the final system to include platform/packaging.

PROTOTYPE: The first early representation of the system which offers the expected functionality and performance expected of the final implementation. Prototypes will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.

RELEVANT ENVIRONMENT: Testing environment that simulates the key aspects of the operational environment.

SIMULATED OPERATIONAL ENVIRONMENTAL: Environment that can simulate all of the operational requirements and specifications required of the final system or a simulated environment that allows for testing of a virtual prototype to determine whether it meets the operational requirements and specifications of the final system.

ELEMENTS OF TECHNOLOGY TRANSITION AGREEMENT

The following elements should be considered for inclusion in a technology agreement between an acquisition program, the intended receiver of a technology or capability development, and a science and technology activity, the developer and provider of the technology. Not every one of these elements is appropriate for every agreement, but each agreement should have considered these for inclusion.

Agreements, to be effective, must be reviewed periodically with both S&T management and program office management representatives participating. These reviews should address technical progress and future directions.

Elements to be provided by the Program Office:

a. **Target Acquisition Program.** A brief description of the acquisition program intended to receive the technology that is to be transitioned. Include major program objectives, current phase of acquisition life cycle, and projected initial operational capability date.

b. **Program Manager/Project Officer.** Program manager and individual in program office responsible for day-to-day management with contact information.

c. **Acquisition Program Technology Need.** Brief description of the benefit that this technology will bring to the acquisition program, or need satisfied. Where possible, relate benefit to ORD, KPP, etc. Include need dates for specific capabilities.

d. **Integration Strategy.** Describe the process for integrating the technology into the acquisition program. Include elements of acquisition strategy – evolutionary acquisition, block upgrade, etc., as well as required contractor to contractor agreements

Elements to be provided by S&T Activity

a. **Description of Technology or Capability to be Delivered.** Brief description of what the S&T activity intends to develop for transition to the acquisition program. Include capability delivery dates.

b. **Technology Manager.** Individual designated by the S&T activity to be the coordinator and day-to-day manager of the development of the needed technology.

c. **Current Status of Technology.**

   1. **Status Summary.** Summarize current state of development. Identify primary areas where additional development is required. Provide estimate of current TRL.

2. **Risk Analysis.** Major areas of risk, prioritized, with planned mitigation activities. Include technical (e.g., producibility, affordability, sustainability) cost, and schedule risks.

d. **Technology Development Strategy**. Outline approach planned. Efforts required beyond those currently underway; integration plans if multiple projects are planned. Planned ATD or ACTD developments, if applicable

e. **Key Technical Measures of Readiness to Transition**. Identify the key parameters or attributes that will be used to measure whether or not the technology development effort is proceeding appropriately. Include parameter to be tracked, current state, interim progress estimates, and final objective. Technology Readiness Levels are a measure of technical maturity and can be used to assess readiness to transition.

f. **Program Plan.** Show major activities/efforts comprised by the technology development activity with milestones.

Signatures. Technology transition agreements should be signed as required to commit the participating organizations to the plan outlined in the agreement. The program manager(s) of the acquisition program(s) involved and the S&T project manager, should sign.

- SAMPLE -

TECHNOLOGY TRANSITION AGREEMENT

Basic Transition Agreement

1. Description of Technology or Capability to be Delivered.

2. Target Acquisition Program.

3. Acquisition Program Technology Need

4. Integration Strategy

5. Program Manager/Project Officer

6. Technology Manager

Technical Details and Programmatics

1. Technology – Current Status

   a. Summary – Status

   b. Risk Analysis

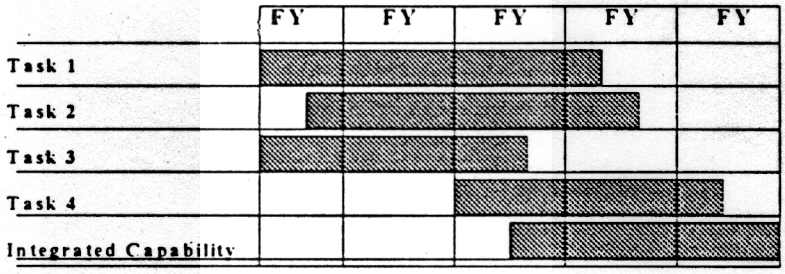
Top Risks	Brief Description	Mitigation Strategy

2. **Technology Development Strategy.**

3. **Key Measures of Transition Readiness**

Attribute/Parameter	Current	Interim (w/Est Date)	Final Objective

4. **Program Plan**



SIGNATURES:

Acquisition PM

S&T Project Manager

ODUSD (S&T)/WS UH-60M Program
Technology Readiness Level Assessment

The UH-60M Program TRL assessment is grouped into three categories. They are Cockpit Digitization, Propulsion, and Airframe. These categories are subdivided into 16 individual TRL assessments. Source information for this appraisal includes direct knowledge of specific supporting science and technology (S&T) activities, documentation provided by the SAALT staff, and information derived from the DOT&E website on Black Hawk modernization at http://www.dote.osd.mil/reports/FY00/army/00blackhawkuh60.html.

Category 1 - Cockpit Digitization

Element 1 - Stormscope

- Army Assessment: 8 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Commercial-off-the-Shelf (COTS) item, already fielded on the UH-60Q and HH-60L

Element 2 - Dual Embedded GPS Inertial (EGI) Navigation System

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: EGI has flown on CH-47 and MH-60K. Apache Program is currently demonstrating/qualifying an updated version.

Element 3 - Cockpit Voice Recorder (CVR)/Flight Data Recorder (FDR)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: COTS component. Technology demonstrated on the MH-60K Program and civil aviation aircraft. Qualification efforts ongoing for MH-60K and MH-47E fleets.

Element 4 - Advanced Flight Control Computer (AFCC)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Based upon SH-60 and S-92 architecture. Qualification testing is ongoing.

Element 5 - Improved Data Modem (IDM)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: IDM currently in use on OH-58D and AH-64 platforms.

Category 2 - Propulsion

Element 1 - Crashworthy External Fuel System (CEFS)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Product of a Cooperative Research and Development Agreement intended to improve the crashworthiness and reduce the ballistic vulnerability of the existing Extended Range Fuel System (ERFS). Airworthiness Qualification Testing ongoing.

ODUSD (S&T)/WS UH-60M Program
Technology Readiness Level Assessment (cont'd)

Category 2 – Propulsion (cont'd)

Element 2 - Wide Chord Blade (WCB)
- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: DoD Dual Use Application Program COSSI effort to qualify a commercially developed main rotor blade for use in the military environment. Airworthiness Qualification Testing ongoing.

Element 3 - T700-GE-701C Engine
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Currently fielded on the UH-60L with over 400 A/C, 2 engines per A/C

Element 4 - Improved Durability Gearbox (IDGB), Rotorhead & Control
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Currently fielded on the UH-60L with over 400 A/C

Element 5 - Improved Infrared (IR) Suppressor
- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Discrete Design Modifications to HIRSS currently installed on the UH-60 fleet. System flight demonstrations completed with no significant issues noted.

Category 3 - Airframe

Element 1 - Refurbishment
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: No new technologies or materials being used in refurbishment efforts.

Element 2 - Standardization
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Using existing Maintenance Work Orders for the current version of the UH-60L aircraft.

Element 3 - Tailcone & Stabilator
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Being accomplished already on the UH-60A/L aircraft.

Element 4 - Transition Access Door
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Same modification being accomplished on the UH-60Q.

ODUSD (S&T)/WS UH-60M Program
Technology Readiness Level Assessment (cont'd)

Category 3 – Airframe (cont'd)

Element 5 - Electro Magnetic Interference (EMI) Wiring
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: No new technologies or materials required. Material solution for the UH-60M is currently fielded wiring or that used on MH-60K.

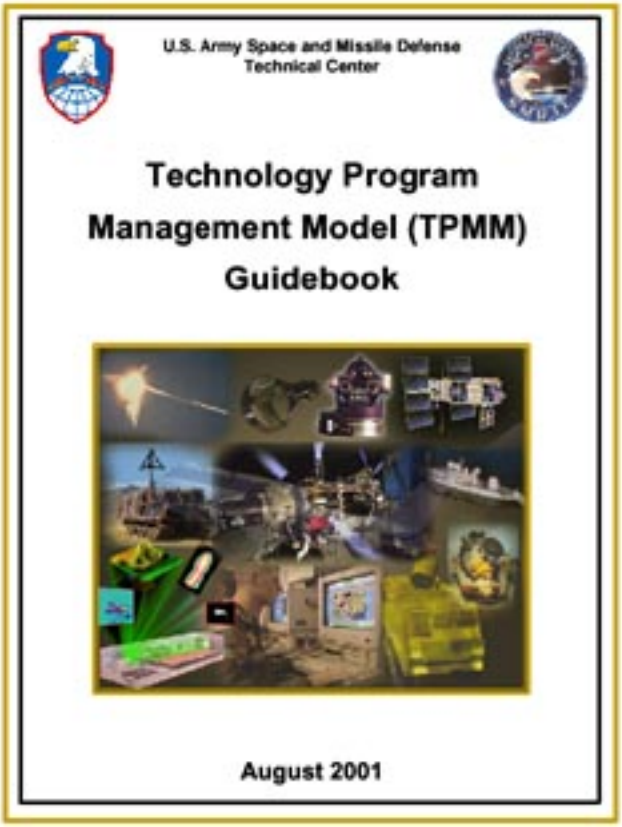
Element 6 - External Stores Support System (ESSS)
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: No new technologies required. Currently fielded on the UH-60L.

Action Officer: >>Signed<< Date:_____
Paul F. Piscopo, Staff Specialist for Aircraft Systems

Director: >>Signed<< Date:_____
George Ullrich, Director, Weapons Systems Directorate

Prepared by: Mr. Paul F. Piscopo, ODUSD (S&T)/WS, 06/06/01

[10] Technology Program Management Model (TPMM) Guidebook, U.S. Army Space and Missile defense Technical Center, August 2001.



U.S. Army Space and Missile Defense
Technical Center

Technology Program Management Model (TPMM) Guidebook

August 2001

FOREWORD

Technical programs/projects must be carefully managed to ensure that technologies are delivered to the customer not only within time and budget constraints, but also that they provide increased capabilities to meet the needs of the warfighter. To accomplish this, a logical methodology is needed to support Technology Managers (TM) through the planning and development of their program/projects. The Technology Program Management Model (TPMM) provides that methodology.

The TPPM offers its users a standardized approach to technology development. It is a simple and flexible management tool for translating technological opportunities, based on validated mission needs and requirements, into stable, affordable, and well-managed acquisition programs. This approach is comprehensive. It consolidates the complex activities inherent in the development of all technology programs as well as the many varying approaches to technology development used in the past. The model offers many benefits, both to the TM and to Technical Center management. It provides the TM a guide to program evolution that is concise, easy to understand and interpret, and is flexible. The model provides a menu of key activities that can be tailored to the precise requirements of the project. By following its timeline, the TM is more assured of achieving project requirements and is able to demonstrate its readiness to transition to the next level/phase. It also facilitates management oversight and ultimate project evolution/validation through the Technology Readiness Levels.

The TPMM provides TM and the Technical Center as a whole with the following benefits:

- Strengthened Technology Program/Project justification to increase customer acceptance and funding support
- Facilitated review and prioritization among Technology Programs/Projects in a constrained resource environment
- Improved documentation process to support the STO/ATD/ACTD nomination process or transition to a acquisition program
- Better program execution through detailed management planning with emphasis on cost, schedule, and performance goals
- Improved technology development process efficiency (less time/resources) and effectiveness (high technology transfer ratio)

To assist TMs through the transition phase and the continued application of the TPMM, I am providing you with this TPMM Guidebook. The Guidebook is an excellent tool for assisting us in facing future challenges and will produce positive results for the Technology Center and ultimately the soldier. I look forward to working with you as we implement the TPMM and continue transitioning technologies to operational systems.

Jess F. Granone
Director, Space and Missile
Defense Technical Center

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SECTION I. PURPOSE AND OBJECTIVES

All technology development, to include streamlined initiatives such as Advanced Concept Technology Demonstrations (ACTDs), Science and Technology Objectives (STOs), Advance Technology Demonstrations (ATDs), Fast Track Programs, etc., requires planning to integrate into the Acquisition Management Process. The development of any product should have a logical process with a starting point and an ending point. The process requires a logical flow from discovery of an idea, based on a military need, to customer integration satisfying that need. Research and development is a creative process, however there must be a way to ensure that the right questions are being asked, at the right times, in developing advanced technologies for successful transition to the customer. The Technology Program Management Model (TPMM) provides that process.

1.1 PURPOSE

The purpose of the TPMM is to provide a logical methodology to guide Technology Managers (TM's) through the planning and development of their programs or projects. The TPMM standardizes planning, documentation, and review of Technology Programs/Projects. It provides a vision for the transition of technologies to a customer, Program Manager, or into an Acquisition Program itself. The TPMM also assists TM's in assessing military utility early in the process, which helps in identifying potential customers who then become involved throughout the entire process.

The purpose of this Guidebook is to assist the TM in applying the TPMM to Technology Programs/Projects. It applies to all Technology Programs/Projects managed by the organizations and elements of the United States Army Space and Missile Defense Command's Space and Missile Defense Technical Center (SMDTC).

1.2 OBJECTIVE

The objective of the TPMM is to establish a simplified and flexible management tool for translating technological opportunities, based on validated mission needs and requirements, into stable, affordable, and well-managed acquisition programs, including weapon systems and automated information systems.

SECTION II. SMDTC MISSION AND STRATEGIES

2.1 MISSION

The mission of the Space and Missile Defense Technical Center (SMDTC) is to develop imaginative, innovative and often high risk research ideas, offering significant technological solutions beyond the normal evolutionary developmental approaches; and to pursue these ideas for feasibilities, for current and future customer's requirements, and assist in technology transition to operational systems.

2.2 STRATEGIES

The SMDTC uses three main strategies to execute its mission. The first strategy is to identify new technology opportunities to support Space and Missile Defense Missions or to support other National Defense Priorities. The second is to mature the right technology at the right time to defend against evolving threats, reduce costs, and/or increase performance of Space and Missile Defense Missions or to support other National Defense Priorities. The third strategy is to implement a command wide, analytically based technology development process to focus efforts toward customers and identify areas for Command synergism.

2.3 TPMM SUPPORT OF SMDTC STRATEGIES

The TPMM assists the SMDTC in implementing its strategies in support of its overall mission. First, the model identifies the close working relationship with Project Managers (PMs), Industry, Academia, and Battle Labs to continuously target new technology requirements/opportunities. Second, the TPPM advocates the development of new technology based on Threat Analysis, Future Operational Capability Requirement, user need, or other relevant sources. This linkage of new technology to applications with a significant military utility ensures the right technology is developed. Third, the TPMM supports implementation of an analytically based technology development process. The use of Technology Readiness Levels (TRLs) and system engineering principles increases the effectiveness of program planning and the review process. Finally, the early identification of a customer and the use of planned phases to mark progress allow for command synergism by effectively tracking programs/projects by customer and/or phase of technology development.

SECTION III. TECHNOLOGY PROGRAM MANAGEMENT MODEL OVERVIEW

3.1 BENEFITS

The TPMM establishes a general approach for managing Technology Programs/ Projects, acknowledging that every program or project is unique. This uniqueness may require tailoring of the process to best address critical Technology Program/Project issues along the evolutionary path to achieving user needs. Key benefits that can be obtained from the use of the TPMM are: strengthened justification for funding support, increased customer acceptance, and improved execution and transition of the technology to the customer.

3.2 DEFINITIONS

The terms **customer**, **user, sponsor, Program Plan, and Program Plan Schedule** are used extensively in this Guidebook. The following definitions are provided for clarification. These definitions are intended for use within the scope of the TPMM.

Customer(s): An organization or individual that will accept the technology program/project normally at the end of the transition phase. A customer who is also providing the funding for the technology program/project may also be referred to as the sponsor.

Sponsor(s): An organization or individual that provides funding or other support for the Technology Program/Project. Typically, the Sponsor does not accept the Technology Program/Project.

User: An organization or individual that will operationally employ the technology.

Program Plan: The primary planning document for technologies containing all of the important elements necessary to accomplish development and transition of the technologies to the customer(s).

Program Plan Schedule: A time phased representation of the Program Plan containing all the necessary activities and milestones required to successfully develop and transition technologies to the customer(s).

3.3 PRINCIPLES

The following principles are the basis of the TPMM:

- Consistent with current Department of Defense (DoD) Acquisition Process and Policies
- Provide for multiple entry/transition points based on maturity of the technology

- Require documentation based on the technology scope but supporting STO / ATD / ACTD nominations and the formal Acquisition Process for transition to the customer
- Tailor and streamline documentation for each Technology Program/Project but still provide the needed information to make informed decisions
- Use the Technology Difficulty Index (TDI) to provide an early indication of technology risk (Appendix H-1 contains a TDI Reference Table)
- Use Technology Readiness Levels (TRLs) to evaluate technology growth (Appendix H-2 contains a TRL Reference Table)
- Tailor the TRLs for the specific technology being developed
- Assign TRL 6 as the goal for Transition to the customer
- Develop requirements for Technology Program/Project covering all areas: System Performance, Form/Fit/Function, Logistic Supportability, Operational Readiness, Interoperability, and Producibility, as some examples
- Provide "PROOF" - Documentation, Results, Plans - at every review to support entry into the next phase
- Increase the level of detail for "PROOF" requirements as technology progresses from concept to a prototype ready for the customer
- Review Technology Program/Project progress and approve entry into the next phase through a Technology Process Review (TPR)
- Determine the size and composition of the TPR and detail of documentation required based on the Technology Program/Project complexity, funding level, and phase

3.4 DoD ACQUISITION PROCESS AND POLICIES

The first principle of the TPMM is that it is consistent with current DoD acquisition processes and policies. The following are DoD policies on science and technology as stated in DoD 5000.1:

- The fundamental role of the DoD Science and Technology (S&T) program is to enable a technologically superior military force
- The S&T program shall address user needs; maintain a broad-based program spanning all Defense-relevant sciences and technologies to anticipate future needs and those not being pursued by civil or commercial communities; preserve long-range research; and enable rapid transition from the S&T base to useful military products
- The S&T projects shall focus on increasing the effectiveness of a capability while decreasing cost, increasing operational life, and incrementally improving products through planned upgrades
- The S&T executives shall encourage the use of initiatives, such as Advanced Technology Demonstrations, designed to accelerate the transition from the S&T base to useful military products

Additionally, the DoD 5000.2 Technology Transition Objective is to mature technology programs to a TRL that is acceptable to the receiving Milestone Decision

Authority (MDA) and puts the MDA at low risk for systems integration. The process to mature a technology continues until successful transition or until the MDA is no longer considering the technology.

3.5 TECHNOLOGY PROGRAM MANAGEMENT MODEL (TPMM)

Based on the previously mentioned principles and DoD process and policies, the TPMM is designed to take a technology program from an idea through a series of steps, or phases, to final transition. TRLs, the formal acquisition process, and system engineering principles were used in developing the phases of technology development that logically lead to a capability ready for transition to the customer. The ACTD would be an exception in some cases in terms of transitioning to customer management as will be explained later.

The TPMM, see foldout in guidebook pocket, consists of seven phases: Discovery, Formulation, Exploration, Development, Demonstration, Transition, and Customer Management. The model provides Considerations/Actions (C/A) that address the major functions in each phase of the technology development process. This facilitates the development of a program strategy, documented in a Program Plan. Following the model methodology and carefully considering the C/A the Program Plan is developed during the Exploration phase and updated during subsequent phases. The Program Plan format is located in Appendix E. Additionally, the TM develops a Program Plan Schedule to show the timing of activities and milestones leading to successful transition to the customer. Figure 3.2 provides a sample format for a Program Plan Schedule.

Since the ACTD are demonstrations jointly sponsored and implemented by the operational user and materiel development communities, with approval and oversight guidance from the Deputy Under Secretary of Defense for Advanced Technology (DUSD(AT)) it would not require a TPMM program plan. The principal management tool for the ACTD is the ACTD Management Plan. This management plan is intended to maintain a flexible approach to the advanced development process and avoid excessive rigidity and formality in the documentation process. The content of each Management Plan should be tailored to meet the diverse needs of the ACTD. For specific guidance on the ACTD management plan and its format see the Defense Acquisition Deskbook (DAD).

The TPMM establishes success criteria consistent with the use of TRLs and DoD Acquisition Policies. The model provides Exit Criteria and Deliverables indicating what is necessary to meet the requirements of each Technology Phase. The implementation of the model's Technology Process Reviews (TPRs) ensures that Technology Program/Project are reviewed to assess technical progress, ability to meet customer needs, and fiscal soundness. The TM provides key information at the TPRs for the Decision Authority to make informed management decisions concerning the program's progress and its suitability for continued effort.

There is no one best way to implement the objectives of this Guidebook. Proposed Technology Programs/Projects, for example, may enter the TPMM process at various TPR points, depending on the concept and technological maturity. Section V provides guidance to determine where to enter the model. Decision Authorities and TM's should tailor strategies to fit the particular conditions of an individual Technology Program/Project, consistent with common sense, sound business management practice, applicable laws and regulations, and the time-sensitive nature of the user's requirement. Tailoring shall be applied to various aspects of the program/project, including documentation, phases, the timing and scope of TPRs, and TPR Decision Authority levels.

Figure 3.1. Technology Program Management Model

(Readable Foldout Is Located In Guidebook Pocket)

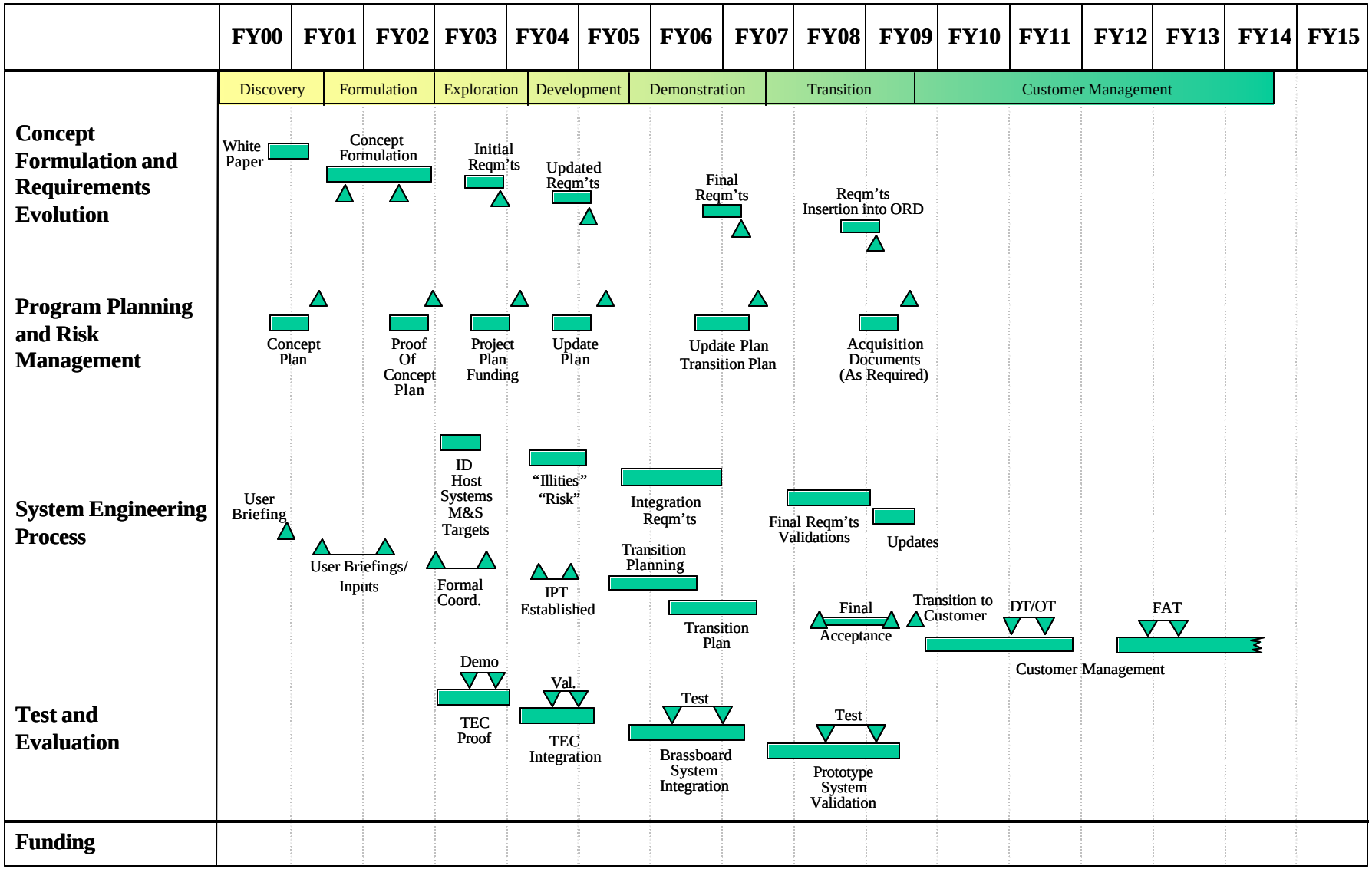


Figure 3-2. Program Plan Schedule - An Important Part of the Technology Program Management Model Process

SECTION IV. TECHNOLOGY PROGRAM MANAGEMENT MODEL BY PHASE

This section provides a detailed description of each phase of the TPMM. Each phase consists of a Phase Description, or Considerations/Actions, an outline of Deliverables, and generalized Exit Criteria. A diagram is also included to clarify where each phase begins, what is accomplished during the phase, and where the phase finishes. Please note that the Considerations/Actions for all of the phases are not to be construed as all inclusive and some may not pertain to a particular technology.
The TM should use best judgment to determine if a particular action or question pertains to the technology and should ask the following: Is there anything else that I should consider? The chart in Figure 4.1 is a simplified overview version of the TPMM. Additionally, the numbers assigned to the Considerations/Actions are for reference only and don't necessarily imply a required order.

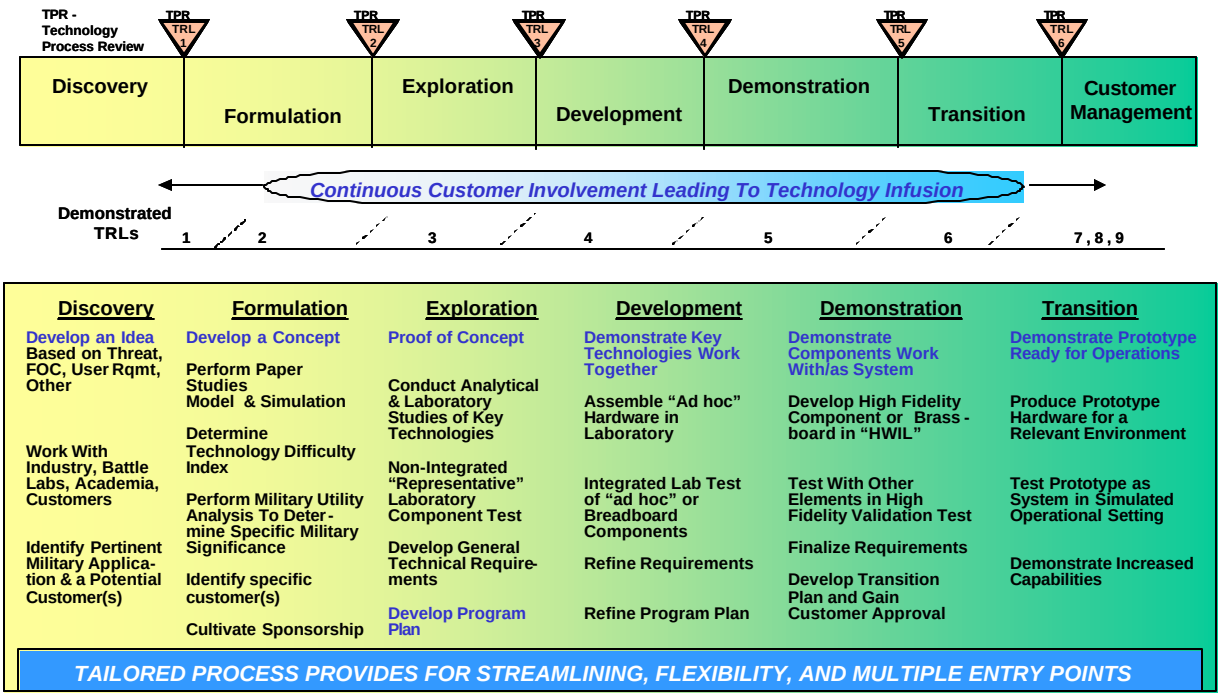
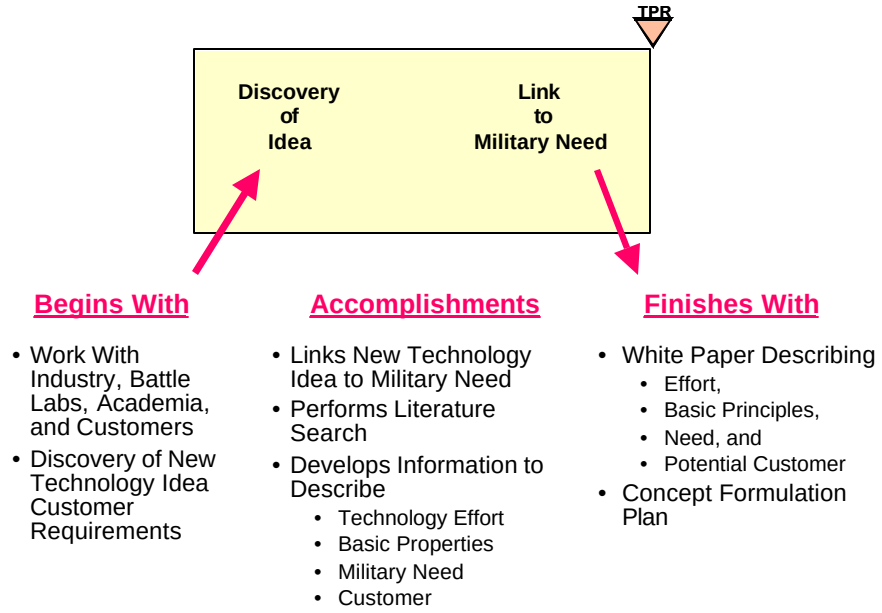


Figure 4-1. Simplified Model Chart

4.1 DISCOVERY PHASE

The Discovery Phase begins with the development of an idea for a new technology based on Threat Analysis, Future Operational Capability Requirement, User need, or other relevant sources. Discovery links the idea for new technology to a military need (or opportunity). During this phase a literature search is performed and information is developed describing the effort, the basic principles/properties involved, and identifying the known or perceived need/application along with potential customer(s)/sponsor(s). Toward the end of this phase, a white paper is developed describing the effort, the basic principles/properties involved, and the known or perceived military need/application along with potential customer(s)/sponsor(s). Additionally, a brief Concept Formulation Plan is developed to identify the process and funding for the next phase. The Discovery Phase is normally funded only for completion of the activities necessary to reach the end of the phase.

Discovery Phase



Discovery Phase Considerations/Actions:

1. What are the primary science and technology objectives and principles that will be investigated in this phase?
2. What known or perceived military need drives this effort?
3. What are the results of your literature search?
4. What identical or similar investigations are underway elsewhere?
5. Who are the potential customers?
6. Who are the potential sponsors?

7. What organizations are involved with this phase?
8. How is this phase of the program effort to be funded?
9. Develop a white paper describing the effort to include basic principles/properties involved.
10. Develop a Concept Formulation Plan for the next phase.
11. Prepare a study funding request for the next phase.

***Deliverables*:**

1. White Paper
2. Concept Formulation Plan

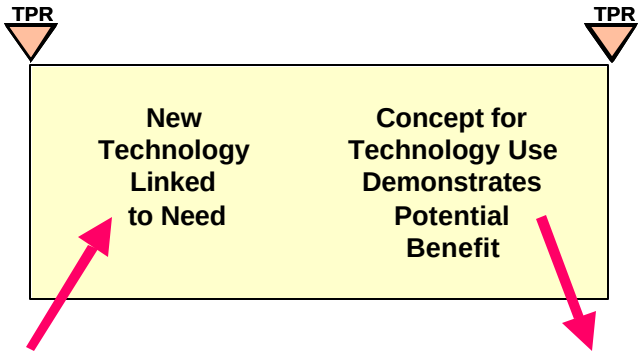
***Exit Criteria Met When*:**

- Literature search demonstrates that this concept has potential and is not a duplication of other efforts
- White paper adequately describes the research effort
- Basic principles/properties involved are clearly stated in White Paper
- Known or perceived military need or application is identified
- Potential customer(s) and/or sponsor(s) are identified
- Funding for the next phase is acceptable and supportable.
- Concept Formulation Plan adequately describes the process for the next phase

4.2 FORMULATION PHASE

The Formulation Phase begins with identified basic properties for a new technology linked to a potential military need. During this phase, concepts for application of the technology are formulated that will demonstrate a practical military utility. A Concept Formulation paper study is conducted to identify key technologies, evaluate alternatives, select the best feasible solution, determine the Technology Difficulty Index (TDI) (see Appendix H-1), and analyze the potential benefit over current technology. A Military Utility Analysis is initiated to determine what the value of a technology, system, or concept will be in an operational environment. Also, specific customer(s)/sponsor(s) is/are identified and are involved throughout the remaining phases. Toward the end of this phase the study is documented in a Concept Formulation analysis report and a Proof of Concept Plan is developed, identifying what models and simulations, or other means, exist to conduct a proof of principle of the required key technology(ies) along with a funding estimate for the next phase.

Formulation Phase



Begins With

- New Technology Idea Linked to Potential Military Need

Accomplishments

- Formulates and Analyzes Concepts which Demonstrate Military Application
- Identifies Key Technology(ies)
- Determines TDI
- Identifies Specific Customer/Sponsor

Finishes With

- Concept Formulation Analysis Paper Documenting Results of Study Effort
- Proof of Concept Plan Describing the Means to Prove Key Technology

Formulation Phase Considerations/Actions:

1. What organizations should be involved with this phase?
2. Initiate a Military Utility Analysis to identify benefits to the warfighter.
3. What potential military application exists?
4. What operational scenarios have been developed for evaluation and are they realistic?
5. What alternative competing concepts (if any), using the key technologies, have been identified?
6. What is the "best feasible" technology concept and how will it be applied to satisfy the identified need?
7. How does this program provide a significant improvement in capability over the current technology?
8. What is the Technology Difficulty Index for this program?
9. Update the study funding request as required: part of concept formulation plan.
10. Prepare a Concept Formulation Analysis Report.
11. Who is/are the specific customer(s)?
12. Who is/are the specific sponsor(s)?
13. Develop a Proof of Concept Plan to include required funding for the next phase.
14. What models and simulations exist to evaluate the 'goodness' of the concept, and are they applicable to the analysis to be performed in the next phase?
15. What functional models need to be developed to assess the system performance?

***Deliverables*:**

1. Concept Formulation Analysis Report
2. Proof of Concept Plan

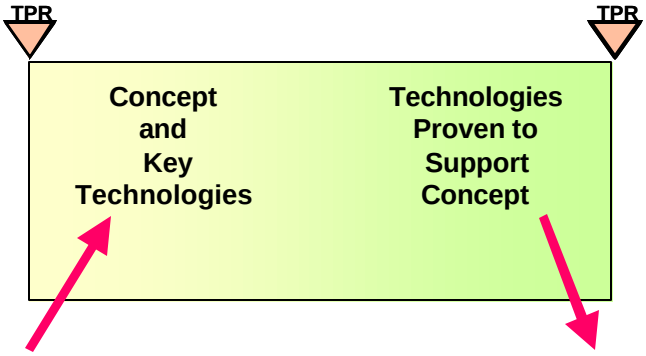
Exit Criteria Met When:

- Military Utility Analysis initiated
- Key technologies are clearly identified and described
- Selection of the "best feasible" concept is based on evaluation/comparison of alternatives
- Scenarios used in evaluation are traceable to realistic situations
- Selected concept demonstrates a potential benefit over current technology
- Technology Difficulty Index is determined as first step in risk management
- Specific customer(s)/sponsor(s) is/are identified
- Proof of Concept Plan (PCP) identifies models and simulations, or other means, to conduct a proof of principle of the required key technology(ies)
- Funding request for next phase of research is acceptable and supportable (included in the PCP).

4.3 EXPLORATION PHASE

The Exploration Phase begins with a selected technology concept for military application and identification of the new key technology(ies) required. This phase explores the key technology(ies) to demonstrate its/their capability to support the concept. Active research and development, including analytical and laboratory studies, provides physical validation and documentation that the key technologies work as envisioned and their capabilities support the requirements of the concept study. Toward the end of this phase, key preliminary (draft) performance and technical parameters are identified and documented. The major deliverable developed during this phase is the Program Plan. The Program Plan is the principle management tool for the TPMM. The Program Plan along with the Program Plan Schedule is updated prior to each TPR until the program/project is transitioned to the Customer.

EXPLORATION PHASE



Begins With

- Selected Concept Providing Military Application
- Identified Key Technology(ies)

Accomplishments

- Demonstrates Key Technology Supports Concept Results
- Conducts Non-Integrated Lab Testing
- Develops General Requirements
- Develops Information for Program Plan

Finishes With

- Key Performance Parameters Documented (Draft)
- Proof of Concept Analysis Report
- Program Plan and Funding Estimate for the Remaining Effort

Exploration Phase Considerations/Actions:

1. What organizations should be involved with this phase?
2. What are the key performance parameters?
3. Develop a Requirements Document for this technology.
4. What historical data have been collected and analyzed to determine probability of successful performance?
5. What critical functions/issues must be evaluated?
6. What laboratory test will be conducted?
7. What 'representative' components will be used in the test?
8. Where will the test(s) be conducted?
9. Who will conduct the test(s)?
10. Will the customer observe the test or be briefed on the outcome?
11. What analytical studies will be conducted?
12. Develop/update/validate models and simulations based on studies and laboratory test results.
13. Prepare a Proof of Concept Analysis Report
14. Has the sponsor/customer been briefed and agreed to fund the technology development program?
15. Prepare a program plan outlining the program through transition.
16. Develop a program plan schedule.
17. What contracting strategies have been selected for the remainder of the program?
18. What is the estimated cost of this technology development program?
19. Develop a Component/Breadboard Laboratory Validation Plan.

***Deliverables*:**

Program Plan to include:

- Requirements Document
- Proof of Concept Analysis Report
- Component/Breadboard Laboratory Validation Plan
- Program funding estimate
- Customer/sponsor briefed and support agreement obtained
- Program Plan Schedule

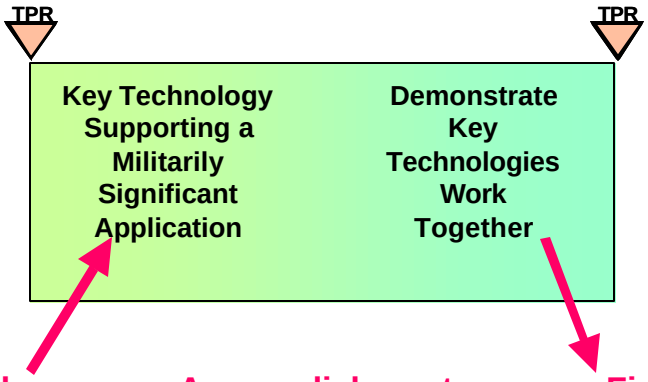
***Exit Criteria Met When*:**

- Key preliminary (draft) performance/technical parameters are identified
- Concept study findings are supported by demonstrated key technology capabilities
- Program Plan adequately outlines remainder of the program through transition
- Technology development program cost estimate is reasonable
- Program Plan Schedule developed and is realistic
- Customer has been briefed on program
- Sponsor agrees to fund technology development program
- Contracting strategy is appropriate for this technology

4.4 DEVELOPMENT PHASE

The Development Phase begins with demonstrated key technology(ies) supporting a concept having a significant military application. This phase integrates the basic key technology components to determine that they will work together. This is accomplished through integration of "ad hoc" hardware in a laboratory "breadboard" setting to validate not only that the technologies work together but also that their performance continues to support the expected concept outcome. During this phase, requirements are further defined and preliminary system engineering begins based on Form, Fit, and Function analysis to include consideration of the "ility" areas. Some examples of "ilities" are: Deployability, Survivability, Reliability, Sustainability, Availability, Maintainability, Safety Human Factors, Supportability, Logistics, Manufacturing, Producibility, Affordability, Interoperability and Environmental. Risk is assessed, a Risk Management Plan is developed, and the Program Plan is updated with increasing levels of detail for all remaining phases.

Development Phase



Begins With

- A Concept Supported by Demonstrated Key Technology(ies)
- Concept and Technology(ies) Provide Significant Military Capabilities

Accomplishments

- Integrates Key Technology Components
- Demonstrates "ad-hoc" Hardware Performance in Laboratory Supports Concept Outcome
- Starts System Engineering Activities

Finishes With

- Component Laboratory Validation Report
- Updated Requirements
- System Engineering Analysis Planned
- Continuing Customer Support
- Updated Program Plan with Increased Detail

Development Phase Considerations/Actions:

1. What organizations should be involved with this phase?
2. What technological 'breadboard' elements need to be integrated in the laboratory?
3. Which components are realistic and which are representative?
4. How will the concept be validated, i.e., by similarity, analysis, simulation or test?
5. Is the validation consistent with potential system applications?
6. What system capabilities have been identified through task analysis and/or timeline studies?
7. How will achievement of concept-enabling levels of performance be demonstrated?
8. What laboratory environment will be used?
9. Who will conduct the validation?
10. Will the customer observe the validation or be briefed on the outcome?
11. Prepare the Component/Breadboard Laboratory Validation Report
12. Prepare an "ilities Analysis Plan
13. What form, fit and function analysis have been performed to assure technology is compatible with customer(s) system(s)?
14. Develop a Risk Management Plan indicating the risk management strategy (including risk planning, assessment, analysis and mitigation) for this program?
15. What is the allocation of system functions to personnel, equipment, software, etc.?
16. What methods have been developed to track hazard identification and analysis?
17. Develop safety requirements that are consistent with the potential utilization of the technology.
18. Develop a Component/Brassboard Relevant Environment Validation Plan
19. What updates are necessary to the technology program funding estimate?
20. What updates are necessary to the program plan?

***Deliverables*:**

Program Plan (Updated) to include:

- Requirements Document (Updated)
- Component/Breadboard Laboratory Validation Report
- Component/Brassboard Relevant Environment Validation Plan
- An "ilities Analysis Plan
- Program funding estimate (Updated)
- Risk Management Plan
- Continuing customer/sponsor support agreement

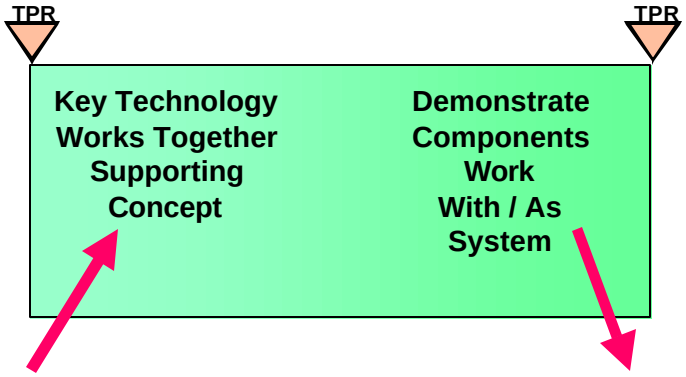
***Exit Criteria Met When*:**

- Validation that the technologies work together
- Technology performance to date continues to support expected concept outcome
- Requirements are further defined based on technology performance to date
- Preliminary system engineering analysis, including “ility” areas consideration, is started and documented
- Preliminary risk assessment completed
- Program Plan update includes increasing levels of detail for all remaining phases
- Sponsor has agreed to continue to fund program
- Customer has been briefed on program status

4.5 DEMONSTRATION PHASE

The Demonstration Phase begins with validated integrated key technology(ies) that continue to support the requirements of a concept with military significance. This phase demonstrates that the technology concept works as a whole with (or as) its intended system. This validation takes place in a relevant simulated environment where the basic technological "brassboard" components are successfully integrated with reasonably realistic supporting elements. Test data collection, analysis, reporting, corrective action, and re-testing as required are performed. During this phase, engineering model/prototype design begins taking into consideration system engineering integration issues and the results from the completed "ility" analysis. Final requirements that fully support the planned concept outcome are documented. In addition, the Program Plan is updated and a Transition Plan is developed with customer input and approval.

Demonstration Phase



Begins With

- Performance of Key Technology Continues to Support Concept Outcome
- Initial System Engineering Analysis

Accomplishments

- Develop High Fidelity Components or Brassboard
- Tests with Other Elements in "HWIL" or Other Relevant Environment
- Develops Transition Plan

Finishes With

- Final Requirements Documented
- Performance Validation Report
- Transition Plan Completed with Customer Concurrence
- Program Plan Updated

Demonstration Phase Considerations/Actions

1. What organizations should be involved with this phase?
2. What, if any, new technologies are introduced in this demonstration?
3. What part of the intended system will be simulated and what part will be reasonably realistic for this demonstration?
4. Which representative, 'ad hoc' components previously utilized have been replaced by realistic components?
5. Will the system-level application be demonstrated? If no, why not?
6. How does this demonstration represent the expected environment?
7. Who will conduct the demonstration and where will it be conducted?
8. Will the customer observe the demonstration or be briefed on the outcome?
9. What analysis has been performed to determine failure modes, effects and criticality issues?
10. Prepare a Component/Brassboard Relevant Environment Validation Report
11. Have the key performance parameters and requirements been updated/finalized?
12. Have all potential risk areas been identified and assessed for program impact?
13. What updates are necessary to the risk management plan?
14. What system maintenance model has been developed to examine alternative configurations, methods and test techniques to minimize downtime and maintenance cost?
15. What methods have been developed to track safety requirements, standards, procedures and certification?
16. What analysis has been performed to identify design criteria, and what are the criteria?
17. What is the manufacturing strategy for this program, and its associated cost?
18. What are the critical technologies and materials needed for manufacturing and production?
19. What is the availability of critical technologies and materials needed for production?
20. Quantify the feasibility of the production for this program.
21. Has a logistics and supportability concept been defined?
22. What updates are necessary to the program plan?
23. What updates are necessary to the technology program funding estimate?
24. Develop a Prototype relevant environment Demonstration Plan.
25. Prepare the transition plan and coordinate with the customer.
26. Does the technology have a planned insertion date?

***Deliverables*:**

Program Plan (Updated) to include:

- Requirements Document (Final)
- Component/Brassboard Relevant Environment Validation Report
- An "ilities" Analysis Report
- Prototype Relevant Environment Demonstration Plan

- Program funding estimate (Updated)
- Risk Management Plan (Updated)
- Transition Plan approved by customer

***Exit Criteria Met When*:**

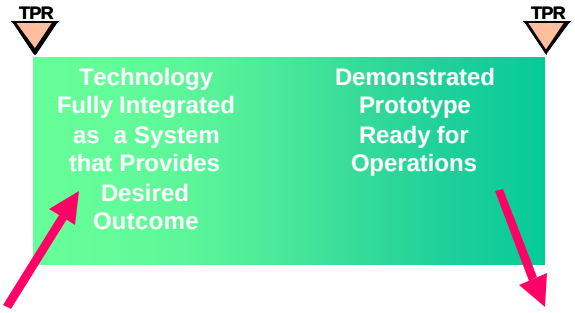
- Technological components successfully integrated with reasonably realistic supporting elements in a relevant simulated environment
- Technology concept demonstrated as a component with its intended system (or as a system itself)
- Engineering model/prototype design takes into consideration integration issues
- An “ilities” analysis completed and results adequately addressed
- Final requirements developed
- Program Plan is updated to reflect results of this phase
- Transition Plan is developed with customer input and approval
- Sponsor has agreed to continue to fund program

4.6 TRANSITION PHASE

The Transition Phase begins with technology components that work as (with) the intended system and support requirements that produce the desired concept outcome. To prepare for transition into the customer system, technology model/prototypes are produced and tested in a relevant environment, or simulated operational environment to validate the system works and all required transition activities are complete. During this phase, transition from design to production begins with manufacturing and producibility issues being addressed. All other "ilities" planning, that supports the transition of the technology into the system, are validated. Customer acceptance and funding is in place and the Transition Plan is updated, as required.

For ACTDs, even though they may never transition to an acquisition program, the TPMM process remains a valid method for planning and executing the technology program/project. There are some differences however, for example, the Technology Readiness Level (TRL) goal of a non-ACTD/ACTD for transition to customer management is TRL 6. Sometimes the ACTD remains under a Technology program/project through TRL 7 and is left behind for a two-year extended user evaluation without a transition to Customer Management. There are even cases where a technology pull could allow a technology program/project to transition as early as TRL 4 or 5.

Transition Phase



Begins With

- Technology Components Working as/with Intended System
- All System Engineering Areas Addressed and Ready for Validation

Accomplishments

- Produces Prototype Hardware
- Conducts Tests in a Relevant or "Operational" Setting
- Validates of All Transition Requirements
- Receives Final Approval of Transition Activities

Finishes With

- Prototype Performance Documented in Validation Report
- All "ilities" Verified and/or Addressed
- Customer Satisfied with Results and Ready for Transition
- Transition Funding in Place

Transition Phase Considerations/Actions

1. What organizations should be involved with this phase?
2. Develop a representative model or prototype.
3. How are the technologies going to be presented in this demonstration?
4. What portions of the demonstration are simulated?
5. How will the demonstration be conducted in a relevant environment, i.e., Hardware-in-the-Loop (HWIL) test bed?
6. What methods have been developed to track reliability growth, qualification, test, and acceptance?
7. What methods have been developed to track failure diagnosis, fault isolation, removal, replacement/repair, retest and verification?
8. Who will conduct the demonstration?
9. Will the customer observe the demonstration or be briefed on the outcome?
10. Prepare a Prototype Relevant Environment Demonstration Report
11. What procedure has been developed to monitor and control sub-contractors and suppliers?
12. How are producibility issues addressed and what are the producibility exit criteria for this phase of the program?
13. How will production readiness be determined for this program?
14. Is there a need for long lead procurement for this program?
15. How are manufacturing issues addressed for this program?
16. What updates are necessary to the program plan?
17. Develop a Transition Memorandum of Agreement (MOA) indicating how the customer will assume responsibility for the system.
18. What updates are necessary to the transition plan?

***Deliverables*:**

Program Plan (Updated) to include:
- Prototype Relevant Environment Demonstration Report
- Program funding estimate (Updated)
- Transition Plan (Updated)
- Transition Memorandum of Agreement (MOA) signed by customer

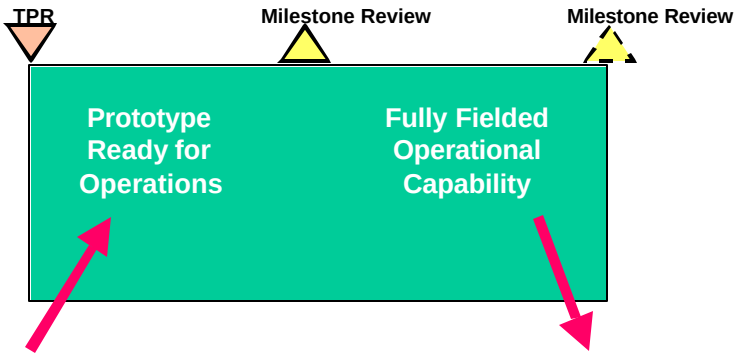
***Exit Criteria Met When*:**

- Technology model/prototype(s) produced and tested in a relevant environment, or simulated operational environment, validating accomplishment of requirements
- Manufacturing and producibility issues are addressed
- All other “ilities planning supporting the transition are validated
- Customer is satisfied that the demonstration is a success and technology is ready for transition
- All required transition activities are complete
- Program plan is updated, as required
- Sponsor has agreed to continue to fund program to transition
- Transition Plan is updated, finalized, and a MOA is agreed to by customer

4.7 CUSTOMER MANAGEMENT

The Customer Management Phase begins with the transfer of the prototype from the TM to a customer such as an Acquisition Program/Project Management Office (PMO) or establishment of its own PMO. The prototype is near or at its planned system operational capability. Demonstration in an operational environment of the system prototype is conducted, most likely in a test bed, to prove the technology will work in its final form under expected conditions. Next, to determine if it meets design specification, the technology is subjected to Developmental Test and Evaluation (DT&E) in its intended weapon system. To determine if the technology can perform as expected under mission conditions DT&E is followed by an Operational Test and Evaluation (OT&E). Upon successful completion of all testing, the technology is incorporated into the designated system. All actions during the Customer Management Phase must comply with the DoD Systems Acquisition Management Model, if applicable.

Customer Management Phase



Begins With

- Transfer of Prototype to Customer
- Prototype near or at Planned System Operational Levels
- All Transition Planning Activities Completed

Accomplishments

- Completes Activities Identified in the DoD 5000 Acquisition Management Regulations

Finishes With

- Technology Fully Incorporated into Designated System and Fielding Activities Accomplished

Customer Management Phase TRL-7 Considerations/Actions

1. How does the prototype adequately represent the actual system?
2. Has the system prototype been demonstrated in a real environment, i.e., ground or flight test?
3. Who will conduct the demonstration?
4. What organizations should be involved with this phase?
5. Is customer funding in place for this effort?

***Exit Criteria 7 Met When*:**

- Program plan is incorporated into customer system program documentation
- Funding for this program has been allocated
- Criteria developed in accordance with Systems Acquisition Management requirements of the DoD 5000 Series

Customer Management Phase TRL-8 Considerations/Actions

1. How will system-engineering analysis be conducted on the system to cover all aspects of integration of the prototype into the system?
2. How is producibility addressed and what are the producibility exit criteria for this phase of the program?
3. Is there a need for production of spares for this program?
4. What alternative materials and processes, if any, have been identified?
5. Where will the production line be established?
6. If a new production line were required, how will it be established?
7. How will the new production line be validated?
8. Are any hazardous or toxic materials used in production, and if yes, what effects will these materials have on the production schedule?
9. How have the design, production and range safety issues been resolved?
10. What are the plans for ‘cut-in’ to system production?
11. Will low rate production be initiated?
12. When will the qualification test be performed?
13. When will a production line unit be flight tested?
14. What plans have been made for the Pre-Planned Product Improvement (P3I) program, if required?
15. How will logistical support functions be evaluated?

***Exit Criteria 8 Met When*:**

- Criteria developed in accordance with Systems Acquisition Management requirements of the DoD 5000 Series

Customer Management Phase TRL-9 Considerations/Actions

1. When will the First Unit Equipped (FUE) be fielded?
2. When will the Pre-Planned Product Improvements (P3I) program be finalized?
3. When will logistical support functions be implemented?
4. When will the system be proven in war games or actual battlefield conditions?

Exit Criteria 9 Met When:

Criteria developed in accordance with Systems Acquisition Management requirements of the DoD 5000 Series

SECTION V. MODEL IMPLEMENTATION

5.1 IMPLEMENTATION STEPS

Implementation of the TPMM is a very flexible process that can be tailored for any Technology Program/Project. Since all programs or projects do not start in the same stage of development, the TM must determine where in the model their Technology Program/Project most appropriately fits. The following are the general steps for implementing the TPMM.

5.1.1 Determine where in the model to start

Although the TPMM is new, the processes and building blocks of the model, which are consistent with the DoD acquisition processes and policies, are not. The TPMM Phase descriptions and corresponding TRLs provide a logical grouping of time phased activities and milestones that must be accomplished for successful development and transition of a technology to the customer.

These same TRLs and Phase descriptions, along with Exit Criteria, provide the basis for determining what phase to enter the model. First, the Technology Manager determines what TRL the Technology Program/Project has achieved by reviewing the phase descriptions and Exit Criteria of all of the phases starting with the Discovery phase. When all of the criteria for a given phase have been met and can be validated with experimental or analytical information, the review continues on to the next phase and so on until a phase is reached where all of the criteria have not yet been met.

Second, the Technology Manager then plans to enter the model at the beginning of the phase where all of the criteria have not yet been met. As an example, if all of the criteria for both the Discovery and Formulation phases have been met but not for the Exploration phase then the TM would plan to enter the model at the Exploration phase. Actual entry into the TPMM starts with *a* Technology Process Review (TPR) that would have occurred at the end of the previous phase where the Technology Manager feels all of the criteria have been met. In our example, this would be at the end of the Formulation phase. The TPR serves to validate that all of the requirements of the previous phase (Formulation phase in our example) have been successfully met and that planning and funding for the next phase (Exploration phase in our example), the phase being entered, is complete and satisfactory.

Once the TPR has given approval, the TM would begin work to accomplish all of the appropriate requirements of the phase entered and continue to follow the model through transition to the customer.

When a program has multiple sub-technologies, the TM has to determine not only the TRL of each separate technology but also the overall program TRL. Each of these sub-technologies are assessed using the previously described method for determining

the TRL. The overall program Technology Readiness Level will be the same as that sub-technology that has been rated with the lowest TRL. For example, a Program consisting of three sub-technologies, two at TRL 3 and one at TRL 2, will have a overall program TRL of 2 because it is the lowest TRL within the program.

5.1.2 Determine what activities need to be planned and accomplished

Planning is a continuous activity throughout the model, taking into consideration the needs and requirements of subsequent phases. If the Technology Program/Project is entering the early stages of the model (Discovery, Formulation) planning for only the next phase is required. However, programs/projects entering in later phases (Exploration, Development) must plan for all activities required through transition to Customer Management of the technology. Proper planning helps to identify more accurately the funding necessary to accomplish requirements. Planning is also important in preparing for TPRs. The TPR Decision Authority must be convinced that there is a plan for the next phase and resources are available to execute that plan.

After selection and TPR approval of the entry phase, the Technology Manager determines what activities need to be planned and accomplished. Start by reviewing the description and Exit Criteria of the proposed entry phase and the remaining phases of the model to determine how the Technology Readiness Levels should be tailored for this technology. Develop a Technology Maturity Matrix similar to the LADAR Example, (located in Figure 5.1) showing the specific tailored criteria to meet each of the Technology Readiness Levels along with how that tailored criteria will be validated.

Next, use sound system engineering principles, the Technology Maturity Matrix, the phase Considerations/Actions, and the Major Activities/Phase Matrix (located in Figure 5.2) as a guide to determine what activities are required in each phase. Careful consideration of the above steps will provide the Technology Manager with a comprehensive list of activities to plan and schedule. Remember, the TPMM is a flexible process, which is tailored for each Technology Program/Project.

5.1.3 Document the accomplishments and the planning

After the selection of the entry point, determination of activities, and planning for their execution, the Technology Manager documents the program/project accomplishments and plans. First, review the Deliverables required for the phase in which the program/project enters the model. This review will identify the documents required to provide adequate information for the Decision Authority during the TPR. Upon initial entry into the model, some of the existing documentation may not be an exact match by name, but the content will provide much of the needed information. Second, review the documentation guidelines in Section VI and the formats located in the Appendices of this guidebook. Finally, develop the Technology Program/Project documentation based on the guidelines and formats. The primary objectives of this

documentation are to assist the TM in planning, scheduling and executing their programs; and for distribution to the TPR Decision Authority prior to a TPR.

The primary planning document for the TPMM is the Program Plan (Appendix E). It contains all of the important elements of what is necessary to accomplish successful development and transition of the technology to the customer. The Program Plan is developed during the Exploration Phase and refined in each of the subsequent phases. The Program Plan Schedule is developed in conjunction with the Program Plan and provides the Technology Manager with an excellent tool for tracking progress on the Technology Program/Project. The TPR Decision Authority also relies on the Program Plan Schedule for reviewing the status of a program/project.

5.1.4 Review

As indicated above, entry into the TPMM starts with a Technology Process Review. The TPR serves to validate that all of the requirements of the previous phase have been met. Technology Programs/Projects must show continuous progress towards completion of a successful transition to the customer. This progress is reported to the TPR Decision Authority at the end of each phase.

The documentation required in each phase is used to provide information concerning the completion of the Exit Criteria for that phase. These Exit Criteria provide a means for measurement by the TPR Decision Authority in determining actual progress versus planned and what action should be taken. Section VII and Appendix F contain information on how to prepare for Technology Process Reviews.

5.1.5 Execute

Upon receiving approval of the TPR to enter the model, as described in par 5.1.1 above, the Technology Manager would start to accomplish all of the appropriate requirements of the phase entered and continue to follow the model through transition to the customer. Details for the technical execution of Technology Programs/ Projects are beyond the scope and intent of this Guidebook. However, there are numerous documents available on the actual execution of a program. Also, there is a wealth of expertise and knowledge resident within the Space and Missile Defense Technology Center upon which the Technology Manager can rely.

5.1.6 Update the Plan

The Technology Manager updates and refines the appropriate Technology Program/Project documentation toward the completion of each phase. This is based on results of tests and evaluations, analytical studies, and other accomplishments. Next, the Technology Manager determines what activities need to be planned and accomplished during the next phase of the TPMM. The appropriate plan needed for the next phase is then developed. As an example, the “Proof of Concept Plan,” needed for the Exploration phase, would be developed before completion of the formulation phase.

The primary planning document, the Program Plan, once it is developed in the Exploration phase, is updated during all remaining phases. All TPMM plans are reviewed and approved at the appropriate TPR.

TRL	Criteria	Tailored LADAR Criteria	Validation
9	Actual system, mission proven	Flight test against C2 + threats	Fly production unit against C2 + threats
8	Actual system, mission qualified	First production unit flight test	Fly production unit LADAR in actual interceptor in a C2 demo
7	System prototype demo, hi-fi environment	Development test flight unit integratable in interceptor	Flight test in space environment
6	System/subsystem prototype demonstration in relevant environment	Develop prototype with required performance and weight traceability	Test prototype on ground or in airborne demonstrations
5	Subsystem/module validation in relevant environment	Develop and test complete brassboard in simulated environment	Conduct high fidelity field experiments
4	Subsystem/module validation in lab environment	Validate performance of partial breadboard	Conduct hardware feasibility tests at AMOR or in field
3	Analytic/experimental proof of concept	Validate performance of all components of conceptual design	Conduct laboratory experiments validating component performance
2	Technology concept, synthetic data	Develop requirements for LADAR using a system flow down process	Develop LADAR conceptual design
1	Basic principles, concepts	Conduct literature search on	Develop LADAR utility

Figure 5-1. Technology Maturity Matrix LADAR Example

		Technology Program Phase						
	Activities	**Discovery**	**Formulation**	**Exploration**	**Development**	**Demonstration**	**Transition**	**Customer Management**
A	**Concept Formulation/ Requirements Evolution**							
	1 Basic Principles/properties defined	X	X					
	2 Military Utility Analysis		X	X	X	X	X	X
	3 Concept Definition		X	X	X			
	4 Key Performance Parameters			X	X	X	X	X
	5 Performance Thresholds/Objectives				X	X	X	X
	6 Customer System Requirements Considerations			X	X	X	X	X
B	**Program Planning and Risk Management**							
	1 Program Plan (Cost, Schedule, Performance)			X	X	X	X	X
	2 Risk Assessment and Risk Management Plan				X	X	X	X
	3 Budgeting and Funds Management	X	X	X	X	X	X	X
	4 Reviews and Assessments	X	X	X	X	X	X	X
	5 Contract Management		X	X	X	X	X	X
	6 Transition/Fielding Considerations				X	X	X	X
	7 Project/System Cost Estimations			X	X	X	X	X
	8 Customer Involvement			X	X	X	X	X
C	**System Engineering Process**							
	1 System Design and Affordability		X	X	X	X	X	X
	2 Software Engineering			X	X	X	X	X
	3 Reliability, Availability, & Maintainability				X	X	X	X
	4 Manufacturing and Production					X	X	X
	5 Interoperability				X	X	X	X
	6 Logistics				X	X	X	X
	7 Human Systems Integration				X	X	X	X
	8 Environmental, Safety, and Health				X	X	X	X
	9 Transition Considerations			X	X	X	X	X
D	**Test and Evaluation**							
	1 Analytical and Simulation Tools (Planning and Acquisition)		X	X	X	X	X	X
	2 Planning		X	X	X	X	X	X
	3 Conduct/Perform Analyses and Simulation		X	X	X	X	X	X
	4 Perform Hardware, Software, & System Testing			X	X	X	X	X
	5 Assess/Report Performance			X	X	X	X	X

Figure 5.2 Major Activities/Phase Matrix

SECTION VI. DOCUMENTATION GUIDELINES

This Guidebook provides the TM with a step-by-step process to move a technology through the various phases of development with the ultimate objective being to transition the Technology Program/Project into an acquisition program. There are many deliverables along the way. These deliverables, primarily in the form of documentation, are required not only for the effective management of the technology development effort but also to support the STO, ATD, and ACTD nomination process and to provide the basis for documentation required as the technology transitions into the formal acquisition process.

The following are some guidelines for consideration in the development of documentation to support the Technology Program/Project as it moves through the TPMM.

- The documentation should be tailored and streamlined for the individual Technology Program/Project.
- The documentation must still provide the needed information to make informed decisions.
- The documentation details should “grow” as the technology progresses from idea to a prototype ready for the customer. In other words, concentrate on documenting the information known at the time; in the Formulation Phase this may be a small amount but increases as the technology moves towards the Transition Phase.
- The documentation must provide the “proof” - Results, Requirements, Risks, and Plans - at every review to support entry in to next phase.

The principal tenet of the TPMM philosophy is to maintain a flexible approach to the technology development process and to avoid excessive rigidity and formality in the documentation and review process. Hence, it is intended that the principal management tool for the TPMM, the Program Plan, (see appendix E) be an executive-level document written in informal language (preferably less than 25 pages). Detailed documentation, as needed, for a phase of the effort will be provided as Annexes to the Program Plan. The TM will generally draft the Plan in coordination with the customer and other participants. The Program Plan is a plan; it is not intended to be immutable as modifications may be warranted from time to time. However, all substantive (i.e., schedule, funding, content, objectives) changes require approval by the TPR Decision Authority.

The principal management tool for the ACTD is the ACTD Management Plan. The guidelines for developing the ACTD Management Plan are provided in the Acquisition Deskbook (www.deskbook.osd.mil). The ACTD Management Plan provides a top-level description of the demonstration with sufficient detail of the vital objectives, approach, critical events, participants, schedule, and funding. The ACTD Management Plan will generally be drafted jointly by the primary acquisition and user organizations for the ACTD, with assistance from other participants. The ACTD Management Plan is evolutionary and is expected to reflect any significant changes, such as in objectives, approach, or critical events.

The primary objective of the documentation is to ensure that the TM has all of the information necessary to successfully execute the program and that it is also available for the Technology Process Reviews. The goal of supporting an informed decision process is much more important than the format of the documentation. Figure 6-1 provides a matrix of documentation by TPMM Phase. An additional objective of this documentation is to provide the "starter set" of documentation for transition to a future acquisition Program/Project Manager (PM) that is consistent with current acquisition policy and processes.

Good documentation provides information that can be used to quickly answer inquiries or other requirements from customers, sponsors, DOD, and Congress, etc. Generally, having the answers to the following ten questions, will provide a ready reference to respond to such inquiries:

Ten Questions for Technology Programs

1. What is the problem?
2. What are the barriers to solving this problem?
3. How will you overcome those barriers?
4. What is the capability you are developing and where is it described?
5. What is the product of this STO?
6. How will success be measured? (Quantitative Metric)
7. What is the Warfighter Payoff?
8. What are the key Transition Milestones?
9. What endorsements have been received?
10. How are you leveraging Non-Army Funding?

Phase	*Discovery*	*Formulation*	*Exploration*	*Development*	*Demonstration*	*Transition*	*PMO*
Technology Readiness Level Achieved During Phase	**1 & 2**	**1 & 2**	**3**	**4**	**5**	**6**	**7, 8 & 9**
Technology Program Management Model Documentation							
White Paper	X						
Concept Formulation Plan	X						
Concept Formulation Analysis Report		X					
Proof of Concept Plan		X					
Program Plan			X	U	U		
Requirements			X	U	U		
Reports and Assessments							
Reports							
Proof of Concept Analysis Report			X				
Component / Breadboard Laboratory Validation Report				X			
Component / Brassboard Relevant Environment Validation Report					X		
Prototype Relevant Environment Demonstration Report						X	
Assessments							
illities Assessment					X		
Plans							
Component / Breadboard Laboratory Validation Plan			X				
Component / Brassboard Relevant Environment Validation Plan				X			
Prototype Relevant Environment Demonstration Plan					X		
illities Analysis Plan				X			
Contracting Information							
Statement of Work for each Phase			X	X	X	X	
Work Breakdown Structure for Each Phase			X	X	X	X	
Contracting / Acquisition Strategy			X	X	X	X	
Funding			X	U	U	U	
Risk Management							
Risk Management Plan				X	U		
Transition							
Customer / Support Briefing and Support Agreement			X	U	U	U	
Transition Plan					X	U	
Transition Memorandum of Agreement (MOA)						X	
Other Considerations							
Technology Process Review Information	X	U	U	U	U	U	

X - Initial
U - Update

Figure 6-1. Documentation by Phase Matrix

SECTION VII. TECHNOLOGY PROCESS REVIEWS

The technology process review (TPR) not only review a technology programs ability to meet the customers needs and fiscal soundness, but it also provides guidance and assistance to help ensure success of the program. A TPR will be conducted at the end of each phase.

The TPR Decision Authority has the option to continue the project or program in its current phase, modify the project or program, terminate the project or program, or proceed into the next phase. The size, composition, and level of the TPR Decision Authority are dependent on the complexity of the technology, the TPMM Phase, and the level of funding involved in the effort. To ensure customer involvement throughout the entire process, the customer should be a sitting member of the TPR. The TPR Decision Authority shall promote flexible, tailored approaches to oversight and review based on mutual trust and a program's dollar value, risk, and complexity.

The objectives of the Technology Process Review (TPR) are to:

- Ensure that the SMDTC is pursuing the most practicable technology path to correct an operational deficiency, or respond to a threat, with full appreciation of limited resources
- Ensure sound tailoring of the technology management strategy to meet the specific needs of the individual program
- Emphasize early life cycle planning for the successful transition of the technology to the customer
- Review the results of technology evaluations pertaining to the assessment of the programs progress towards achieving effectiveness, suitability, and survivability requirements for the technology phase for which the review is held
- Ensure Risks are considered
- Ensure adequate funding is identified for the next phase
- Provide the Decision Authority accurate and timely program information to enable firm decisions and clear guidance

In support of these objectives the membership of the TPR must have the necessary information to assist them to in reviewing the need, progress, risks, and future plans for the technology. The typical questions to be addressed during a TPR may consist of the following:

- What is the technology?
- What need does it address?
- Who is the customer?
- What are the required capabilities to meet the need in a significant way?
- What capabilities have been demonstrated?
- What are the risks?
- What is the plan (including cost and schedule) for the rest of the effort?

- What are the exit criteria for the next phase?
- What funding is allocated?
- Are there any unfunded requirements?

Examples of TPR information and outlines are provided in Appendix F.

The TPR Decision Authority may hold other reviews to adjust plans, review progress, or determine how best to proceed toward a favorable transition to the customer. The purpose of an interim progress review is to confirm that the program is progressing within the phase as planned or to adjust the program due to changes in requirements/funding. If the adjustment involves changing the technology management strategy, the TPR Decision Authority must approve the change. There is no required information necessary for interim progress reviews other than the information specifically requested by the TPR Decision Authority.

SECTION VIII. SUMMARY

The purpose of the TPMM is to provide a logical methodology to guide TM's through the planning and documentation of their programs. The TPMM standardizes planning, documentation, and review of Technology Programs/Projects. It provides a vision for the transition of technologies to a customer, Program Manager, or as an Acquisition Program. The TPMM also assists TM's in determining military utility early in the process, which helps in identifying potential users and customers who are then involved throughout the entire process.

The purpose of this Guidebook is to provide a source of information that the TM should find useful in developing, structuring, and documenting their program. However, this Guidebook alone does not provide the TM with a definitive management strategy for his/her program. Well informed, educated, and innovative applications and judgments concerning the particular technology are necessary to structure a successful management plan. TM's should continue to seek guidance, data, and assistance from available sources as they prepare and revise their Technology Program Plan.

The TPMM establishes a general approach for managing Technology Programs/Projects while acknowledging that every Technology Program/Project is unique. The TPMM process benefits the Space and Missile Defense Technology Center and the individual TM because of the potential to:

- Strengthen Technology Program/Project justification to increase customer acceptance and funding support
- Facilitate review and prioritization among Technology Programs/Projects in a constrained resource environment
- Improve the documentation process to support the STO / ATD / ACTD Nomination Process or Transition to an Acquisition Program
- Support better program execution through detailed management planning with emphasis on Cost, Schedule, and Performance Goals
- Improve Technology Development Process Efficiency (Less Time/Resources) and Effectiveness (High Technology Transfer Ratio)

APPENDIX A. WHITE PAPER

The White Paper is developed during the Discovery Phase after conducting a literature search. The paper describes the effort, the basic principles/properties involved, and identifies the known or perceived need/application along with potential customers(s)/sponsor(s). The white paper is a key reference for development of the Program Plan during the Exploration Phase. The following are questions that should be answered prior to preparing the White Paper.

- What is the Problem?
- What are the barriers to solving this problem?
  - Identify key technical and manufacturing barriers to success
- How will you overcome those barriers?
- What is the capability you are developing and where is it described?
  - Army Vision, Investment Guidance, Mission Needs Statement, etc. .
- What are the basic principles/properties involved?
- What is the product of this Technology Program / Project?
- Quantitative Metrics:
  - Current achievable capability: start TRL,
  - Minimum acceptable capability: end TRL
- What is the Warfighter Payoff?
- Endorsements?
- How are you leveraging non-Army funding?

Format

1. Title
2. Description
3. Objective
4. Need, Significance, and Opportunities
5. Potential Customer/Sponsorship/Endorsement
6. Technology Capability Requirements
7. Technology System Engineering Approach
8. Relationship to Other Service or Agency Related Programs
9. Funding Requirement
10. Other Considerations

APPENDIX B. CONCEPT FORMULATION PLAN

1. Brief description of the technology and the potential military needs/benefits

2. Description of Concept Formulation Process
   a. Identify how the potential concepts will be defined for the technology and how the associated practical military application will be determined.
   b. Identify the approach for identifying key technologies for this program.

3. Description of Analysis and Evaluation of Feasible Alternatives Plan
   a. Describe the plan for how the analysis will be accomplished
   b. Describe the conceptual formulation studies that will be considered and analyzed.
   c. Describe the analytical tools that will be used for the assessment
   d. Describe the key performance parameters and other criteria that will be used to select the preferred concept.
   e. Approach to determine the Technology Difficulty Index
   f. Discuss how the military benefits and performance potential will be determined
   g. Process to identify specific customer(s)/sponsor(s)

4. Other Factors
   a. Identify costs for concept formulation/definition
   b. Present schedule for concept formulation effort
   c. Identify organizations that should be participating

APPENDIX C. CONCEPT FORMULATION ANALYSIS REPORT

1. Brief description of the technology and the potential military needs/benefits

2. Description of Concept Formulation Effort
   a. Identify potential concepts that were defined for the technology and the associated practical military application.
   b. Identify the key technologies resulting from the concept formulation

3. Description of analysis and evaluation of feasible alternatives results
   a. Describe the concepts and feasible alternatives that were considered
   b. Describe the results of the analysis
   c. Describe the conceptual formulation studies that were conducted
   d. Describe the analytical tools that were used for the assessment
   e. Describe the key performance parameters and other criteria and their values that were used to select the preferred concept (s)
   f. The Technology Difficulty Index for The Preferred Concepts
   g. Describe the military benefits and performance potential for the preferred concept (s)
   h. Describe the potential customer(s)/sponsor(s)

4. Other Factors
   a. Identify costs for the next phase
   b. Present schedule for the next phase
   c. Identify organizations participating in the next phase

5. Recommended Best Feasible Concepts

APPENDIX D. PROOF OF CONCEPT PLAN

1. Summary of the technology/system concept

2. Summary Description of Alternatives To Be Considered
   a. Describe how the alternate concepts will be defined and concepts already known
   b. Describe the analytical tools that will be used for the assessment.
   c. Describe the key performance parameters and other criteria that will be used to select the preferred concept.

3. Analysis Plan
   a. Describe the plan for how the analysis will be accomplished
   b. Describe the conceptual design tradeoff studies that will be considered and analyzed.
   c. Describe how the results of the analyses and tradeoffs will be used to determine the most promising candidate concepts/designs in terms of Key Performance Parameters (KPPs), technology verification requirements for future phases, cost, schedule, and risk.
   d. Discuss how the sensitivities from tradeoffs that require tightening or loosening of design/performance requirements will be accomplished,

4. Descriptions of how the preferred alternatives would be presented/defined and the process for finalizing the design/technology concept and determining the technology verification requirements for future phases. Discuss how cost, producibility, and supportability will be addressed.

5. Describe how the assessment of risk and plan for managing risks will be accomplished.

6. Other Factors
   a. Identify costs for accomplishing the proof of concept
   b. Present schedule for proof of concept effort
   c. Identify organizations participating

APPENDIX E. PROGRAM PLAN

The principal management tool for the Technology Program Management Model (TPMM) is the Technology Program Plan, the guidelines for which are given below. The TM should draw on information from previous documentation, ie. White Paper as a starting point for developing the Program Plan. A tenet of the TPMM philosophy is to maintain a flexible approach to the technology development process and to avoid excessive rigidity and formality in documentation and process. Hence, it is intended that this Plan be an executive-level document (preferably less than 25 pages), written in non-technical language. Detailed documentation, as needed, for a phase of the effort will be provided as an Annex to the Plan. The TM will generally draft the Plan in coordination with the customer and other participants. The Technology Program Plan is a plan; it is not intended to be immutable, as modifications may be warranted from time to time. However, all substantive (i.e., schedule, funding, content, objectives) changes require approval at the Technology Process Review.

1. Title: Proposed program title. Provide also the existing or proposed nomination Science and Technology Objective (STO) number, if applicable.

2. Description:

a. A short easily understood executive summary of the program. Avoid acronyms and technical jargon. Use clear English.

b. Quad Chart: A summary of information in a quad-chart format with each quadrant showing (clockwise from upper left-hand corner): (1) objective and justification including customer/Program Manager (PM) support, (2) proposed concept (picture or diagram), (3) approach and applications, and (4) program schedule and funding. A format is not provided in this guidebook. However the TM should check with the JCTI for the latest format required for the QSR.

c. Concept Diagram: A Color concept diagram or photo to represent the program in viewgraph form.

3. Objective:

a. Purpose and Goal: A concise statement of the program's overall purpose and goal including the operational context.

b. Technical Concept: A short description of the technologies to be demonstrated.

c. Demonstration Concept: A short description of the planned environment for the validation of the technologies proposed.

4. Need, Significance, and Opportunities:

a. Military Need: A short description of the future capabilities required and addressed by the program. Indicate the materiel deficiencies, operational deficiencies, or the threats that are addressed by the program.

b. Military Significance: Provide a short description of the operational payoffs based on the results of Military Utility Analysis. This includes descriptions of the improvements to an existing capability, and/or the new operational capability, and the implications related to affordability, cost, maintainability, and sustainability. Specifically, address the beneficial impact this will have on the military user, i.e. will it afford more time to react, be easier to use, provide greater safety or protect or, reduce costs, etc? Include any other relevant points.

c. Logistics Implications: Indicate the program's logistics impacts on manpower, maintenance, supply, transportation, training, facilities and other logistics system concepts and doctrine.

d. Horizontal Technology Integration (HTI) Opportunities: Identify HTI opportunities. HTI is the common application of standardized components and subsystems across multiple systems to minimize support burdens, reduce life cycle cost, and increase total force effectiveness.

5. Customer/Sponsorship/Endorsement: Identify the customer(s), sponsor(s) and/or the endorsing organization(s). Outline the support/interest of these groups and the PM to whom the technology might transition. When appropriate, include a concurrence sheet showing the name (minimum O-6 level), organization, office symbol, telephone and fax numbers, and electronic mailing address of the interested/supporting organizations.

6. Technology Capability Requirements: Summarize the identified performance parameters (capabilities and characteristics) required. Operational performance parameters include performance in an operational environment. Articulate requirements in operational, output-oriented, and measurable terms. Specify each performance parameter in terms of a minimum acceptable value (threshold) required to satisfy the capability need. Objectives, if stated, should represent a measurable, beneficial increase in capability or operations and support above the threshold. Give rationale separately for every requirement and include that in the body immediately following the requirement it supports (e.g., “The XYZ requires X. Rationale: The XYZ must be able to operate ...”). If objectives are stated, provide rationale that justifies the objective as well as the threshold. State the rationale in operational language providing a credible audit trail explaining the operational significance of each requirement. The rationale should not refer to Army regulations, military standards, or military specifications. (Provide a detailed Requirements Document as Annex A)

7. Technology System Engineering Approach:

a. Technology Maturity: Describe the maturity of key technologies and components (use Technology Readiness Level descriptions). Identify the improvements needed before the program can transition to the customer. Identify and describe the Technology Difficulty Index rating that applies to the program and addresses risks as part of the Risk Management Plan. (Provide details of technology readiness level assessment in Annex B)

b. Provide summary of how a sound system engineering approach will be used to accomplish the technology maturity needed and to fully support the translation of the needs and requirements into an operationally suitable system. The operationally suitable system should fulfill all the requirements to smoothly transition into the customer's system. The approach should consist of a top-down, iterative process of requirements analysis, functional analysis and allocation, design synthesis and verification, and analysis and control. In a summary narrative, describe the process for transforming needs and requirements into an integrated design solution through concurrent consideration of all life-cycle needs to include: development, manufacturing, test and evaluation, deployment, operations, support, and training. The approach should address the scope of the technical effort required to develop the technology(ies) by answering the basic questions of "who will do what" and "when (Provide details of plans in Annex C)

c. Briefly describe how the planned technology system engineering approach will include the coordination with related activities such as; verification testing, integrated logistics support planning, design producibility, and interoperability issues. (Provide details of analysis or plans in Annex C)

8. Technology Program Execution:

a. Acquisition Plan: Describe the acquisition plan that will guide program execution from initiation through transition. The acquisition plan should evolve through an iterative process and become increasingly more definitive in describing the relationship of the essential elements of a program. A primary goal of the plan is to minimize the time and cost it takes, consistent with common sense and sound business practices, to satisfy identified, validated needs for technologies, products, and services, and to maximize affordability throughout a program's useful life cycle. The acquisition plan should provide a complete picture of the program, to include system engineering and contracting actions, for the decision-makers who will be asked to coordinate on or approve the program. Ensure the plan is in sufficient detail to identify, address, describe, summarize, or otherwise document specific, major aspects or issues of the program or strategy. (Provide an outline of contract information Annex D)

b. Proposed Program Schedule by Fiscal Year (FY) with Major Milestones: Show all major activities and milestones/time lines in a tabular or Gantt chart format, including proposed TRADOC or Battle Lab experiment(s), accurate to within a quarter of a FY. (Provide in graphic form as part of this section)

c. Funding Required: Show funding required by FY, by Program Element (PE)/ Project. Identify any shortfalls and approaches to resolution of shortfalls. (Provide summary cost funding line as part of program schedule graphic in this section. Provide summary details of funding analysis and estimate in Annex E)

d. Integrated Product and Process Development (IPPD) Plan: Describe the plan for implementing the IPPD process, the elements of that process, and the plan for including IPPD in the contracting statement of work. IPPD shall be employed to the maximum extent practicable. IPPD considers and integrates program activities throughout the entire program life cycle, including systems management, development, manufacturing, testing, deployment, operations, support, training, and eventual disposal. Using IPPD, multi-disciplined Integrated Product Teams (IPTs) should simultaneously optimize the product, product manufacturing, and supportability to meet system cost and performance objectives.

e. Principal Performers and Roles: Identify the points of contact (POCs), e.g., Technology Program Manager, Battle Labs (BL) or Director of Combat Developments (DCD), and other participants as appropriate by name, organization, office symbol, telephone, and fax numbers, and electronic mailing address. List also the Government, and academic groups who will perform the program support functions. When the effort is dependent on products developed outside of the direct management of the Technology Program Manager, attach an appendix identifying the individuals, and their organizations responsible for the delivery of these products.

f. Leveraging: Identify and describe the technology and/or resources external from the Army used in this program from the other services, DoD and non-DoD agencies, universities, non-profit organizations, federal labs, U.S. industry, and foreign sources. Describe any dependencies (specific deliverables, needed performance levels, and delivery dates) on programs (Army or not) external to the effort.

g. Risk Management and Mitigation: (Provide detail Risk Management Plan in Annex F)

(1) Program Execution Risk. Provide a narrative summary of the risks and a risk mitigation approach for each of the following: technical, performance, cost (are funds adequate considering the risk identified), and schedule.
(2) Acquisition Program Risk Identify any transition risks for the technology developed by the program.
(3) Cost Risk. Assess affordability and manufacturability risks.
(4) Risk Mitigation Plan. Provide summary details of the risk mitigation effort.

9. Transition Plan: Describe in general terms the actions required to transition the technology to the customer. The primary TM's will generally draft the Transition Plan, with assistance and in coordination with the customer and other participants. List

windows of opportunity to transition the technology (components, subsystems, and software) into new or existing systems, as well as outlining the interest and support of the combat developer and the PM(s) for the technology. If HTI opportunities were identified in paragraph 4.4, describe the efforts to aid in planning HTI transition or designation. (Provide details of transition planning in Annex G)

a. Joint Technical Architecture - Army: Address the relationship between the technology and the Joint Technical Architecture - Army.

b. Potential Acquisition Program Manager: Identify the potential Acquisition System/Program Manager(s) that may transition the technology (viz., to whom will the successfully demonstrated technology transition for implementation?).

c. Contracting/Acquisition Strategy: Address the contracting/acquisition strategy for the transition of the technology in to the acquisition program.

d. PMO Concurrence: When appropriate, include a concurrence sheet showing the name (minimum O-6 level), organization, office symbol, telephone and fax numbers, and electronic mailing address of the Program Manager to whom the technology will transition.

10. Relationship to Other Service or Agency Related Programs: Identify the technology's relationship to any other service/DARPA/national Labs/OSD programs that appear to be related to the effort or that have developed relevant "seed" technology. Address any program relationships that could be perceived as duplication or complementary.

11. Other Considerations: Address other issues not included above but considered important. (If needed provide details or plans in Annex H)

a. Simulation Support Plan (SSP) Summary: If the program includes significant simulations/simulator support as part of the execution plan, then a SSP must be developed.

ANNEXES:

A. Requirements

B. Reports and Assessments
   1. Reports
      a. Proof of concept analysis report (Proof of TRL 3)
      b. Component / Breadboard laboratory validation Report (Proof of TRL 4)
      c. Component / Brassboard relevant environment validation report (Proof of TRL 5)
      d. Prototype relevant environment demonstration report (Proof of TRL 6)
   2. Assessments

C. Plans
   1. Component / Breadboard laboratory validation plan
   2. Component / Brassboard relevant environment Validation plan
   3. Prototype relevant environment demonstration plan
   4. “ilities” analysis plan

D. Contracting information
   1. Statement of Work of each Phase
   2. Work Breakdown Structure for Each Phase
   3. Contract / Acquisition Strategy

E. Funding

F. Risk Management
   1. Risk Management Plan

G. Transition
   1. Customer / Support Briefing and Support Agreement
   2. Transition Plan
   3. Transition Memorandum of Agreement (MOA)

H. Other Considerations

Annex A: Requirements

Requirements Document (Draft / Updates / Final)

All versions will be coordinated with the Customer/User and reflect their requirements.

1. General Description of Required Technology.
   a. Summarize the technology need
   b. Describe what warfighting mission areas and/or existing defense systems will benefit from the technology program
   c. Describe the proposed concept for the technology
   d. Describe the analysis that supports the technology concept and benefits
   e. Define the functions that the proposed system will be tasked to accomplish
   f. Operations, support, and "ilities considerations/requirements
   g. Describe any plans for evolutionary technology growth and when a certain level is needed

2. Threat. Summarize the threat to be countered and projected threat environment.

3. Shortcomings of Existing Systems and Technologies. Describe why existing technologies and operational systems cannot meet current or projected requirements.

4. Capabilities required.
   a. General Guidelines for developing the table of required capabilities:
      (1) Identify the operational performance parameters (capabilities and characteristics) required for the proposed system
      (2) State the requirements in measurable terms. Use Threshold/Objective format, and provide criteria and rationale for each requirement
      (3) Timing of requirements should specify the time-based nature of the need and the events that are driving that need
   b. Table of Key Performance Parameters (KPPs). Develop the threshold and objective KPP goals for the technology program and include a table summarizing them

Table xxx KPPs for: Title of Technology Program

Key Performance Parameter	Threshold Values	Objective Values

c. “ilities.

(1) Identify combat support requirements to include possible interfacing systems, interoperability requirements, standardization, and support equipment

(2) Identify other System Characteristics: Including design, cost and risk drivers

5. Schedule. Define what actions, when complete, will constitute attainment of initial and final technology requirements.

6. Program Affordability. Cost constraints and affordability should be considered early in the technology program.

Annex B: Reports and Assessments

B-1. Reports

B-1-a. Proof of Concept Analysis Report (Proof of TRL 3)

1. Summary of the technology/system concept
2. Summary Description of Alternatives Considered - describe the alternate concepts and conceptual design tradeoff studies that were considered and analyzed.
3. Describe the analytical tools used for the assessment.
4. Analysis Results - present the results of analysis for the promising candidate concepts/designs in terms of KPPs, technology verification requirements for future phases, cost, schedule, and risk. Include sensitivities from tradeoffs that require tightening or loosening of design/performance requirements.
5. Descriptions of Preferred Alternatives and process for finalizing the design/technology concept and determining the technology verification requirements for future phases.
6. Assessment of risk and plan for managing risks
7. Draft Specification Tree, ICD Scope Sheets, and Program Work Breakdown Structure for Development Phase

B-1-b. Component / Breadboard Laboratory Validation Report (Proof of TRL 4)

B-1-c. Component / Brassboard Relevant Environment Validation Report (Proof of TRL 5)

B-1-d. Prototype Relevant Environment Demonstration Report (Proof of TRL 6)

These report outlines will be the same, but will differ in the particular details of the breadboard/prototype and the extent of the test environment during the testing.

Validation/Demonstration Report for _____

1. Introduction
   a. Purpose
      1). Objectives
      2). Scope
      3). Summary of Results
         (a) Objectives/KPP Results
         (b) Conclusions
         (c) Recommendations
      4). System Description (Objective System, Test System, and System Concept)
         (a) Objective System/Technology Description
         (b) Key Features and Subsystems of Brassboard/Prototype
   b. System Concept

2. Description of Threat or Future Operational Capability

3. Test Setup. (Laboratory/Field Configuration and set-up procedures at Test Facility)
   a. Item(s) Tested/System Set-up
   b. Hardware Tested/Set-up
   c. Algorithms/Software Tested/Set-up
   d. Threat Representation
   e. Environment
   f. Instrumentation
   g. Special Test Equipment
   h. External Systems Participating
   i. Organizations Participating

4. Test Conduct
   a. Test Location(s)
   b. System checkout
   c. Anomalies/Deviations from Test Plan
   d. Discussion for Each Test/Subtest
   e. Date(s)
   f. Configuration Description
   g. Subtest Objectives
   h. Test and Evaluation Events
   i. Scope of Analyses, Simulations and Tests
   j. Basic Scenarios
   k. Test Environment
   l. Operational Considerations
   m. Limitations

5. Technical Assessment/Results (Summary and for Each Subtest)
   (Subtests are subdivided by Objectives, Criteria, Test Procedure, Test Findings, and Technical Analysis).
   a. Description of Analyses and Simulations Performed
   b. Technical results
   c. Technical problems

6. Conclusions

7. Recommendations

TAB

A - Test Criteria
B - Test Data
C - Preliminary Determination of Deficiencies, Shortcomings, and Suggested Improvements
D - Performance Results Matrix
E - References
F - Abbreviations

B-2. Assessments

"ilities" Analysis Assessment Report

1. System Introduction
   a. System Concept
   b. Summary Description of Threat or Future Operational Capability
   c. Measures of Effectiveness (MOEs) and Suitability
   d. System Description (Brief description of Key Features and Subsystems, Functions Performed
   e. Interfaces
   f. Critical Technical Parameters

2. Supportability Strategy
   a. Determine the extent of support-related parameters or specifications to be addressed during each phase
   b. Identify supportability analyses and tradeoffs to be conducted for each ILS element:
      (1) Design Influence
      (2) Maintenance planning.
      (3) Manpower and personnel.
      (4) Supply support.
      (5) Support Equipment.
      (6) Technical data.
      (7) Training and training devices
      (8) Transportation and Transportability
      (9) Computer resources support
      (10) Standardization and interoperability, reliability, Availability and Maintainability (RAM)
      (11) Materiel Fielding Planning
      (12) Facilities.
      (13) Packaging, handling, and storage

3. Manufacturing and Producibility Strategy

Annex C: Plans

C-1. Component / Breadboard Laboratory Validation Plan
(Laboratory Validation Plan evolves into the Relevant Environment Plan

C-2. Component / Brassboard Relevant Environment Validation Plan
(Update of Laboratory Validation Plan to Reflect Testing In Relevant Environment)

C-3. Prototype Relevant Environment Demonstration Plan

These plan outlines will be the same, but will differ in the particular details of the brassboard/prototype and the extent of the test environment.

Validation/Demonstration Plan for _____

1. Introduction
   a. Purpose
   b. Objectives
   c. Scope
   d. Objectives/KPPs To Be Validated/Demonstrated
2. System Description (Objective System, Test System, and System Concept)
   a. Objective System/Technology Description
   b. Key Features and Subsystems of Breadboard/Prototype
   c. System Concept
3. Description of Threat or Future Operational Capability
4. Test Setup. (Laboratory/Field Configuration and set-up procedures at Test Facility)
   a. Item(s) To Be Tested/System Set-up
   b. Hardware To Be Tested/Set-up
   c. Algorithms/Software To Be Tested/Set-up
   d. Threat Representation
   e. Environment
   f. Instrumentation
   g. Special Test Equipment
   h. External Systems Participating
   i. Organizations Participating
   j. Test/Requirements Crosswalk
5. Describe How Test Will Be Conducted
   a. Test Location(s)
   b. System checkout Procedures
   c. Data to Be Collected
   d. Discussion for Each Test/Subtest
      1). Date(s)
      2). Configuration Description
      3). Subtest Objectives

4). Test Description
5). Analyses, Simulations and Tests To Be Performed
6). Basic Scenarios
7). Test Environment
8). Operational Considerations
9). Limitations

6. Describe How Results Will Be Determined

(Subtests are subdivided by Objectives, Criteria, Test Procedure, Test Findings, and Technical Analysis).

TABS

A - Test Criteria
B - Test Data
C - Preliminary Determination of Deficiencies, Shortcomings, and Suggested Improvements
D - Performance Results Matrix
E - References
F - Abbreviations

C-4 "ilities" Analysis Plan

1. Introduction
   a. Purpose
   b. Objectives
   c. Scope
2. System Description
   a. Objective System/Technology Description
   b. Key Features and Subsystems of Brassboard/Prototype
   c. System Concept
3. Description of Threat or Future Operational Capability
4. Supportability Strategy
   a. Determine the extent of support-related parameters or specifications to be addressed during each phase
   b. Identify supportability analyses and tradeoffs to be conducted for each ILS element:
      1. Maintenance planning.
      2. Manpower and personnel.
      3. Supply support.
      4. Equipment support.
      5. Technical data.
      6. Training and training support.
      7. Computer resources support.
      8. Facilities.
      9. Packaging, handling, storage, and transportation.
      10. Design interface.
      11. Battlelab and other exercises needed to understand user/operator needs and support

Annex D: Contracting Information

D-1. Statement of Work for Each Phase

D-2. Work Breakdown Structure (WBS) For Each Phase

D-3. Contracting/Acquisition Strategy

Discuss approach for contracting during each phase and how solicitations will be accomplished and the contract will be structured. This will includes such things as:

1. Industry Involvement In The Program To Date

2. Major Contract (s) Planned (Contracting Approach Through Program Life, e.g., New Competition For Each Phase, Initial Award With Priced Options For Subsequent Phases, etc.)

3. Type of solicitation: e.g., RFI, BAA, and Standard Contract Solicitation

4. Competition
   a. Market Research Conducted and/or Planned (RFIs)
   b. Identify Potential Sources
   c. Plans for Full and Open Competition, or Reasons and Plans for Other than Full and Open Competition

5. Contract Structure
   a. Basic Contract (what it buys; major deliverable items definition)
   b. Options, if any

6. Contract Type
   a. Basis for selection (in terms of FAR Part 16)
   b. Linkage to program risk assessment

7. Meeting or exceeding program cost objectives

8. Performance

9. Special Contract Terms and Conditions

Annex E: Funding

1. Basis/Methodology For Funding Estimate. Provide justification in sufficient detail as to how the estimate was developed. Describe what models/methods were used.
   a. Cost-Estimating Relationship (CER) Method. Describe CER(s) used and cite the source and/or the model and the set of data with which it was calibrated.
   b. Delphi/Subjective Judgments Method. Identify/explain the use of subjective judgments to adjust estimates made by analogy with other systems or components of systems.
   c. Environmental Cost Considerations. Describe what environmental factors were considered in the cost estimates.
   d. Cost Estimates Based on Analogous Programs. Describe the actual cost history from past or present contracts or analogous programs that were used.
   e. Other. Identify other methods used to identify required risk reduction costs to include identifying areas of uncertainty and system sensitivities.

Cost Estimates Breakdown Tables that present program costs by FY. The breakdown should follow a work breakdown structure for government and contract costs and include cost for each major element of the technology program to include contractor development of the hardware/software, test costs, system engineering, government oversight, etc.

Annex F: Risk Management

Risk management is concerned with the identification of uncertainties that threaten cost, schedule, and performance objectives, and the development and implementation of actions to best deal with those uncertainties within established limits. Its primary focus is to identify and manage risk so that program objectives can best be achieved and to support development of an acquisition strategy to meet the user's needs while balancing cost, schedule, performance, and their risk.

Acquisition Risk is defined as a measure of potential inability to achieve program objectives within defined cost/schedule constraints. Each risk event has 2 components; the probability of failing to achieve a particular outcome and the consequences of failing to achieve that outcome

F-1. Risk Management Plan

1. **INTRODUCTION.** This section should address the purpose and objective of the plan, and provide a brief summary of the program, to include the approach being used to manage the program, and the technology development strategy.

2. **PROGRAM SUMMARY.** This section contains a brief description of the program, including the program management approach.

3. **DEFINITIONS.** Definitions used should be consistent with DoD definitions for ease of understanding and consistency. However, the DoD definitions allow flexibility in constructing risk management programs. Therefore, each program's risk management plan may include definitions that expand the DoD definitions to fit its particular needs. For example, each plan should include, among other things, definitions for the ratings used for technical, schedule, and cost risk.

4. **RISK MANAGEMENT STRATEGY AND APPROACH.** Provide an overview of the risk management approach, to include the status of the risk management effort to date, and a description of the risk management strategy.

5. **ORGANIZATION.** Describe the risk management organization of the technology management group / office and list the responsibilities of each of the risk management participants.

6. **RISK MANAGEMENT PROCESS AND PROCEDURES.** Describe the program risk management process to be employed, i.e., risk planning, assessment, handling, monitoring and documentation, and a basic explanation of these components. Address how the information associated with each element of the risk management process will be documented and made available to all participants in the process, and how risks will be tracked, to include the identification of specific metrics if possible.

7. **RISK PLANNING.** This section describes the risk planning process and provides guidance on how it will be accomplished, and the relationship between continuous risk planning and this RMP.

8. **RISK ASSESSMENT.** This section of the plan describes the assessment (identification and analysis) process. It includes procedures for examining the critical risk areas and processes to identify and document the associated risks. It also summarizes the analyses process for each of the risk areas leading to the determination of a risk rating. This rating is a reflection of the potential impact of the risk in terms of its probability of occurrence, its consequence, and its relationship to other risk areas or processes. This section may include:

    - Overview and scope of the assessment process
    - Sources of information
    - Information to be reported and formats
    - Description of how risk information is retained
    - Assessment techniques and tools (see Section 2.5.2.4.2 of the *Deskbook*)

9. **RISK HANDLING.** This section describes the risk handling options, and identifies tools that can assist in implementing the risk handling process.

10. **RISK MONITORING.** This section describes the process and procedures that will be followed to monitor the status of the various risk events identified. It should provide criteria for the selection of risks to be reported on, and the frequency of reporting. Guidance on the selection of metrics should also be included.

11. **RISK MANAGEMENT INFORMATION SYSTEM, DOCUMENTATION AND REPORTS.** This section describes the MIS structure, rules, and procedures that will be used to document the results of the risk management process. It also identifies the risk management documentation and reports that will be prepared and assigns responsibility for their preparation.

Annex G: Transition

G-1. Customer / Sponsor Briefing and Support Agreement

G-2. Transition Plan

The TM in conjunction with the Customer/Sponsor develops the transition plan. The customer/sponsors are briefed and the support agreement is completed and signed. The Transition Plan is developed during the Demonstration Phase and updated throughout the technology program. The Transition Plan and updates require approval by the Customer/Sponsor. A Transition Memorandum of Agreement (MOA) is prepared and signed by Customer.

Transition Plan

1. **Purpose.** Indicate name of program/system(s) to transition, gaining organization, and the effective date.

2. **Program/System Description.** Include function and technical description of the technology program/system to transition.

3. **Program Status.** Include the life cycle phase.

4. **Organizational Responsibilities.** Identify those management responsibilities and tasks that the gaining organization will need to continue after transition. When appropriate, address any provisions required to facilitate the transition of the program/system from Technology management to Program Office management. Areas to be addressed in this paragraph include the following:
   a. Item Documentation and Records
   b. Configuration Management
   c. Engineering Responsibility, Engineering Data and Technical Data Package
   d. Integrated Logistics Support
   e. Software
   f. Transportation and Packaging
   g. Product Assurance Responsibility
   h. Safety
   i. Human Systems Integration
   j. Security Classification Guidance
   k. Environmental Documentation

5. **Assumptions.**

6. **Contract Status.** Open contracts/contractor(s)/time to completion/contract amount(s)/type dollars. Also include description of acquisition/ procurement activities, status of contracts, and contract-related responsibilities pertinent to the transition process.

7. **Funding summary.** RDT&E/Procurement/OMA/Future Year Defense Plan. Include portrayal of the overall budgeting and funding to include funds necessary for transition of the program/PMO and any anticipated future funding needs.

8. **Personnel Summary.** Include proposed disposition of all manpower spaces and personnel involved in the transition

9. **Plan For Transition Actions/Milestones.** Document the transition process. Identify tasks and milestones for activities involved in transition.

10. **Agreements And Commitments.** Identify any Memoranda of Agreement/Understanding that supports the program/system being transitioned.

G-3. Transition Memorandum of Agreement (MOA) Signed by Customer (See MOA Format in Reference H-3, page H-5)

Annex H: Other Considerations

To Be Published as Needed

APPENDIX F: Technology Process Review Information

F-1. Technology Program Schedule and Funding Summary

a). Program Title
b). Technology Program Objectives (From Updated Quad Chart)
c). Justification (Justification including customer/PM support from Updated Quad Chart)
d). Concept (Proposed concept (Concept Diagram, Picture, and/or Photo) from Updated Quad Chart and/or from Paragraph 2.c.
e). Approach and Applications (From Updated Quad Chart)
f). Program Schedule (Proposed Program by Fiscal Year with Major Milestones from Paragraph 8.b of Program Plan (unless too detailed for the level of reviewers then do one level up in detail.)
g). Funding (Show funding by Fiscal Year, by Program Element (PE)/Project from Program Plan Paragraph 8.c of Program Plan. Identify shortfalls by FY/Program Total and approaches to resolution of shortfalls.)

F-2. Technology Program Baseline

Technology Program Baseline (TPB): The TPB provides an essential reference baseline for maintaining, measuring, and reporting the status of technology program performance, cost, and schedule implementation. The Baseline constitutes an agreement between the SMDTC TM and the SMDC Technical Center Director.

<u>COVER PAGE</u>

TECHNOLOGY PROGRAM BASELINE AGREEMENT

Title of Technology Program

Provide a sentence that states that the Technology Program Baseline is approved by the undersigned TPDA and TM. Also provide several sentences that state the agreement and any qualifications. Identify any conditions that would require further reporting to or review by the TPDA.

Signature and Signature Block for the SMDTC Technology Manager

Signature and Signature Block for Relevant Director of the directorate to which the TM is assigned.

Signature and Signature Block for the Technology Program Decision Authority

TECHNOLOGY PROGRAM XXX BASELINE OUTLINE

SECTION I: PERFORMANCE

A. Reference 1/: Requirements Annex dated MM/DD/YY

B. Table of Key Parameters and Program Characteristics:

Provide a tabular list of key performance parameters and those other program characteristics, which, if the thresholds values are not met during this and subsequent phases of the technology program, would require program reevaluation and a decision on whether to continue the technology program. Performance includes operational, technical, and supportability parameters. Format should be similar to the KPP Table in Annex A of the Program Plan.

SECTION II: SCHEDULE (Dates)

Dates of key events must be shown along with those other dates necessary to adequately describe the program. Dates will be specified as MON YR. If an event (milestone) is scheduled for a quarter of fiscal year, the date will be converted to the last month of the quarter or the fiscal year. The schedule parameters shall include technology program initiation, major TPR decision points and transition to the customer.

SECTION III: COST

Provide the total cost (by then-year and base-year dollars in millions. Cost data reflected in the baseline must reflect realistic cost estimates.

F-3. Exit Criteria

Define and describe the Technology Program/Project exit criteria. Provide a narrative description for each parameter and explicitly describe all assumptions. Include clear definition of characteristics and rationale.

F-4. Technology Program Decision Memorandum

To be supplied for Technology Process Reviews. Outline the decision requested (i.e. proceed to next phase), any management issues to resolve, and provide as an attachment the exit criteria for successful completion of the next phase. (Format is on page F-3).

Office Symbol

MEMORANDUM FOR ***Name of Responsible SMDTC Organization***

SUBJECT: ***Name of Technology Program*** **Technology Decision Memorandum**

1. Based upon the recommendation of the Technology Review Board (TRB), Validation Report Results for Current Technology Phase, Add ***Other Concurring Organizations (Customer, User, etc),*** the entry into the ***Name of Next Technology Phase*** for the ***Name of Technology Program (Is/Is Not)*** approved. The ***Name of Technology Program*** Technology Program Baseline, dated dd/mm/yyyy and the Exit Criteria for the ____ Phase are approved.

2. The following direction is provided for the ***Name of Technology Program*** Technology Manager.

a. **Concise Statement of Authorization Granted By Decision.** "Authorization is granted to proceed with {listing of scope of approval with respect to contract actions, expenditure of funds, execution of next technology phase, conduct of laboratory tests, etc.)."

b. **Concise Statement of Restrictions and Conditions to the Authorization.** "No actions will be taken to {list of constrained and/or forbidden activities and what is required to lift/modify constraints}."

APPENDIX G: Acronyms

ACTD	Advanced Concept Technology Demonstrations
ATD	Advanced Technology Demonstration
BAA	Broad Agency Announcement
BL	Battle Lab
C/A	Considerations / Actions
CER	Cost-Estimating Relationship
DARPA	Defense Advanced Research Projects Agency
DCD	Directorate of Combat Developments
DoD	Department of Defense
DT&E	Developmental Test and Evaluation
DT/OT	Development Test / Operational Test
FAR	Federal Acquisition Regulation
FAT	First Article Test
FUE	First Unit Equipped
FY	Fiscal Year
HTI	Horizontal Technology Integration
HWIL	Hardware-in-the-Loop
ICD	Interface Control Drawing
IPPD	Integrated Product and Process Development
IPT	Integrated Product Teams
JCTI	Joint Center of Technology Integration
KPP	Key Performance Parameters
MDA	Milestone Decision Authority
MOA	Memorandum of Agreement
MOE	Measures of Effectiveness
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
P3I	Pre-Planned Product Improvement
PCP	Proof of Concept Plan
PE	Program Element
PM	Program or Product Manager

PMO	Program Management Office
POC	Point of Contact
R&D	Research and Development
RDT&E	Research Development Test and Experimentation
RFI	Request For Information
S&T	Science and Technology
SMDTC	Space and Missile Defense Technical Center
SSP	Simulation Support Plan
STO	Science and Technology Objectives
TPDA	Technology Program Decision Authority
TDI	Technology Difficulty Index
TM	Technology Manager
TPMM	Technology Program Management Model
TPB	Technology Program Baseline
TPR	Technology Process Review
TRADOC	Training and Doctrine Command
TRB	Technology Review Board
TRL	Technology Readiness Level
TY$	Then Year Dollars
WBS	Work Breakdown Structure

APPENDIX H: References

H-1 Technology Difficulty Index

H-2 Technology Readiness Levels / Key Term Definitions

H-3 Transition Memorandum of Agreement (MOA)

TECHNOLOGY DIFFICULTY INDEX

Difficulty in Achieving Research And Development (R&D) Objectives

Index	Degree of Difficulty	Probability of Success in "Normal" R&D Effort
TD-1	Very Low	**99%**
TD-2	Moderate	**90%**
TD-3	High	**80%**
TD-4	Very High	**50%**
TD-5	Fundamental Breakthrough	**20%**

- **Provides early indication of risk**
- **Facilitates Prioritization Among Technology Programs In A Constrained Resource Environment**

Technology Readiness Levels
DoD 5000.2-R

1. Basic principles observed and reported.	Lowest level to technology readiness. Scientific research begins to be translated into technology's basic properties.
2. Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be inverted. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
3. Analytical and experimental critical function and/or characteristic proof of concept.	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Component and/or breadboard validation in laboratory environment.	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.
5. Component and/or breadboard (brassboard)[1] validation in relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested simulated environment. Examples include "high fidelity" lab oratory integration of components.
6. System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond the breadboard tested for level 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated operational environment.
7. System prototype demonstration in an operational environment.	Prototype near or at planned operational system. Represents a major step up from level 6, requiring the demonstration of an actual system prototype in an operational environment. Examples include testing the prototype in a test bed aircraft.
8. Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this level represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specs.
9. Actual system proven through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.

* Key definitions are on following page.

[1] TPMM model uses "Brassboard" terminology versus "Breadboard" at TRL 5.

Technology Readiness Levels
Key Term Definitions

Breadboard: Integrated components that provide a representation of a system/subsystem and which can be used to determine concept feasibility and to develop technical data. Typically configured for laboratory use to demonstrate the technical principles of immediate interest. May resemble final system/subsystem in function only.

Brassboard: An experimental device (or group of devices) used to determine feasibility and to develop technical and operational data. It normally will be a model sufficiently hardened for use outside of laboratory environments to demonstrate the technical and operational principles of immediate interest. It may resemble the end item, but is not intended for use as the end item.

High Fidelity: Addresses from, fit and function. High fidelity laboratory environment would involve testing with equipment that can simulate and validate all system specifications within a laboratory setting.

Low Fidelity: A representative of the component or system that has limited ability to provide anything but first order information about the end product. Low fidelity assessments are used to provide trend analysis.

Model: A reduced scale, functional form of a system, near or at operational specification. Models will be sufficiently hardened to allow demonstration of the technical and operational capabilities required to the final system.

Operational Environment: Environment that addresses all of the operational requirements and specifications required of the final system to include platform/packing.

Prototype: The first early representation of the system, which offers the expected functionality and performance expected of the final implementation. Prototypes will be sufficiently hardened to allow demonstration of the technical and operational environment.

Relevant Environment: Testing environment that simulates the key aspects of the ope4ratioal environment.

Simulated Operational Environmental: Environment that can simulate all of the operational requirements and specifications required of the final system or simulated environment that allows for testing of a virtual prototype to determine whether it meets the operational requirements and specifications of the final system.

Transition Memorandum of Agreement (MOA)

Basic Transition Agreement

1. Description or Technology or Capability to be Delivered.

2. Target Acquisition Program.

3. Acquisition Program Technology Need

4. Integration Strategy (include a transition date)

5. Program Manager/Project Officer

6. Technology Manager

Technical Details and Programmatics

1. Technology – Current Status

a. Summary - Status

b. Risk Analysis

Top Risks	Brief Description	Mitigation Strategy

2. Technology Development Strategy.

3. Key Measures of Transition Readiness

Attribute/Parameter	Current	Interim (w/Est Date)	Final Objective

4. Program Plan

SIGNATURES:

Acquisition PM **Technology Manager (T M)**

[11] White Paper, Research and Development Degree of Difficulty (R&D^3), March 10, 1998, John C. Mankins, Advanced Projects Office, Office of Space Flight, NASA Headquarters.

RESEARCH & DEVELOPMENT DEGREE OF DIFFICULTY
(R&D^3)

A White Paper
March 10, 1998

John C. Mankins
Advanced Projects Office
Office of Space Flight
NASA Headquarters

Introduction

A measure of how much difficulty is expected to be encountered in the maturation of a particular technology is needed to complement the existing Technology Readiness Levels (TRLs) metric. TRL's are a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology. A measure characterized as the "Research and Development Degree of Difficulty" (R&D^3) is proposed as an additional measure.

R&D^3 Summary

R&D^3 – I	A very low degree of difficulty is anticipated in achieving research and development objectives for this technology. Probability of Success in "Normal" R&D Effort □90%
R&D^3 – II	A moderate degree of difficulty should be anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort □80%
R&D^3 – III	A high degree of difficulty anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort □60%
R&D^3 – IV	A very high degree of difficulty anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort □50%
R&D^3 – V	The degree of difficulty anticipated in achieving R&D objectives for this technology is so high that a fundamental breakthrough is required. Probability of Success in "Normal" R&D Effort □20%

- 1 -

RESEARCH & DEVELOPMENT DEGREE OF DIFFICULTY
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R&D^3 Summary

R&D^3 – I	A very low degree of difficulty is anticipated in achieving research and development objectives for this technology. Probability of Success in "Normal" R&D Effort 99%
R&D^3 – II	A moderate degree of difficulty should be anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort 90%
R&D^3 – III	A high degree of difficulty anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort 80%
R&D^3 – IV	A very high degree of difficulty anticipated in achieving R&D objectives for this technology. Probability of Success in "Normal" R&D Effort 50%
R&D^3 – V	The degree of difficulty anticipated in achieving R&D objectives for this technology is so high that a fundamental breakthrough is required. Probability of Success in "Normal" R&D Effort 20%

R&D^3 – Level I

Probability of Success in "Normal" R&D Effort 99%

A very low degree of difficulty is anticipated in achieving research and development objectives for this technology (including both the system concept, as well as performance, reliability and cost goals). Only a single, short-duration technological approach needed to be assured of a high probability of success in achieving technical objectives in later systems applications.

For example, a simple interpolation of an existing capability (e.g., an RF device at a new frequency, but one that is bracketed by the frequencies of past devices) or a modest extrapolation (e.g., a new engine at a thrust of N lbs, where an existing engine exists at a thrust of N/2 lbs for the same propellant and with similar other performance/cost goals).

R&D^3 – Level II

Probability of Success in "Normal" R&D Effort 90%

A moderate degree of difficulty should be anticipated in achieving R&D objectives for this technology. A single technological approach will probably be sufficient; however, this R&D should be conducted early to allow an alternate approach to be pursued if needed in order to be assured of a high probability of success in achieving technical objectives in later systems applications.

For example, a significant, but not extreme extrapolation from some existing capability (e.g., an RF device at a new frequency that is significantly different from current frequencies in use, but which should be achievable with devices similar to those already in use) or a modestly new capability (e.g., a new engine that is somewhat reusable — say a few firings — with some degree of integrated health management, where an existing engine exists that is expendable for the same propellant and with similar other performance goals).

R&D^3 – Level III

Probability of Success in "Normal" R&D Effort 80%

A high degree of difficulty could be anticipated in achieving R&D objectives for this technology. At least two technological approaches will probably be needed and these efforts should be conducted early enough to allow an alternate subsystem approach to be pursued to be assured of a high probability of success inachieving technical objectives in later systems applications.

For example, a very significant extrapolation from some existing capability (e.g., an RF device at a new frequency that is quite different — e.g., a factor of 5 — from current frequencies in use, and requires new RF devices, possibly operating on different physical

principals from those already in use) or a significantly new capability (e.g., a new engine that is very reusable — say a 10s of firings — with a high degree of integrated health management, where the existing engine is expendable, possibly with a different propellant, but still with similar other performance goals).

R&D^3 – Level IV

Probability of Success in "Normal" R&D Effort 50%

A very high degree of difficulty should be anticipated in achieving R&D objectives for this technology. Multiple technological approaches need to be pursued. These activities should be conducted early enough to allow an alternate system concept to be pursued in order to allow managers to be assured of a high probability of success in achieving technical objectives in later systems applications.

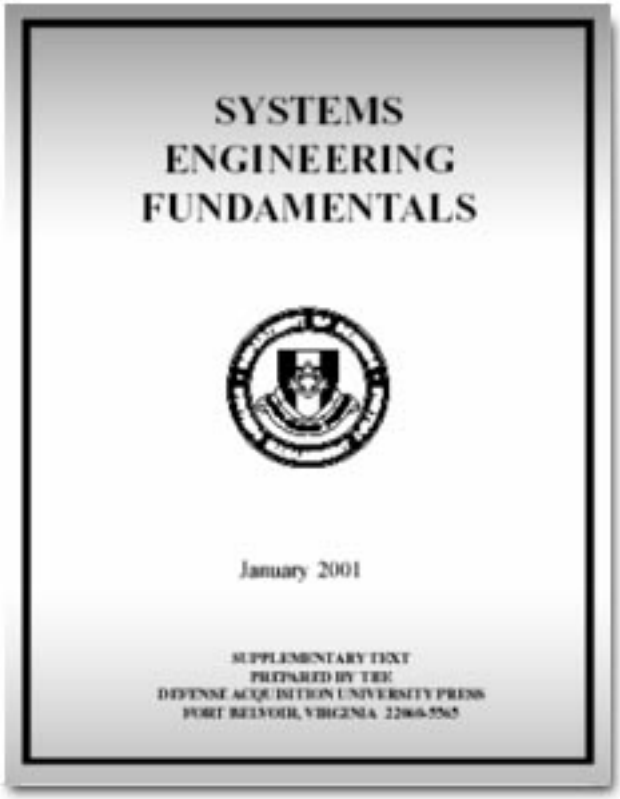
For example, a dramatic extrapolation from some existing capability (e.g., an RF device at a very different frequency — e.g., factors of 10 — than those in use, and requiring completely new RF devices, operating on different physical principals from those already in use, as well as various other new subsystems/component technologies, such as heat rejection) or a significantly new capability (e.g., a new engine that is air breathing as well as very highly reusable — say a 100s of firings — with a very high degree of integrated health management, where the existing engines are expendable rockets, possibly with different propellants, and with other different performance goals).

R&D^3 – Level V

Probability of Success in "Normal" R&D Effort 10%-20%

The degree of difficulty should be anticipated in achieving R&D objectives for this technology is so high that a fundamental breakthrough in physics/chemistry/etc. is needed. Basic research in key areas needed before feasible system concepts can be refined.

[12] Systems Engineering Fundamentals, Defense Acquisition University Press, January 2001.



SYSTEMS ENGINEERING FUNDAMENTALS

January 2001

SUPPLEMENTARY TEXT
PREPARED BY THE
DEFENSE ACQUISITION UNIVERSITY PRESS
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PREFACE

This book provides a basic, conceptual-level description of engineering management disciplines that relate to the development and life cycle management of a system. For the non-engineer it provides an overview of how a system is developed. For the engineer and project manager it provides a basic framework for planning and assessing system development.

Information in the book is from various sources, but a good portion is taken from lecture material developed for the two Systems Planning, Research, Development, and Engineering courses offered by the Defense Acquisition University.

The book is divided into four parts: *Introduction; Systems Engineering Process; Systems Analysis and Control;* and *Planning, Organizing, and Managing*. The first part introduces the basic concepts that govern the systems engineering process and how those concepts fit the Department of Defense acquisition process. Chapter 1 establishes the basic concept and introduces terms that will be used throughout the book. The second chapter goes through a typical acquisition life cycle showing how systems engineering supports acquisition decision making.

The second part introduces the systems engineering problem-solving process, and discusses in basic terms some traditional techniques used in the process. An overview is given, and then the process of requirements analysis, functional analysis and allocation, design synthesis, and verification is explained in some detail. This part ends with a discussion of the documentation developed as the finished output of the systems engineering process.

Part three discusses analysis and control tools that provide balance to the process. Key activities (such as risk management, configuration management, and trade studies) that support and run parallel to the system engineering process are identified and explained.

Part four discusses issues integral to the conduct of a systems engineering effort, from planning to consideration of broader management issues.

In some chapters supplementary sections provide related material that shows common techniques or policy-driven processes. These expand the basic conceptual discussion, but give the student a clearer picture of what systems engineering means in a real acquisition environment.

PART 1

INTRODUCTION

CHAPTER 1

INTRODUCTION TO SYSTEMS ENGINEERING MANAGEMENT

1.1 PURPOSE

The overall organization of this text is described in the Preface. This chapter establishes some of the basic premises that are expanded throughout the book. Basic terms explained in this chapter are the foundation for following definitions. Key systems engineering ideas and viewpoints are presented, starting with a definition of a system.

1.2 DEFINITIONS

A System Is …

Simply stated, a system is an integrated composite of people, products, and processes that provide a capability to satisfy a stated need or objective.

Systems Engineering Is…

Systems engineering consists of two significant disciplines: the technical knowledge domain in which the systems engineer operates, and systems engineering management. This book focuses on the process of systems engineering management.

Three commonly used definitions of systems engineering are provided by the best known technical standards that apply to this subject. They all have a common theme:

- A logical sequence of activities and decisions that transforms an operational need into a description of system performance parameters and a preferred system configuration. (MIL-STD-499A, *Engineering Management*, 1 May 1974. Now cancelled.)

- An interdisciplinary approach that encompasses the entire technical effort, and evolves into and verifies an integrated and life cycle balanced set of system people, products, and process solutions that satisfy customer needs. (EIA Standard IS-632, *Systems Engineering*, December 1994.)

- An interdisciplinary, collaborative approach that derives, evolves, and verifies a life-cycle balanced system solution which satisfies customer expectations and meets public acceptability. (IEEE P1220, *Standard for Application and Management of the Systems Engineering Process*, [Final Draft], 26 September 1994.)

In summary, systems engineering is an interdisciplinary engineering management process that evolves and verifies an integrated, life-cycle balanced set of system solutions that satisfy customer needs.

Systems Engineering Management Is…

As illustrated by Figure 1-1, systems engineering management is accomplished by integrating three major activities:

- Development phasing that controls the design process and provides baselines that coordinate design efforts,

- A systems engineering process that provides a structure for solving design problems and

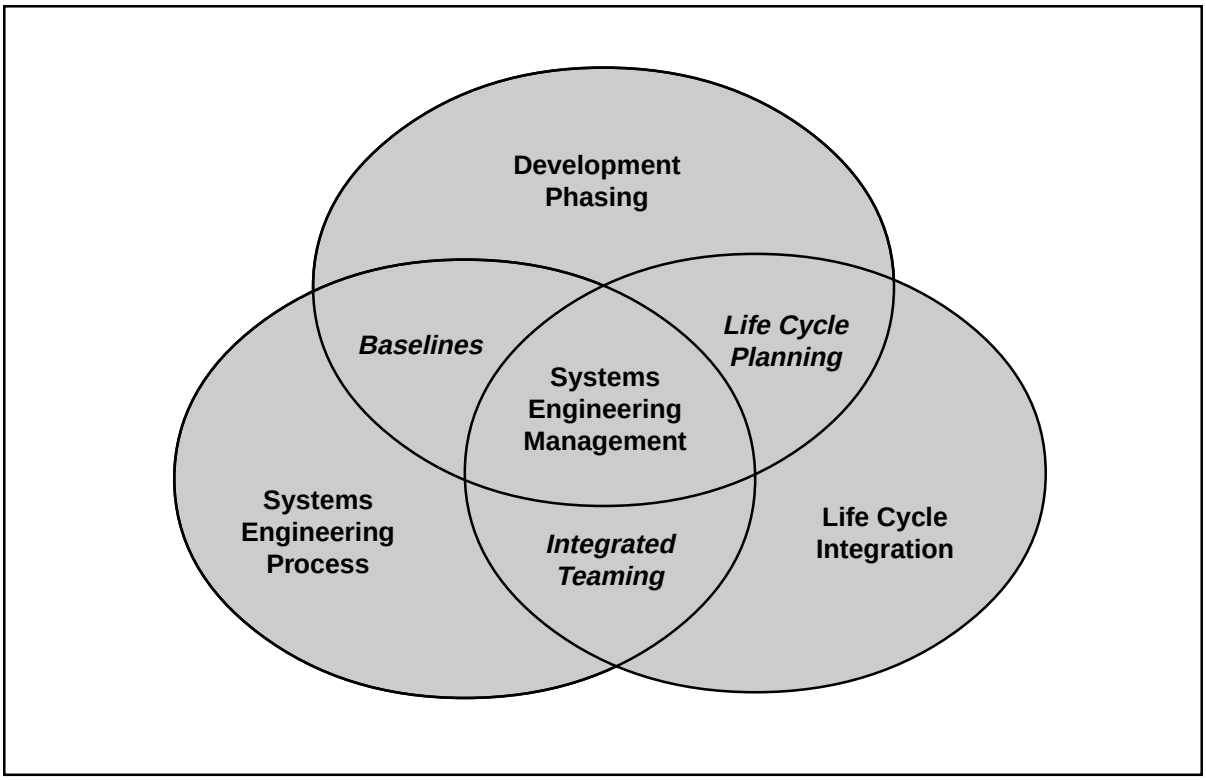


Figure 1-1. Three Activities of Systems Engineering Management

tracking requirements flow through the design effort, and

- Life cycle integration that involves customers in the design process and ensures that the system developed is viable throughout its life.

Each one of these activities is necessary to achieve proper management of a development effort. Phasing has two major purposes: it controls the design effort and is the major connection between the technical management effort and the overall acquisition effort. It controls the design effort by developing design baselines that govern each level of development. It interfaces with acquisition management by providing key events in the development process, where design viability can be assessed. The viability of the baselines developed is a major input for acquisition management Milestone (MS) decisions. As a result, the timing and coordination between technical development phasing and the acquisition schedule is critical to maintain a healthy acquisition program.

The systems engineering process is the heart of systems engineering management. Its purpose is to provide a structured but flexible process that transforms requirements into specifications, architectures, and configuration baselines. The discipline of this process provides the control and traceability to develop solutions that meet customer needs. The systems engineering process may be repeated one or more times during any phase of the development process.

Life cycle integration is necessary to ensure that the design solution is viable throughout the life of the system. It includes the planning associated with product and process development, as well as the integration of multiple functional concerns into the design and engineering process. In this manner, product cycle-times can be reduced, and the need for redesign and rework substantially reduced.

1.3 DEVELOPMENT PHASING

Development usually progresses through distinct levels or stages:

- Concept level, which produces a system concept description (usually described in a concept study);
- System level, which produces a system description in performance requirement terms; and
- Subsystem/Component level, which produces first a set of subsystem and component product performance descriptions, then a set of corresponding detailed descriptions of the products' characteristics, essential for their production.

The systems engineering process is applied to each level of system development, one level at a time, to produce these descriptions commonly called configuration baselines. This results in a series of configuration baselines, one at each development level. These baselines become more detailed with each level.

In the Department of Defense (DoD) the configuration baselines are called the functional baseline for the system-level description, the allocated baseline for the subsystem/ component performance descriptions, and the product baseline for the subsystem/component detail descriptions. Figure 1-2 shows the basic relationships between the baselines. The triangles represent baseline control decision points, and are usually referred to as technical reviews or audits.

Levels of Development Considerations

Significant development at any given level in the system hierarchy should not occur until the configuration baselines at the higher levels are considered complete, stable, and controlled. Reviews and audits are used to ensure that the baselines are ready for the next level of development. As will be shown in the next chapter, this review and audit process also provides the necessary assessment of system maturity, which supports the DoD Milestone decision process.

1.4 THE SYSTEMS ENGINEERING PROCESS

The systems engineering process is a top-down comprehensive, iterative and recursive problem

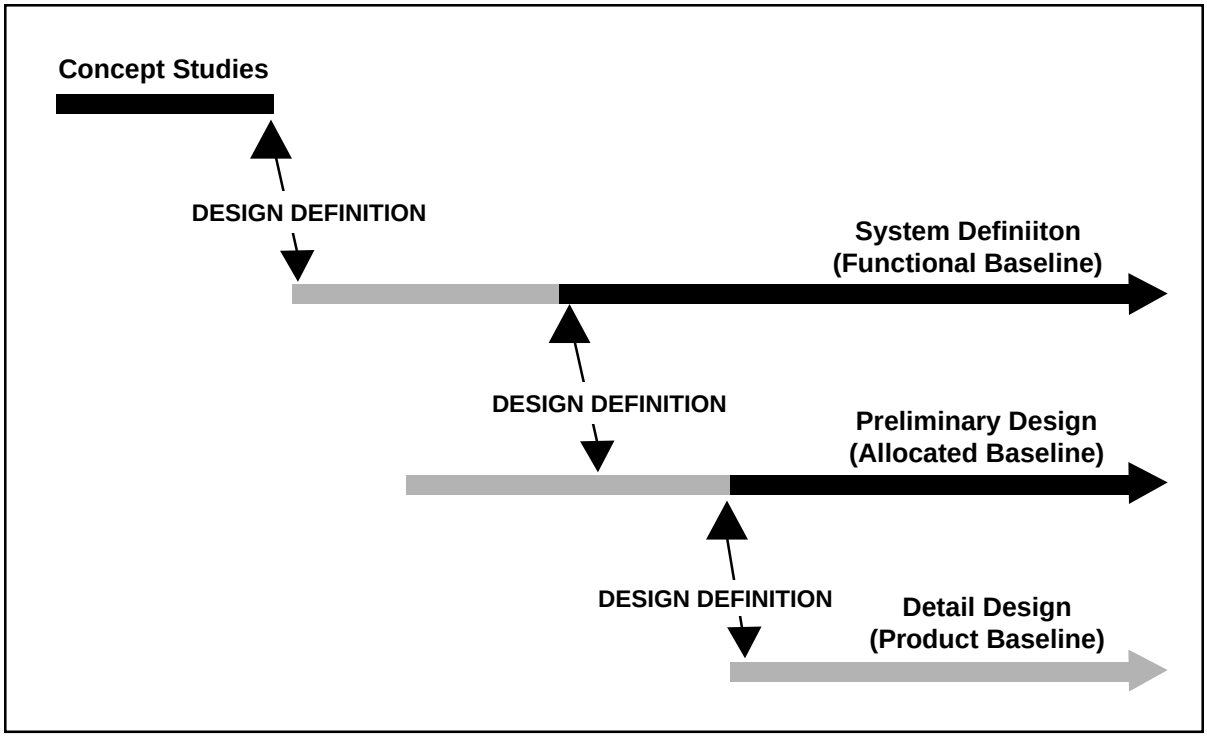


Figure 1-2. Development Phasing

solving process, applied sequentially through all stages of development, that is used to:

- Transform needs and requirements into a set of system product and process descriptions (adding value and more detail with each level of development),
- Generate information for decision makers, and
- Provide input for the next level of development.

As illustrated by Figure 1-3, the fundamental systems engineering activities are Requirements Analysis, Functional Analysis and Allocation, and Design Synthesis—all balanced by techniques and tools collectively called System Analysis and Control. Systems engineering controls are used to track decisions and requirements, maintain technical baselines, manage interfaces, manage risks, track cost and schedule, track technical performance, verify requirements are met, and review/audit the progress.

During the systems engineering process architectures are generated to better describe and understand the system. The word "architecture" is used in various contexts in the general field of engineering. It is used as a general description of how the subsystems join together to form the system. It can also be a detailed description of an aspect of a system: for example, the Operational, System, and Technical Architectures used in Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR), and software intensive developments. However, Systems Engineering Management as developed in DoD recognizes three universally usable architectures that describe important aspects of the system: functional, physical, and system architectures. This book will focus on these architectures as necessary components of the systems engineering process.

The *Functional Architecture* identifies and structures the allocated functional and performance requirements. The *Physical Architecture* depicts the

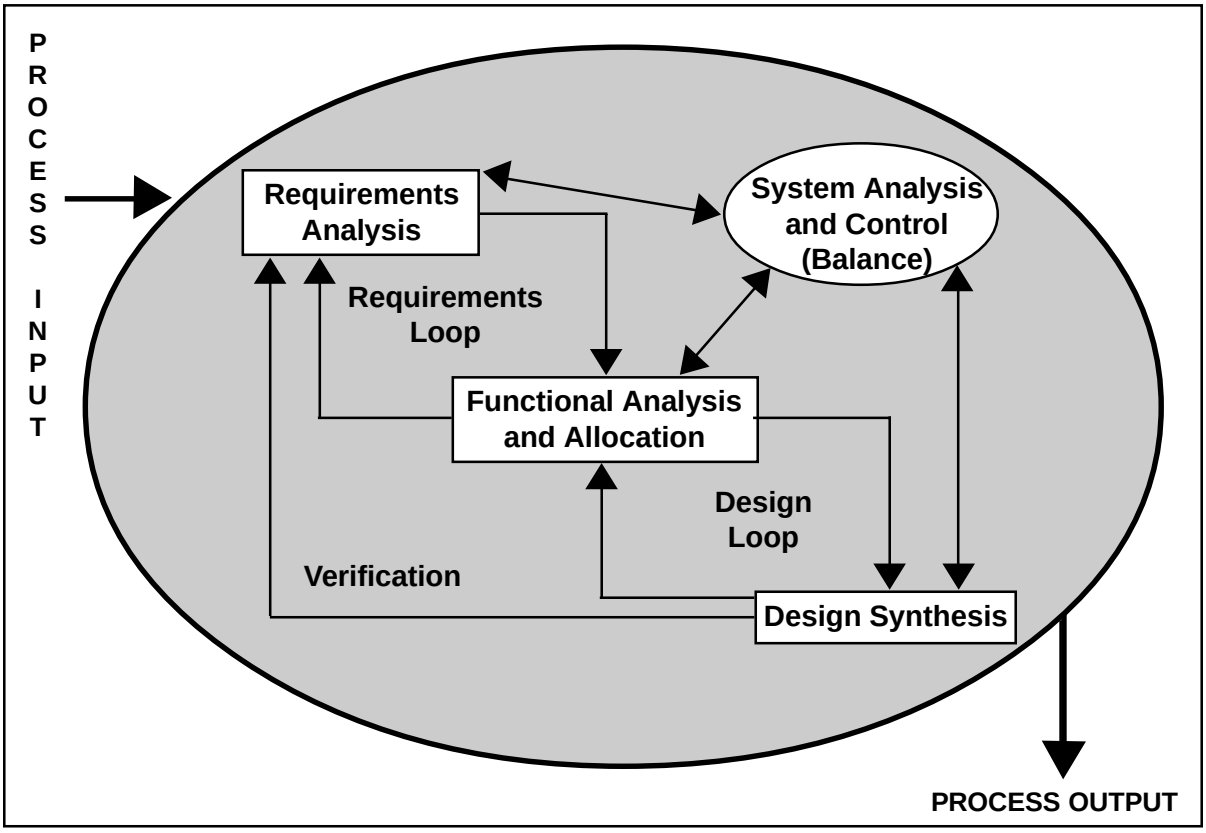


Figure 1-3. The Systems Engineering Process

system product by showing how it is broken down into subsystems and components. The *System Architecture* identifies all the products (including enabling products) that are necessary to support the system and, by implication, the processes necessary for development, production/construction, deployment, operations, support, disposal, training, and verification.

Life Cycle Integration

Life cycle integration is achieved through integrated development—that is, concurrent consideration of all life cycle needs during the development process. DoD policy requires integrated development, called Integrated Product and Product Development (IPPD) in DoD, to be practiced at all levels in the acquisition chain of command as will be explained in the chapter on IPPD. Concurrent consideration of all life cycle needs can be greatly enhanced through the use of interdisciplinary teams. These teams are often referred to as Integrated Product Teams (IPTs).

The objective of an Integrated Product Team is to:

- Produce a design solution that satisfies initially defined requirements, and
- Communicate that design solution clearly, effectively, and in a timely manner.

Multi-functional, integrated teams:

- Place balanced emphasis on product and process development, and
- Require early involvement of all disciplines appropriate to the team task.

Design-level IPT members are chosen to meet the team objectives and generally have distinctive competence in:

- Technical management (systems engineering),
- Life cycle functional areas (eight primary functions),
- Technical specialty areas, such as safety, risk management, quality, etc., or
- When appropriate, business areas such as finance, cost/budget analysis, and contracting.

Life Cycle Functions

Life cycle functions are the characteristic actions associated with the system life cycle. As illustrated by Figure 1-4, they are development, production and construction, deployment (fielding), operation, support, disposal, training, and verification. These activities cover the "cradle to grave" life cycle process and are associated with major functional groups that provide essential support to the life cycle process. These key life cycle functions are commonly referred to as the eight primary functions of systems engineering.

The customers of the systems engineer perform the life-cycle functions. The system user's needs are emphasized because their needs generate the requirement for the system, but it must be remembered that all of the life-cycle functional areas generate requirements for the systems engineering process once the user has established the basic need. ***Those that perform the primary functions also provide life-cycle representation in design-level integrated teams.***

Primary Function Definitions

Development includes the activities required to evolve the system from customer needs to product or process solutions.

Manufacturing/Production/Construction includes the fabrication of engineering test models and "brass boards," low rate initial production, full-rate production of systems and end items, or the construction of large or unique systems or subsystems.

Deployment (Fielding) includes the activities necessary to initially deliver, transport, receive, process, assemble, install, checkout, train, operate, house, store, or field the system to achieve full operational capability.

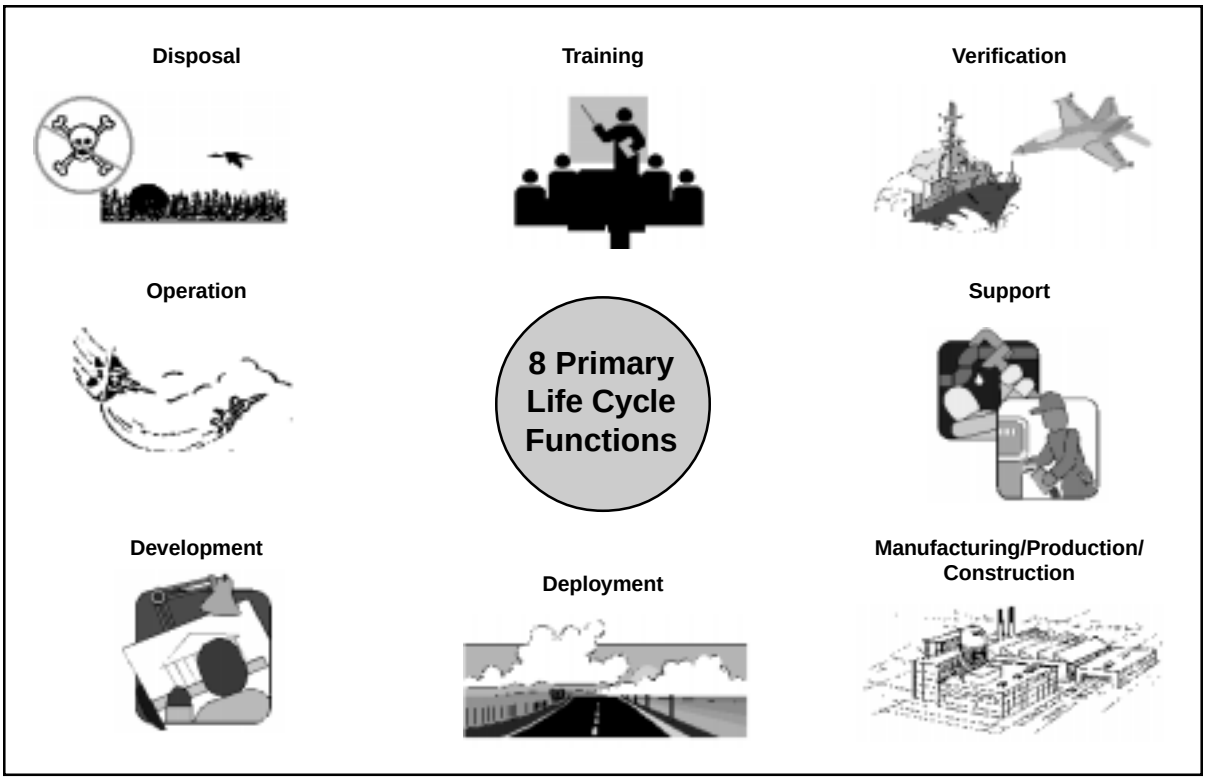


Figure 1-4. Primary Life Cycle Functions

Operation is the user function and includes activities necessary to satisfy defined operational objectives and tasks in peacetime and wartime environments.

Support includes the activities necessary to provide operations support, maintenance, logistics, and material management.

Disposal includes the activities necessary to ensure that the disposal of decommissioned, destroyed, or irreparable system components meets all applicable regulations and directives.

Training includes the activities necessary to achieve and maintain the knowledge and skill levels necessary to efficiently and effectively perform operations and support functions.

Verification includes the activities necessary to evaluate progress and effectiveness of evolving system products and processes, and to measure specification compliance.

Systems Engineering Considerations

Systems engineering is a standardized, disciplined management process for development of system solutions that provides a constant approach to system development in an environment of change and uncertainty. It also provides for simultaneous product and process development, as well as a common basis for communication.

Systems engineering ensures that the correct technical tasks get done during development through planning, tracking, and coordinating. Responsibilities of systems engineers include:

- Development of a total system design solution that balances cost, schedule, performance, and risk,
- Development and tracking of technical information needed for decision making,
- Verification that technical solutions satisfy customer requirements,

- Development of a system that can be produced economically and supported throughout the life cycle,
- Development and monitoring of internal and external interface compatibility of the system and subsystems using an open systems approach,
- Establishment of baselines and configuration control, and
- Proper focus and structure for system and major sub-system level design IPTs.

1.5 GUIDANCE

DoD 5000.2-R establishes two fundamental requirements for program management:

- It requires that an Integrated Product and Process approach be taken to design wherever practicable, and
- It requires that a disciplined systems engineering process be used to translate operational needs and/or requirements into a system solution.

Tailoring the Process

System engineering is applied during all acquisition and support phases for large- and small-scale systems, new developments or product improvements, and single and multiple procurements. The process must be tailored for different needs and/or requirements. Tailoring considerations include system size and complexity, level of system definition detail, scenarios and missions, constraints and requirements, technology base, major risk factors, and organizational best practices and strengths.

For example, systems engineering of software should follow the basic systems engineering approach as presented in this book. However, it must be tailored to accommodate the software development environment, and the unique progress tracking and verification problems software development entails. In a like manner, all technology domains are expected to bring their own unique needs to the process.

This book provides a conceptual-level description of systems engineering management. The specific techniques, nomenclature, and recommended methods are not meant to be prescriptive. Technical managers must tailor their systems engineering planning to meet their particular requirements and constraints, environment, technical domain, and schedule/budget situation.

However, the basic time-proven concepts inherent in the systems engineering approach must be retained to provide continuity and control. For complex system designs, a full and documented understanding of what the system must do should precede development of component performance descriptions, which should precede component detail descriptions. Though some parts of the system may be dictated as a constraint or interface, in general, solving the design problem should start with analyzing the requirements and determining what the system has to do before physical alternatives are chosen. Configurations must be controlled and risk must be managed.

Tailoring of this process has to be done carefully to avoid the introduction of substantial unseen risk and uncertainty. Without the control, coordination, and traceability of systems engineering, an environment of uncertainty results which will lead to surprises. Experience has shown that these surprises almost invariably lead to significant impacts to cost and schedule. Tailored processes that reflect the general conceptual approach of this book have been developed and adopted by professional societies, academia, industry associations, government agencies, and major companies.

1.6 SUMMARY POINTS

- Systems engineering management is a multi-functional process that integrates life cycle functions, the systems engineering problem-solving process, and progressive baselining.

- The systems engineering process is a problem-solving process that drives the balanced development of system products and processes.
- Integrated Product Teams should apply the systems engineering process to develop a life cycle balanced-design solution.
- The systems engineering process is applied to each level of development, one level at a time.
- Fundamental systems engineering activities are Requirements Analysis, Functional Analysis/ Allocation, and Design Synthesis, all of which are balanced by System Analysis and Control.
- Baseline phasing provides for an increasing level of descriptive detail of the products and processes with each application of the systems engineering process.
- Baselining in a nut shell is a concept description that leads to a system definition which, in turn, leads to component definitions, and then to component designs, which finally lead to a product.
- The output of each application of the systems engineering process is a major input to the next process application.

CHAPTER 2

SYSTEMS ENGINEERING MANAGEMENT IN DOD ACQUISITION

2.1 INTRODUCTION

The DoD acquisition process has its foundation in federal policy and public law. The development, acquisition, and operation of military systems is governed by a multitude of public laws, formal DoD directives, instructions and manuals, numerous Service and Component regulations, and many inter-service and international agreements.

Managing the development and fielding of military systems requires three basic activities: technical management, business management, and contract management. As described in this book, systems engineering management is the technical management component of DoD acquisition management.

The acquisition process runs parallel to the requirements generation process and the budgeting process (Planning, Programming, and Budgeting System.) User requirements tend to be event driven by threat. The budgeting process is date driven by constraints of the Congressional calendar. Systems Engineering Management bridges these processes and must resolve the dichotomy of event driven needs, event driven technology development, and a calendar driven budget.

Direction and Guidance

The Office of Management and Budget (OMB) provides top-level guidance for planning, budgeting, and acquisition in OMB Circular A-11, Part 3, and the Supplemental Capital Programming Guide: Planning, Budgeting, and Acquisition of Capital Assets, July 1997. These documents establish the broad responsibilities and ground rules to be followed in funding and acquiring major assets. The departments of the executive branch of government are then expected to draft their own guidance consistent with the guidelines established. The principal guidance for defense system acquisitions is the DoD 5000 series of directives and regulations. These documents reflect the actions required of DoD acquisition managers to:

- Translate operational needs into stable, affordable programs,
- Acquire quality products, and
- Organize for efficiency and effectiveness.

2.2 RECENT CHANGES

The DoD 5000 series documents were revised in 2000 to make the process more flexible, enabling the delivery of advanced technology to warfighters more rapidly and at reduced total ownership cost. The new process encourages multiple entry points, depending on the maturity of the fundamental technologies involved, and the use of evolutionary methods to define and develop systems. This encourages a tailored approach to acquisition and engineering management, but it does not alter the basic logic of the underlying systems engineering process.

2.3 ACQUISITION LIFE CYCLE

The revised acquisition process for major defense systems is shown in Figure 2-1. The process is

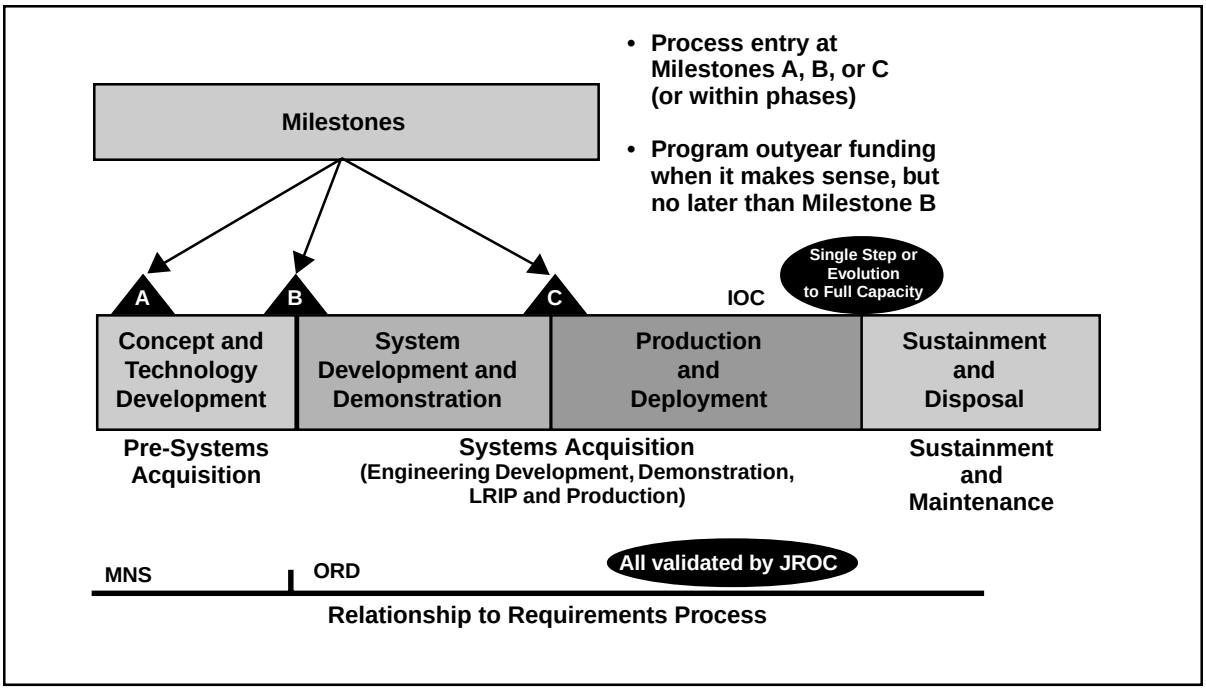


Figure 2-1. Revised DoD 5000 Acquisition Process

defined by a series of phases during which technology is defined and matured into viable concepts, which are subsequently developed and readied for production, after which the systems produced are supported in the field.

The process allows for a given system to enter the process at any of the development phases. For example, a system using unproven technology would enter at the beginning stages of the process and would proceed through a lengthy period of technology maturation, while a system based on mature and proven technologies might enter directly into engineering development or, conceivably, even production. The process itself (Figure 2-1) includes four phases of development. The first, **Concept and Technology Development**, is intended to explore alternative concepts based on assessments of operational needs, technology readiness, risk, and affordability. Entry into this phase *does not* imply that DoD has committed to a new acquisition program; rather, it is the initiation of a process to determine whether or not a need (typically described in a Mission Need Statement (MNS)) can be met at reasonable levels of technical risk and at affordable costs. The decision to enter into the Concept and Technology Development phase is made formally at the Milestone A forum.

The **Concept and Technology Development** phase begins with concept exploration. During this stage, concept studies are undertaken to define alternative concepts and to provide information about capability and risk that would permit an objective comparison of competing concepts. A decision review is held after completion of the concept exploration activities. The purpose of this review is to determine whether further technology development is required, or whether the system is ready to enter into system acquisition. If the key technologies involved are reasonably mature and have already been demonstrated, the Milestone Decision Authority (MDA) may agree to allow the system to proceed into system acquisition; if not, the system may be directed into a component advanced development stage. (See Supplement A to this chapter for a definition of Technology Readiness levels.) During this stage, system architecture definition will continue and key technologies will be demonstrated in order to ensure that technical and cost risks are understood and are at acceptable levels prior to entering acquisition. In any event, the

Concept and Technology Development phase ends with a defined system architecture supported by technologies that are at acceptable levels of maturity to justify entry into system acquisition.

Formal system acquisition begins with a Milestone B decision. The decision is based on an integrated assessment of technology maturity, user requirements, and funding. A successful Milestone B is followed by the **System Development and Demonstration** phase. This phase could be entered directly as a result of a technological opportunity and urgent user need, as well as having come through concept and technology development. The System Development and Demonstration phase consists of two stages of development, system integration and system demonstration. Depending upon the maturity level of the system, it could enter at either stage, or the stages could be combined. This is the phase during which the technologies, components and subsystems defined earlier are first integrated at the system level, and then demonstrated and tested. If the system has never been integrated into a complete system, it will enter this phase at the system integration stage. When subsystems have been integrated, prototypes demonstrated, and risks are considered acceptable, the program will normally enter the system demonstration stage following an interim review by the MDA to ensure readiness. The system demonstration stage is intended to demonstrate that the system has operational utility consistent with the operational requirements. Engineering demonstration models are developed and system level development testing and operational assessments are performed to ensure that the system performs as required. These demonstrations are to be conducted in environments that represent the eventual operational environments intended. Once a system has been demonstrated in an operationally relevant environment, it may enter the Production and Deployment phase.

The **Production and Deployment** phase consists of two stages: production readiness and low rate initial production (LRIP), and rate production and deployment. The decision forum for entry into this phase is the Milestone C event. Again, the fundamental issue as to where a program enters the process is a function of technology maturity, so the possibility exists that a system could enter directly into this phase if it were sufficiently mature, for example, a commercial product to be produced for defense applications. However the entry is made—directly or through the maturation process described, the production readiness and LRIP stage is where initial operational test, live fire test, and low rate initial production are conducted. Upon completion of the LRIP stage and following a favorable Beyond LRIP test report, the system enters the rate production and deployment stage during which the item is produced and deployed to the user. As the system is produced and deployed, the final phase, Sustainment and Disposal, begins.

The last, and longest, phase is the **Sustainment and Disposal** phase of the program. During this phase all necessary activities are accomplished to maintain and sustain the system in the field in the most cost-effective manner possible. The scope of activities is broad and includes everything from maintenance and supply to safety, health, and environmental management. This period may also include transition from contractor to organic support, if appropriate. During this phase, modifications and product improvements are usually implemented to update and maintain the required levels of operational capability as technologies and threat systems evolve. At the end of the system service life it is disposed of in accordance with applicable classified and environmental laws, regulations, and directives. Disposal activities also include recycling, material recovery, salvage of reutilization, and disposal of by-products from development and production.

The key to this model of the acquisition process is that programs have the flexibility to enter at any of the first three phases described. The decision as to where the program should enter the process is primarily a function of user needs and technology maturity. The MDA makes the decision for the program in question. Program managers are encouraged to work with their users to develop evolutionary acquisition strategies that will permit deliveries of usable capabilities in as short a timeframe as possible, with improvements and enhancements added as needed through continuing

definition of requirements and development activities to support the evolving needs.

2.4 SYSTEMS ENGINEERING IN ACQUISITION

As required by DoD 5000.2-R, the systems engineering process shall:

1. Transform operational needs and requirements into an integrated system design solution through concurrent consideration of all life-cycle needs (i.e., development, manufacturing, test and evaluation, verification, deployment, operations, support, training and disposal).

2. Ensure the compatibility, interoperability and integration of all functional and physical interfaces and ensure that system definition and design reflect the requirements for all system elements: hardware, software, facilities, people, and data; and

3. Characterize and manage technical risks.

4. Apply scientific and engineering principles to identify security vulnerabilities and to minimize or contain associated information assurance and force protection risks.

These objectives are accomplished with use of the management concepts and techniques described in the chapters which follow in this book. The application of systems engineering management coincides with acquisition phasing. In order to support milestone decisions, major technical reviews are conducted to evaluate system design maturity.

Concept and Technology Development

The Concept and Technology Development phase consists of two pre-acquisition stages of development. The first, **Concept Exploration**, is represented in Figure 2-2. The exploration of concepts is usually accomplished through multiple short-term studies. Development of these studies is

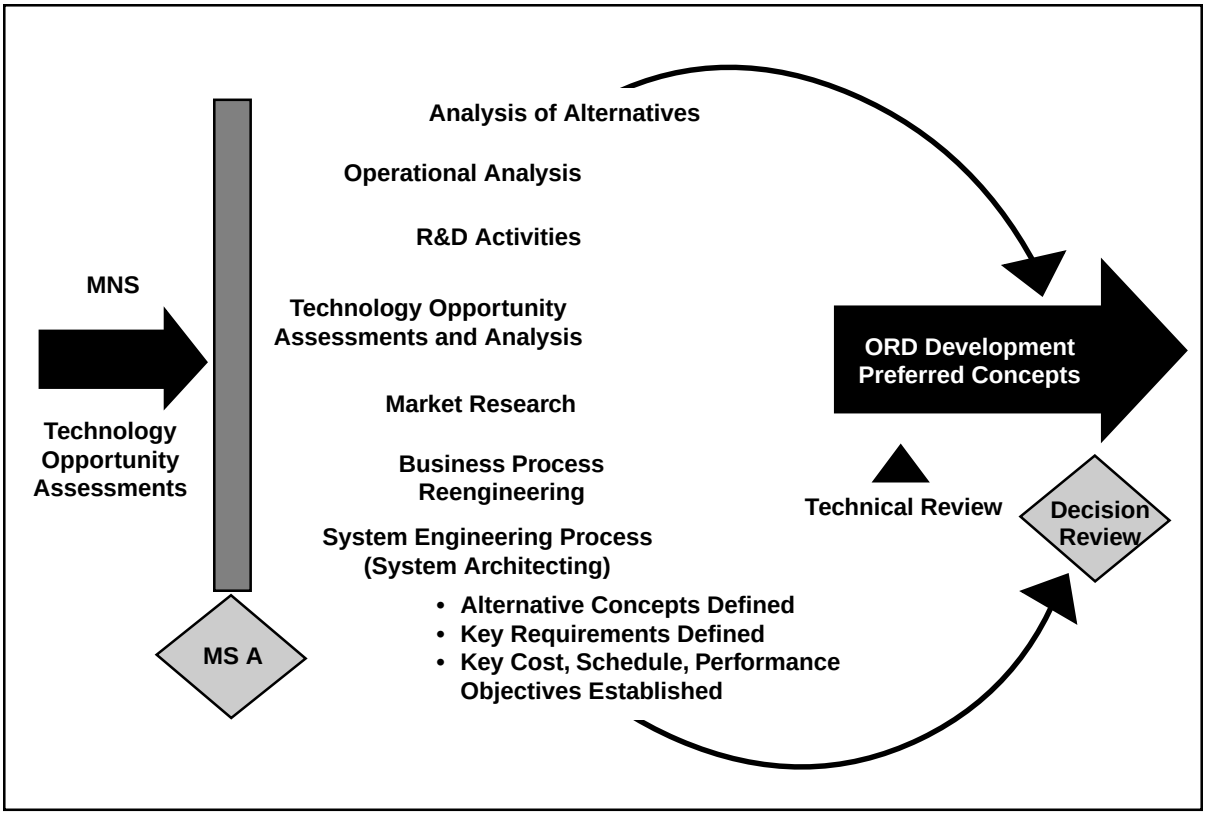


Figure 2-2. Concept and Technology Development (Concept Exploration Stage)

expected to employ various techniques including the systems engineering process that translates inputs into viable concept architectures whose functionality can be traced to the requirements. In addition, market surveys, Business Process Reengineering activities, operational analysis, and trade studies support the process.

The primary inputs to these activities include requirements, in form of the MNS, assessments of technology opportunities and status, and the outputs from any efforts undertaken to explore potential solutions. When the contractor studies are complete, a specific concept to be pursued is selected based on a integrated assessment of technical performance; technical, schedule and cost risk; as well as other relevant factors. A decision review is then held to evaluate the concept recommended and the state of technology upon which the concept depends. The MDA then makes a decision as to whether the concept development work needs to be extended or redirected, or whether the technology maturity is such that the program can proceed directly to either Mile-stone B (System Development and Demonstration) or Milestone C (Production and Deployment).

If the details of the concept require definition, i.e., the system has yet to be designed and demonstrated previously, or the system appears to be based on technologies that hold significant risk, then it is likely that the system will proceed to the second stage of the Concept and Technology Development phase. This stage, **Component Advanced Development**, is represented in Figure 2-3. This is also a pre-acquisition stage of development and is usually characterized by extensive involvement of the DoD Science and Technology (S&T) community. The fundamental objectives of this stage of development are to define a system-level architecture and to accomplish risk-reduction activities as required to establish confidence that the building blocks of the system are sufficiently well-defined, tested and demonstrated to provide confidence that, when integrated into higher level assemblies and subsystems, they will perform reliably.

Development of a system-level architecture entails continuing refinement of system level requirements based on comparative analyses of the system concepts under consideration. It also requires that consideration be given to the role that the system

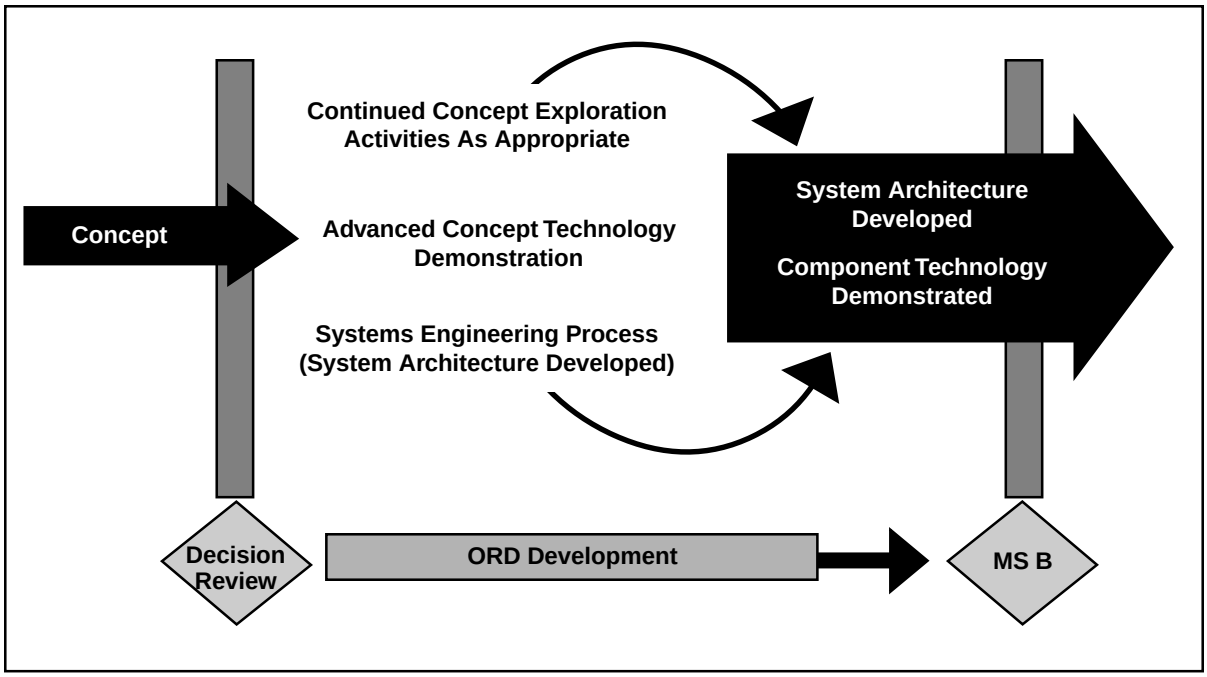


Figure 2-3. Concept and Technology Development (Component Advanced Development Stage)

will play in the system of systems of which it will be a part. System level interfaces must be established. Communications and interoperability requirements must be established, data flows defined, and operational concepts refined. Top level planning should also address the strategies that will be employed to maintain the supportability and affordability of the system over its life cycle including the use of common interface standards and open systems architectures. Important design requirements such as interoperability, open systems, and the use of commercial components should also be addressed during this stage of the program.

Risk reduction activities such as modeling and simulation, component testing, bench testing, and man-in-the-loop testing are emphasized as decisions are made regarding the various technologies that must be integrated to form the system. The primary focus at this stage is to ensure that the key technologies that represent the system components (assemblies and sub-systems) are well understood and are mature enough to justify their use in a system design and development effort. The next stage of the life cycle involves engineering development, so research and development (R&D) activities conducted within the science and technology appropriations should be completed during this stage.

System Development and Demonstration

The decision forum for entry into the System Development and Demonstration (SD&D) phase is the Milestone B event. Entry into this phase represents *program initiation*, the formal beginning of a system acquisition effort. This is the government commitment to pursue the program. Entry requires mature technology, validated requirements, and funding. At this point, the program requirement must be defined by an Operational Requirements Document (ORD). This phase consists of two primary stages, system integration (Figure 2-4) and system demonstration (Figure 2-5).

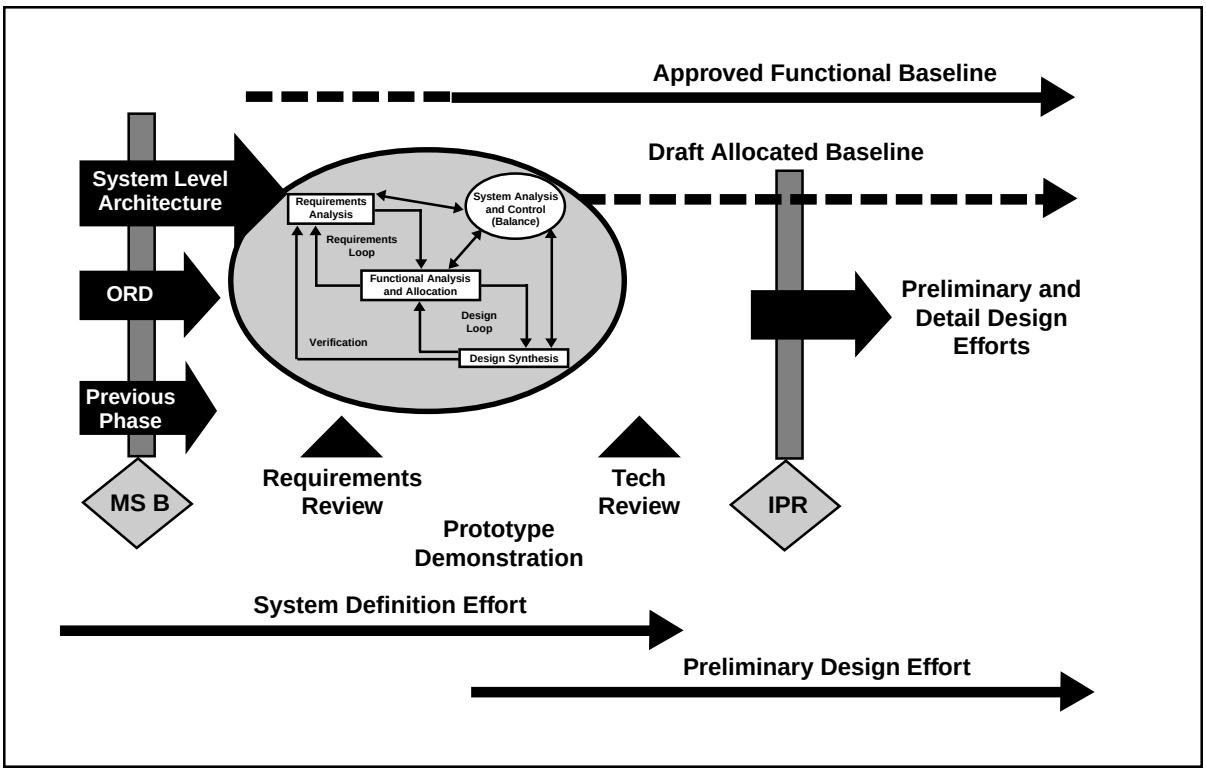


Figure 2-4. System Development and Demonstration (System Integration Stage)

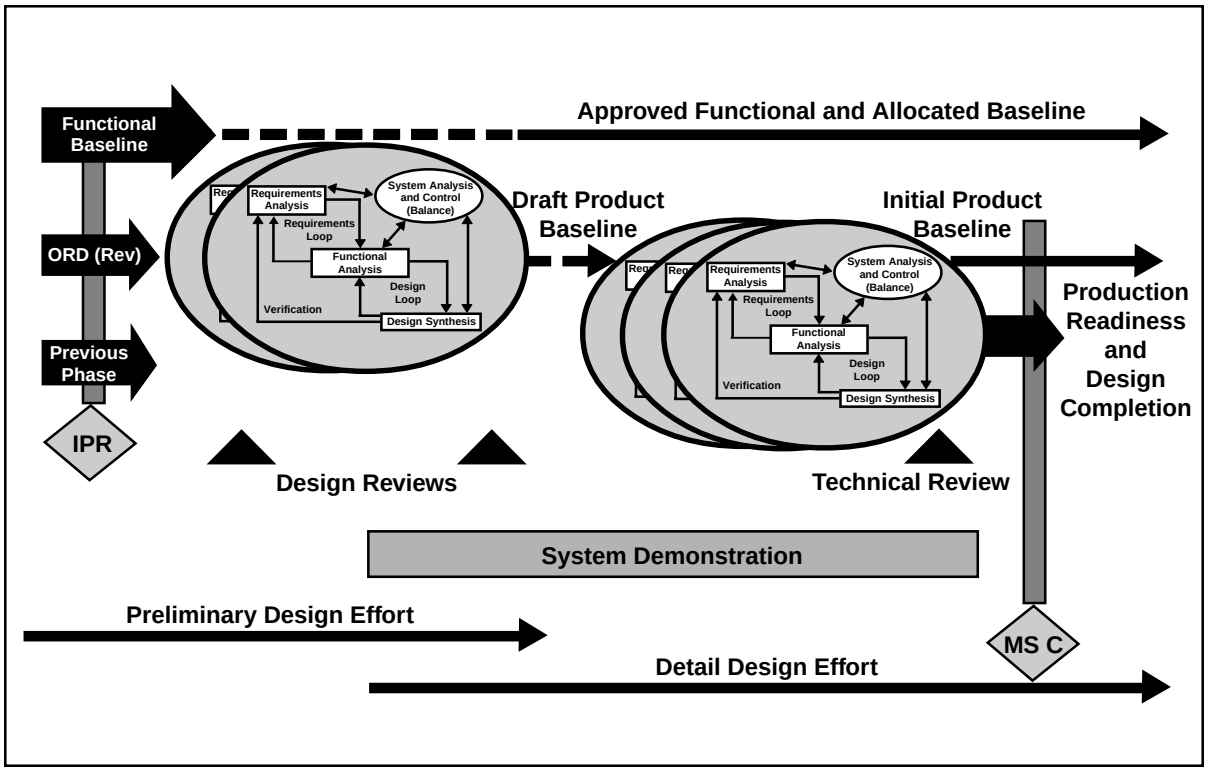


Figure 2-5. System Development and Demonstration (System Demonstration Stage)

There is no hard and fast guidance that stipulates precisely how the systems engineering process is to intersect with the DoD acquisition process. There are no specified technical events, e.g., DoD designated technical reviews, that are to be accomplished during identified stages of the SD&D phase. However, the results of a SD&D phase should support a production go-ahead decision at Milestone C. That being the case, the process described below reflects a configuration control approach that includes a system level design (functional baseline), final preliminary designs (allocated baselines), and detail designs (initial product baselines). Along with their associated documentation, they represent the systems engineering products developed during SD&D that are most likely needed to appropriately support Milestone C.

System Integration is that stage of SD&D that applies to systems that have yet to achieve system level design maturity as demonstrated by the integration of components at the system level in relevant environments. For an unprecedented system (one not previously defined and developed), this stage will continue the work begun in the component advanced development stage, but the flavor of the effort now becomes oriented to engineering development, rather than the research-oriented efforts that preceded this stage. A formal ORD, technology assessments, and a high-level system architecture have been established. (These will form major inputs to the systems engineering process.) The engineering focus becomes establishment and agreement on system level technical requirements stated such that designs based on those technical requirements will meet the intent of the operational requirements. The system level technical requirements are stabilized and documented in an approved system level requirements specification. In addition, the system-level requirements baseline (functional baseline) is established. This baseline is verified by development and demonstration of prototypes that show that key technologies can be integrated and that associated risks are sufficiently low to justify developing the system.

Program initiation signals the transition from an S&T focus to management by the program office. The R&D community, the users, and the program office may have all been involved in defining the concepts and technologies that will be key to the system development. It is appropriate at this point, therefore, to conduct a thorough requirements analysis and review to ensure that the user, the contractor, and the program office all hold a common view of the requirements and to preserve the lessons learned through the R&D efforts conducted in the earlier phase. The risk at this point can be high, because misunderstandings and errors regarding system-level requirements will flow down to subsequent designs and can eventually result in overruns and even program failure. The contractor will normally use the occasion of the system requirements review early in this stage to set the functional baseline that will govern the flow-down of requirements to lower level items as preliminary designs are elaborated.

The Interim Progress Review held between System Integration and System Demonstration has no established agenda. The agenda is defined by the MDA and can be flexible in its timing and content. Because of the flexibility built into the acquisition process, not all programs will conform to the model presented here. Programs may find themselves in various stages of preliminary design and detailed design as the program passes from one stage of the SD&D phase to the succeeding stage. With these caveats, **System Demonstration** (Figure 2-5) is the stage of the SD&D phase during which preliminary and detailed designs are elaborated, engineering demonstration models are fabricated, and the system is demonstrated in operationally relevant environments.

System level requirements are flowed down to the lower level items in the architecture and requirements are documented in the item performance specifications, which represent the preliminary design requirements for those items. The item performance specifications and supporting documentation, when finalized, together form the allocated baseline for the system. Design then proceeds toward the elaboration of a detailed design for the product or system. The product baseline is drafted as the design is elaborated. This physical description of the system may change as a result of testing that will follow, but it forms the basis for initial fabrication and demonstration of these items. If the system has been previously designed and fabricated, then, clearly, this process would be curtailed to take advantage of work already completed.

Following the elaboration of the detailed design, components and subsystems are fabricated, integrated, and tested in a bottom-up approach until system level engineering demonstration models are developed. These demonstration models are not, as a rule, production representative systems. Rather, they are system demonstration models, or integrated commercial items, that serve the purpose of enabling the developer to accomplish development testing on the integrated system. These models are often configured specifically to enable testing of critical elements of the system, for example, in the case of an aircraft development, there may be separate engineering demonstration models developed specifically to test the integrated avionics subsystems, while others demonstrate the flying qualities and flight controls subsystems.

For purposes of making decisions relative to progress through the acquisition process, these system-level demonstrations are not intended to be restricted to laboratory test and demonstrations. They are expected to include rigorous demonstrations that the integrated system is capable of performing operationally useful tasks under conditions that, while not necessarily equal to the rigor of formal operational testing, represent the eventual environment in which the system must perform. The result of these demonstrations provide the confidence required to convince the decision-maker (MDA) that the system is ready to enter the production phase of the life cycle. This implies that the system has demonstrated not only that technical performance is adequate, but also that the affordability, supportability, and producibility risks are sufficiently low to justify a production decision.

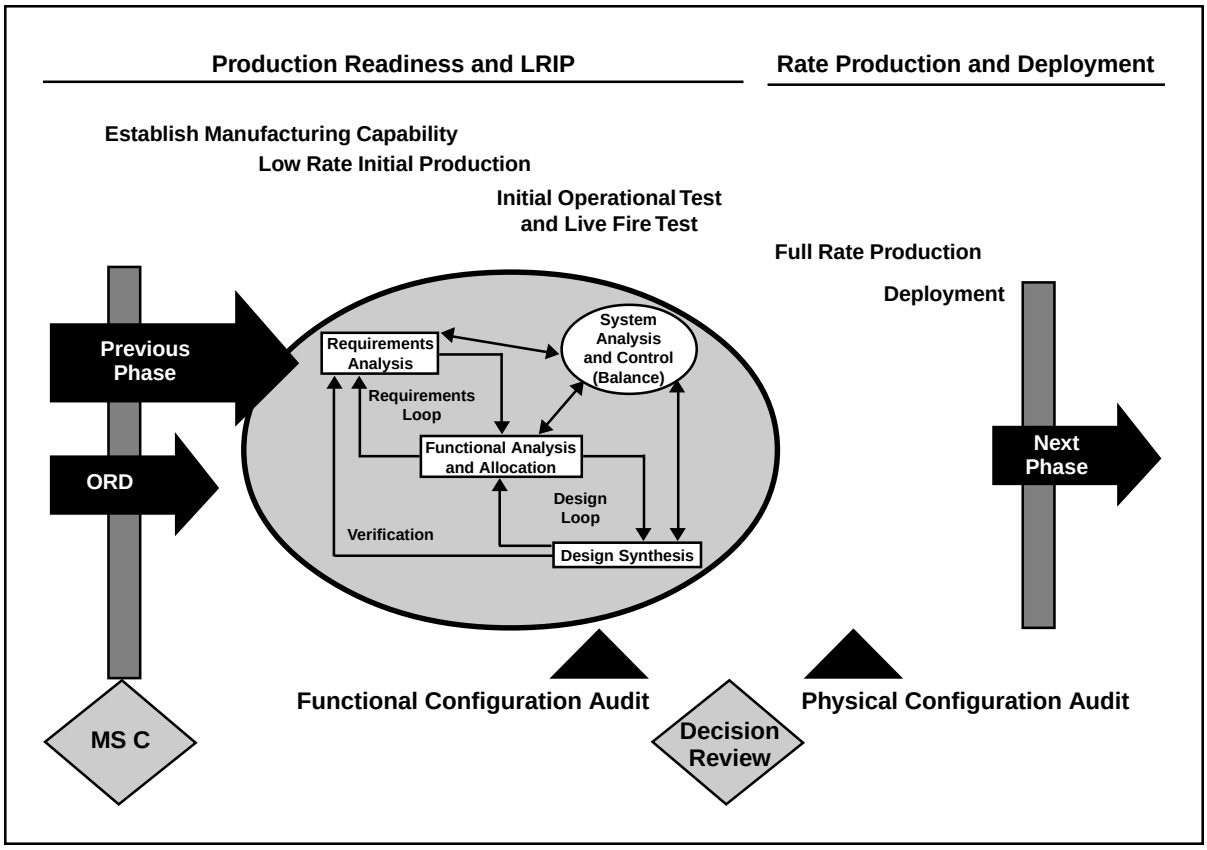


Figure 2-6. Production and Deployment

Production and Deployment

Milestone C is the decision forum for entry into the Production and Deployment phase of the program. Like other phases, this phase is also divided into stages of development. Production Readiness and LRIP is the first of these. At this point, system-level demonstrations have been accomplished and the product baseline is defined (although it will be refined as a result of the activities undertaken during this phase). The effort is now directed toward development of the manufacturing capability that will produce the product or system under development. When a manufacturing capability is established, a LRIP effort begins.

The development of a LRIP manufacturing capability has multiple purposes. The items produced are used to proof and refine the production line itself, items produced on this line are used for Initial Operational Test and Evaluation (IOT&E) and Live Fire Test and Evaluation (LFT&E), and this is also the means by which manufacturing rates are ramped upward to the rates intended when manufacturing is fully underway.

Following the completion of formal testing, the submission of required Beyond-LRIP and Live Fire Test reports, and a full-rate production decision by the MDA, the system enters the Rate Production and Deployment stage. After the decision to go to full-rate production, the systems engineering process is used to refine the design to incorporate findings of the independent operational testing, direction from the MDA, and feedback from deployment activities. Once configuration changes have been made and incorporated into production, and the configuration and production is considered stable, Follow-on Operational Test and Evaluation (FOT&E), if required, is typically performed on the stable production system. Test results are used to further refine the production configuration. Once this has been accomplished and production again becomes stable, detailed audits are held to

confirm that the Product Baseline documentation correctly describes the system being produced. The Product Baseline is then put under formal configuration control.

As the system is produced, individual items are delivered to the field units that will actually employ and use them in their military missions. Careful coordination and planning is essential to make the deployment as smooth as possible. Integrated planning is absolutely critical to ensure that the training, equipment, and facilities that will be required to support the system, once deployed, are in place as the system is delivered. The systems engineering function during this activity is focused on the integration of the functional specialties to make certain that no critical omission has been made that will render the system less effective than it might otherwise be. Achieving the user's required initial operational capability (IOC) schedule demands careful attention to the details of the transition at this point. Furthermore, as the system is delivered and operational capability achieved, the system transitions to the Sustainment and Disposal phase of the system life cycle—the longest and most expensive of all phases.

Sustainment and Disposal

There is no separate milestone decision required for a program to enter this phase of the system life cycle. The requirement for the Sustainment phase is implicit in the decision to produce and deploy the system. This phase overlaps the Production phase. Systems Engineering activities in the Sustainment phase are focused on maintaining the system's performance capability relative to the threat the system faces. If the military threat changes or a technology opportunity emerges, then the system may require modification. These modifications must be approved at an appropriate level for the particular change being considered. The change then drives the initiation of new systems engineering processes, starting the cycle (or parts of it) all over again.

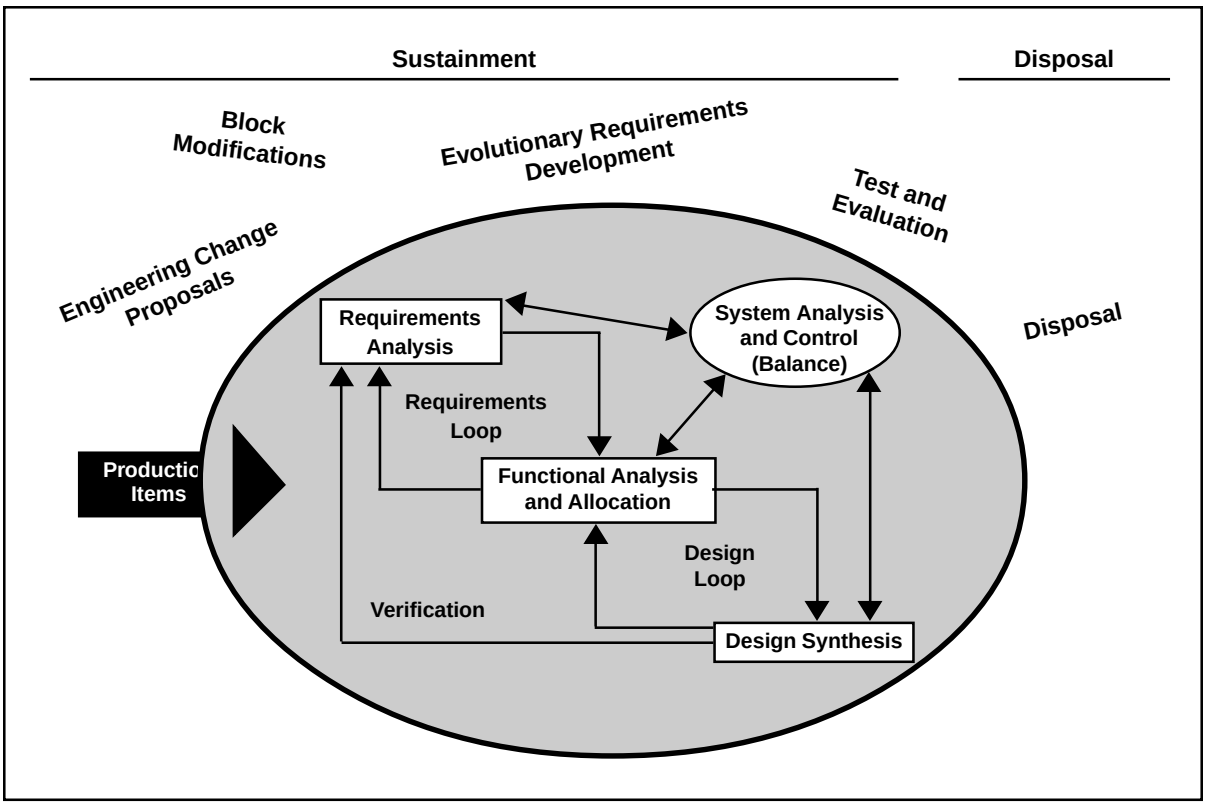


Figure 2-7. Sustainment and Disposal

Also, in an evolutionary development environment, there will be a continuing effort to develop and refine additional operational requirements based on the experience of the user with the portion of the system already delivered. As new requirements are generated, a new development cycle begins, with technology demonstrations, risk reduction, system demonstrations and testing—the same cycle just described—all tailored to the specific needs and demands of the technology to be added to the core system already delivered.

The final activity in the system life cycle is Disposal. System engineers plan for and conduct system disposal throughout the life cycle beginning with concept development. System components can require disposal because of decommissioning, their destruction, or irreparable damage. In addition, processes and material used for development, production, operation, or maintenance can raise disposal issues throughout the life cycle. Disposal must be done in accordance with applicable laws, regulations, and directives that are continually changing, usually to require more severe constraints. They mostly relate to security and environment issues that include recycling, material recovery, salvage, and disposal of by-products from development and production.

Every Development is Different

The process described above is intended to be very flexible in application. There is no "typical" system acquisition. The process is therefore defined to accommodate a wide range of possibilities, from systems that have been proven in commercial applications and are being purchased for military use, to systems that are designed and developed essentially from scratch. The path that the system development takes through the process will depend primarily on the level of maturity of the technology employed. As explained in the preceding discussion, if the system design will rely significantly on the use of proven or commercial items, then process can be adjusted to allow the system to skip phases, or move quickly from stage to stage within phases. If the type of system is well understood within the applicable technical domains, or it is an advanced version of a current well understood system, then the program definition and risk reduction efforts could be adjusted appropriately.

It is the role of the system engineer to advise the program manager of the recommended path that the development should take, outlining the reasons for that recommendation. The decision as to the appropriate path through the process is actually made by the MDA, normally based on the recommendation of the program manager. The process must be tailored to the specific development, both because it is good engineering and because it is DoD policy as part of the Acquisition Reform initiative. But tailoring must done with the intent of preserving the requirements traceability, baseline control, lifecycle focus, maturity tracking, and integration inherent in the systems engineering approach. The validity of tailoring the process should always be a risk management issue. Acquisition Reform issues will be addressed again in Part IV of this text.

2.5 SUMMARY POINTS

- The development, acquisition, and operation of military systems is governed by a multitude of public laws, formal DoD directives, instructions and manuals, numerous Service and Component regulations, and many inter-service and international agreements.

- The system acquisition life cycle process is a model used to guide the program manager through the process of maturing technology based systems and readying them for production and deployment to military users.

- The acquisition process model is intended to be flexible and to accommodate systems and technologies of varying maturities. Systems dependent on immature technologies will take longer to develop and produce, while those that employ mature technologies can proceed through the process relatively quickly.

- The system engineering effort is integrated into the systems acquisition process such that the activities associated with systems engineering

(development of documentation, technical reviews, configuration management, etc.) support and strengthen the acquisition process. The challenge for the engineering manager is to ensure that engineering activities are conducted at appropriate points in the process to ensure that the system has, in fact, achieved the levels of maturity expected prior to progressing into succeeding phases.

SUPPLEMENT 2-A

TECHNOLOGY READINESS LEVELS

Technology Readiness Level	Description
1. Basic principles observed and reported.	Lowest level of technology readiness. Scientific research begins to be translated into technology's basic properties.
2. Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
3. Analytical and experimental critical function and/or characteristic proof of concept.	Active R&D is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Component and/or breadboard validation in laboratory environment.	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.
5. Component and/or breadboard validation in relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in simulated environment. Examples include "high fidelity" laboratory integration of components.
6. System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond the breadboard tested for level 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in a simulated operational environment.
7. System prototype demonstration in an operational environment.	Prototype near or at planned operational system. Represents a major step up from level 6, requiring the demonstration of an actual system prototype in an operational environment. Examples include testing the prototype in a test bed aircraft.

(continued)

Technology Readiness Level	Description
8. Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this level represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9. Actual system proven through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.

SUPPLEMENT 2-B

EVOLUTIONARY ACQUISITION CONSIDERATIONS

The evolutionary approach to defense acquisition is the simple recognition that systems evolve as a result of changing user needs, technological opportunities, and knowledge gained in operation. Evolutionary Acquisition is not new to military systems. No naval ship in a class is the same; aircraft and vehicles have block changes designed to improve the design; variants of systems perform different missions; satellites have evolutionary improvements between the first and last launched; and due to fast evolving technology, computer resources and software systems are in constant evolution.

As shown by Figure 2-8, evolutionary acquisition starts with the development and delivery of a core capability. As knowledge is gained through system use and as technology changes, the system is evolved to a more useful or effective product. At the beginning of an evolutionary acquisition the ultimate user need is understood in general terms, but a core need that has immediate utility can be well-defined. Because future events will affect the eventual form of the product, the requirements can not be fully defined at the program initiation. However, the evolutionary development must be accomplished in a management system that demands

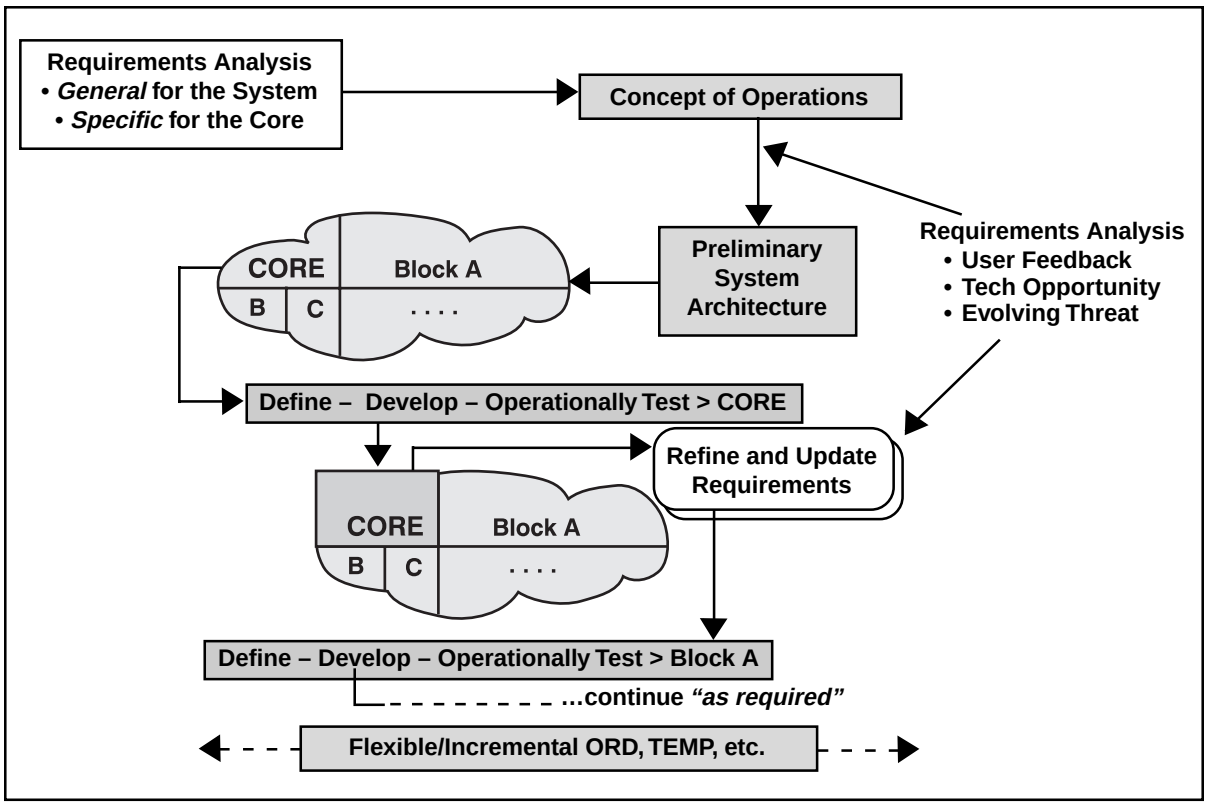


Figure 2-8. Evolutionary Acquisition

requirements validation, fully funded budgets, and rigorous review. In addition, the systems engineering function remains responsible for controlling requirements traceability and configuration control in the absence of complete definition of all requirements or final configurations. These constraints and concerns require the evolutionary approach be accomplished in a manner such the various concerns of users, developers, and managers are adequately addressed, while the risks associated with these issues are mitigated.

Acquisition Managment

Acquisition management requirements established in the DoD 5000 documents and associated component regulations or instructions establish a series of program-specific analyses, reports, and decision documents that support the milestone decision process. In addition, prior to decision points in the acquisition process, substantial coordination is required with an array of stakeholders. This process is resource consuming but necessary to establish the program's validity in the eyes of those responsible to approve the public resources committed to the program.

Evolutionary acquisition, by its nature, represents an "acquisition within an acquisition." On one level, the engineering manager is confronted with the management and control of the system as it progresses to its eventual final configuration, and, on another level, there is the management and control of the modifications, or blocks, that are successively integrated into the system as they are developed. The system has associated requirements, baselines, reviews—the normal elements of a system acquisition; however, each block also has specified requirements, configuration, and management activities. The challenge for technical management then becomes to ensure that good technical management principles are applied to the development of each block, while simultaneously ensuring that the definition and control of requirements and baselines at the system level include and accommodate the evolving architecture.

System Engineering Concerns

Evolutionary acquisition will require incremental and parallel development activities. These activities are developing evolutionary designs that represent a modification as well as an evolved system. The evolutionary upgrade is developed as a modification, but the new evolved system must be evaluated and verified as a system with new, evolved requirements. This implies that, though we can enter the acquisition process at any point, the basic baselining process required by systems engineering must somehow be satisfied for each block upgrade to assure requirements traceability and configuration control.

As shown by Figure 2-9, incremental delivery of capability can be the result of an evolutionary block upgrade or be an incremental release of capability within the approved program (or current evolutionary block) baseline. System engineering is concerned with both. There is no check list approach to structure these relationships, but the following is presented to provide some general guidance in a difficult and complex area of acquisition management planning and implementation.

Evolutionary upgrades may be based on known operational requirements where delivery of the capability is incremental due to immediate operational need, continuing refinement of the product baseline prior to full operational capability, and pre-planned parallel developments. If the modification is only at the allocated or product baseline, and the program's approved performance, cost, and schedule is not impacted, then the system would not necessarily require the management approvals and milestones normal to the acquisition process.

In all cases, the key to maintaining a proper systems engineering effort is to assure that architectures and configuration baselines used for evolutionary development can be upgraded with minimal impact to documented and demonstrated configurations. The risk associated with this issue can be significantly reduced through program planning that addresses optimization of the acquisition baseline and control of the evolving configuration.

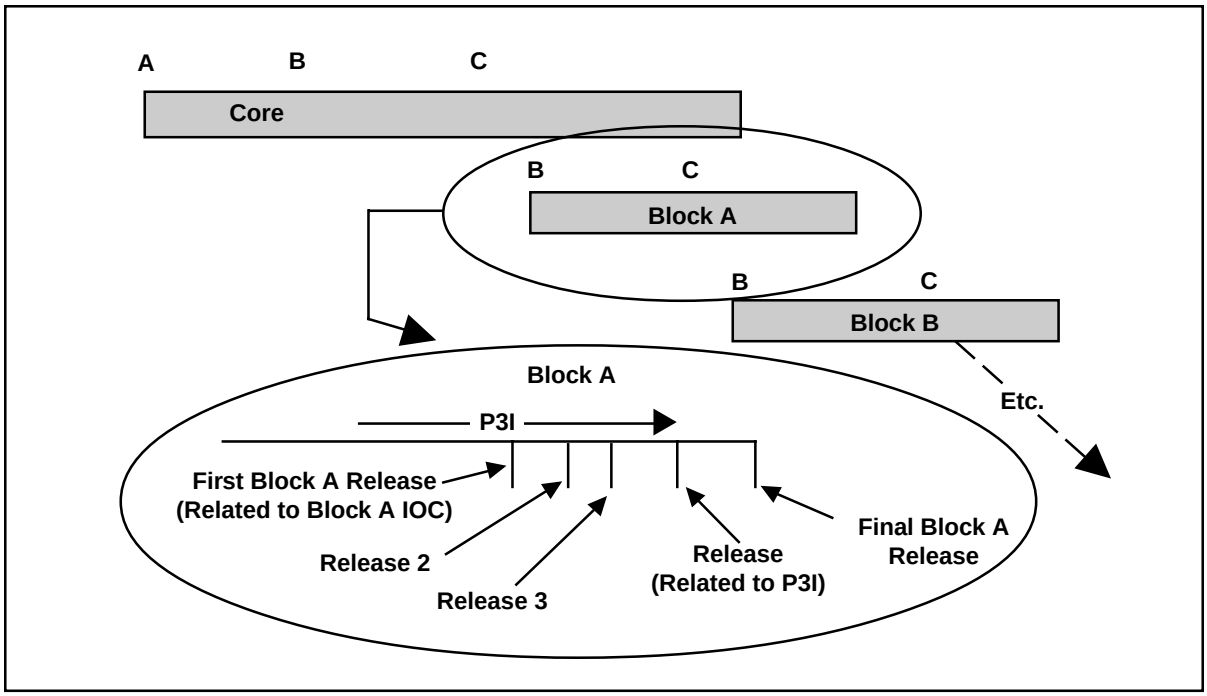


Figure 2-9. Incremental Release Within Evolutionary Blocks

Planning

Evolutionary acquisition program planning must clearly define how the core and evolutionary blocks will be structured, including:

1. A clear description of an operationally suitable core system including identification of subsystems and components most likely to evolve.

2. Establishment of a process for obtaining, evaluating and integrating operational feedback, technology advancements, and emerging commercial products.

3. Planning for evolutionary block upgrade evaluation, requirements validation, and program initiation.

4. Description of the management approach for evolutionary upgrades within a block and the constraints and controls associated with incremental delivery of capability.

5. Risk analysis of the developmental approach, both technical and managerial.

Systems engineering planning should emphasize:

1. The openness and modularity of the design of the core system architecture in order to facilitate modification and upgrades,

2. How baseline documentation is structured to improve flexibility for upgrade,

3. How evolutionary acquisition planning impacts baseline development and documentation control,

4. How technical reviews will be structured to best support the acquisition decision points, and

5. How risk management will monitor and control the management and technical complexity introduced by evolutionary development.

The basic system architecture should be designed to accommodate change. Techniques such as open architecting, functional partitioning, modular design, and open system design (all described later in this book) are key to planning for a flexible system that can be easily and affordably modified.

Notional Example of Evolutionary MAIS Acquisition Relationships					
Characterization	**System Level**	**Acquisition Program Level**	**Acquisition Documentation Required**	**Baseline**	**CM Authority**
Overall Need	Major Program or Business Area	Capstone or Sub-Portfolio	Capstone Acquisition Documentaion	Top Level Functional Baseline	PMO
Core and Evolutionary Blocks	Build or Block of Major Program	Acquisition Program	Full Program Documentation	Cumulative Functional and Allocated Baseline	PMO with Contractor Support
Incremental Delivery of Capability	Release or Version of Block	Internal to Acquisition Program	Separate Acquisition Documentation Not Required	Product Baseline	Contractor (Must Meet Allocated Basleine)
Associated Product Improvements	Application or Bridge	Parallel Product Improvement (Less than MAIS)	Component or Lower Decision Level Acquisition Processing	Functional, Allocated, and Product Baselines	PMO/Contractor

Table 2-1. Evolutionary Acquisition Relationships

Example

Table 2-1 illustrates some of the relationships discussed above as it might apply to a Major Automated Information System (MAIS) program. Due to the nature of complex software development, a MAIS acquisition inevitably will be an evolutionary acquisition. In the notional MAIS shown in the table, management control is primarily defined for capstone, program, subsystem or incremental delivery, and supporting program levels. The table provides relationships showing how key acquisition and system engineering activities correlate in the evolutionary environment. Probably the most important lesson of Table 2-1 is that these relationships are complex and if they are not planned for properly, they will present a significant risk to the program.

Summary

Acquisition oversight is directly related to the performance, cost, and schedule defined in the acquisition baseline. It establishes the approved scope of the developmental effort. Evolutionary development that exceeds the boundaries established by the acquisition baseline requires a new or revised acquisition review process with additional oversight requirements. The development and approval of the ORD and Acquisition Program Baseline are key activities that must structure an evolutionary process that provides user and oversight needs, budgetary control, requirements traceability, risk mitigation, and configuration management.

PART 2

THE SYSTEMS ENGINEERING PROCESS

CHAPTER 3

SYSTEMS ENGINEERING PROCESS OVERVIEW

3.1 THE PROCESS

The Systems Engineering Process (SEP) is a comprehensive, iterative and recursive problem solving process, applied sequentially top-down by integrated teams. It transforms needs and requirements into a set of system product and process descriptions, generate information for decision makers, and provides input for the next level of development. The process is applied sequentially, one level at a time, adding additional detail and definition with each level of development. As shown by Figure 3-1, the process includes: inputs and outputs; requirements analysis; functional analysis and allocation; requirements loop; synthesis; design loop; verification; and system analysis and control.

Systems Engineering Process Inputs

Inputs consist primarily of the customer's needs, objectives, requirements and project constraints.

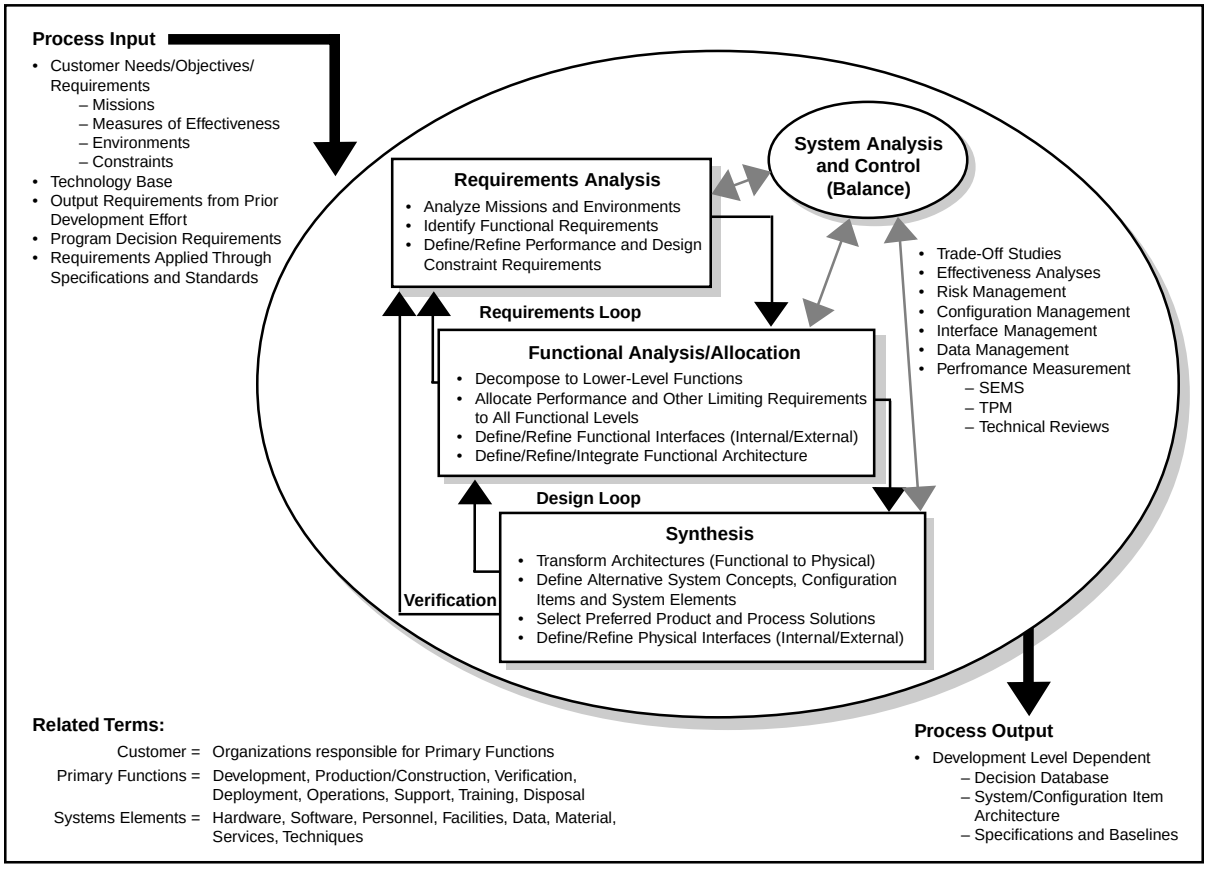


Figure 3-1. The Systems Engineering Process

Inputs can include, but are not restricted to, missions, measures of effectiveness, environments, available technology base, output requirements from prior application of the systems engineering process, program decision requirements, and requirements based on "corporate knowledge."

Requirements Analysis

The first step of the Systems Engineering Process is to analyze the process inputs. Requirements analysis is used to develop functional and performance requirements; that is, customer requirements are translated into a set of requirements that define what the system must do and how well it must perform. The systems engineer must ensure that the requirements are understandable, unambiguous, comprehensive, complete, and concise.

Requirements analysis must clarify and define functional requirements and design constraints. Functional requirements define quantity (how many), quality (how good), coverage (how far), time lines (when and how long), and availability (how often). Design constraints define those factors that limit design flexibility, such as: environmental conditions or limits; defense against internal or external threats; and contract, customer or regulatory standards.

Functional Analysis/Allocation

Functions are analyzed by decomposing higher-level functions identified through requirements analysis into lower-level functions. The performance requirements associated with the higher level are allocated to lower functions. The result is a description of the product or item in terms of what it does logically and in terms of the performance required. This description is often called the functional architecture of the product or item. Functional analysis and allocation allows for a better understanding of what the system has to do, in what ways it can do it, and to some extent, the priorities and conflicts associated with lower-level functions. It provides information essential to optimizing physical solutions. Key tools in functional analysis and allocation are Functional Flow Block Diagrams, Time Line Analysis, and the Requirements Allocation Sheet.

Requirements Loop

Performance of the functional analysis and allocation results in a better understanding of the requirements and should prompt reconsideration of the requirements analysis. Each function identified should be traceable back to a requirement. This iterative process of revisiting requirements analysis as a result of functional analysis and allocation is referred to as the requirements loop.

Design Synthesis

Design synthesis is the process of defining the product or item in terms of the physical and software elements which together make up and define the item. The result is often referred to as the physical architecture. Each part must meet at least one functional requirement, and any part may support many functions. The physical architecture is the basic structure for generating the specifications and baselines.

Design Loop

Similar to the requirements loop described above, the design loop is the process of revisiting the functional architecture to verify that the physical design synthesized can perform the required functions at required levels of performance. The design loop permits reconsideration of how the system will perform its mission, and this helps optimize the synthesized design.

Verification

For each application of the system engineering process, the solution will be compared to the requirements. This part of the process is called the verification loop, or more commonly, Verification. Each requirement at each level of development must be verifiable. Baseline documentation developed during the systems engineering process must establish the method of verification for each requirement.

Appropriate methods of verification include examination, demonstration, analysis (including modeling and simulation), and testing. Formal test and evaluation (both developmental and operational) are important contributors to the verification of systems.

Systems Analysis and Control

Systems Analysis and Control include technical management activities required to measure progress, evaluate and select alternatives, and document data and decisions. These activities apply to all steps of the sysems engineering process.

System analysis activities include trade-off studies, effectiveness analyses, and design analyses. They evaluate alternative approaches to satisfy technical requirements and program objectives, and provide a rigorous quantitative basis for selecting performance, functional, and design requirements. Tools used to provide input to analysis activities include modeling, simulation, experimentation, and test.

Control activities include risk management, configuration management, data management, and performance-based progress measurement including event-based scheduling, Technical Performance Measurement (TPM), and technical reviews.

The purpose of Systems Analysis and Control is to ensure that:

- Solution alternative decisions are made only after evaluating the impact on system effectiveness, life cycle resources, risk, and customer requirements,
- Technical decisions and specification requirements are based on systems engineering outputs,
- Traceability from systems engineering process inputs to outputs is maintained,
- Schedules for development and delivery are mutually supportive,
- Required technical disciplines are integrated into the systems engineering effort,
- Impacts of customer requirements on resulting functional and performance requirements are examined for validity, consistency, desirability, and attainability, and,
- Product and process design requirements are directly traceable to the functional and performance requirements they were designed to fulfill, and vice versa.

Systems Engineering Process Output

Process output is dependent on the level of development. It will include the decision database, the system or configuration item architecture, and the baselines, including specifications, appropriate to the phase of development. In general, it is any data that describes or controls the product configuration or the processes necessary to develop that product.

3.2 SUMMARY POINTS

- The system engineering process is the engine that drives the balanced development of system products and processes applied to each level of development, one level at a time.
- The process provides an increasing level of descriptive detail of products and processes with each system engineering process application. The output of each application is the input to the next process application.

CHAPTER 4

REQUIREMENTS ANALYSIS

4.1 SYSTEMS ENGINEERING PROCESS INPUTS

The inputs to the process include the customer's requirements and the project constraints. Requirements relate directly to the performance characteristics of the system being designed. They are the stated life-cycle customer needs and objectives for the system, and they relate to how well the system will work in its intended environment.

Constraints are conditions that exist because of limitations imposed by external interfaces, project support, technology, or life cycle support systems. Constraints bound the development teams' design opportunities.

Requirements are the primary focus in the systems engineering process because the process's primary purpose is to transform the requirements into designs. The process develops these designs within the constraints. They eventually must be verified to meet both the requirements and constraints.

Types of Requirements

Requirements are categorized in several ways. The following are common categorizations of requirements that relate to technical management:

Customer Requirements: Statements of fact and assumptions that define the expectations of the system in terms of mission objectives, environment, constraints, and measures of effectiveness and suitability (MOE/MOS). The customers are those that perform the eight primary functions of systems engineering (Chapter 1), with special emphasis on the operator as the key customer. Operational requirements will define the basic need and, at a minimum, answer the questions posed in Figure 4-1.

Operational distribution or deployment: Where will the system be used?

Mission profile or scenario: How will the system accomplish its mission objective?

Performance and related parameters: What are the critical system parameters to accomplish the mission?

Utilization environments: How are the various system components to be used?

Effectiveness requirements: How effective or efficient must the system be in performing its mission?

Operational life cycle: How long will the system be in use by the user?

Environment: What environments will the system be expected to operate in an effective manner?

Figure 4-1. Operational Requirements – Basic Questions

Functional Requirements: The necessary task, action or activity that must be accomplished. Functional (what has to be done) requirements identified in requirements analysis will be used as the top-level functions for functional analysis.

Performance Requirements: The extent to which a mission or function must be executed; generally measured in terms of quantity, quality, coverage, timeliness or readiness. During requirements analysis, performance (how well does it have to be done) requirements will be interactively developed across all identified functions based on system life cycle factors; and characterized in terms of the degree of certainty in their estimate, the degree of criticality to system success, and their relationship to other requirements.

Design Requirements: The "build to," "code to," and "buy to" requirements for products and "how to execute" requirements for processes expressed in technical data packages and technical manuals.

Derived Requirements: Requirements that are implied or transformed from higher-level requirement. For example, a requirement for long range or high speed may result in a design requirement for low weight.

Allocated Requirements: A requirement that is established by dividing or otherwise allocating a high-level requirement into multiple lower-level requirements. Example: A 100-pound item that consists of two subsystems might result in weight requirements of 70 pounds and 30 pounds for the two lower-level items.

Attributes of Good Requirements

The attributes of good requirements include the following:

- A requirement must be achievable. It must reflect need or objective for which a solution is technically achievable at costs considered affordable.
- It must be verifiable—that is, not defined by words such as excessive, sufficient, resistant, etc. The expected performance and functional utility must be expressed in a manner that allows verification to be objective, preferably quantitative.
- A requirement must be unambiguous. It must have but one possible meaning.
- It must be complete and contain all mission profiles, operational and maintenance concepts, utilization environments and constraints. All information necessary to understand the customer's need must be there.
- It must be expressed in terms of need, not solution; that is, it should address the "why" and "what" of the need, not how to do it.
- It must be consistent with other requirements. Conflicts must be resolved up front.
- It must be appropriate for the level of system hierarchy. It should not be too detailed that it constrains solutions for the current level of design. For example, detailed requirements relating to components would not normally be in a system-level specification.

4.2 REQUIREMENTS ANALYSIS

Requirements analysis involves defining customer needs and objectives in the context of planned customer use, environments, and identified system characteristics to determine requirements for system functions. Prior analyses are reviewed and updated, refining mission and environment definitions to support system definition.

Requirements analysis is conducted iteratively with functional analysis to optimize performance requirements for identified functions, and to verify that synthesized solutions can satisfy customer requirements. The purpose of Requirements Analysis is to:

- Refine customer objectives and requirements;
- Define initial performance objectives and refine them into requirements;
- Identify and define constraints that limit solutions; and
- Define functional and performance requirements based on customer provided measures of effectiveness.

In general, Requirements Analysis should result in a clear understanding of:

- Functions: What the system has to do,
- Performance: How well the functions have to be performed,
- Interfaces: Environment in which the system will perform, and
- Other requirements and constraints.

The understandings that come from requirements analysis establish the basis for the functional and physical designs to follow. Good requirements analysis is fundamental to successful design definition.

Inputs

Typical inputs include customer needs and objectives, missions, MOE/MOS, environments, key performance parameters (KPPs), technology base, output requirements from prior application of SEP, program decision requirements, and suitability requirements. (See Figure 4-2 for additional considerations.)

Input requirements must be comprehensive and defined for both system products and system processes such as development, manufacturing, verification, deployment, operations, support, training and disposal (eight primary functions).

Role of Integrated Teams

The operator customers have expertise in the operational employment of the product or item being developed. The developers (government and contractor) are not necessarily competent in the operational aspects of the system under development. Typically, the operator's need is neither clearly nor completely expressed in a way directly

- **Inputs converted to putputs:**
  - Customer requirements
  - Mission and MOEs (MNS, ORD)
  - Maintenance concept and other life-cycle function planning
  - SE outputs from prior development efforts
- **Controls:**
  - Laws and organizational policies and procedures
  - Military specific requirements
  - Utilization environments
  - Tech base and other constraints
- **Enablers:**
  - Multi-disciplinary product teams
  - Decision and requirements database including system/configuration item descriptions from prior efforts
  - System analysis and control

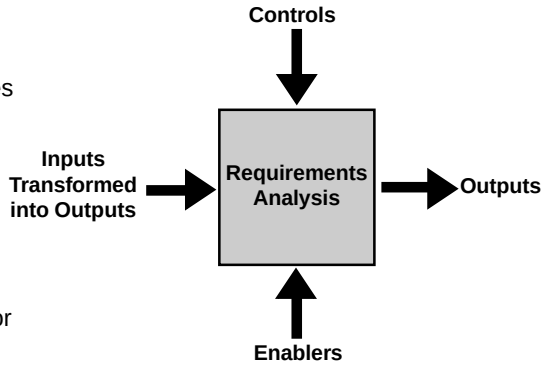


Figure 4-2. Inputs to Requirements Analysis

usable by developers. It is unlikely that developers will receive a well-defined problem from which they can develop the system specification. Thus, teamwork is necessary to understand the problem and to analyze the need. It is imperative that customers are part of the definition team.

On the other hand, customers often find it easier to describe a system that attempts to solve the problem rather than to describe the problem itself. Although these "solutions" may be workable to some extent, the optimum solution is obtained through a proper technical development effort that properly balances the various customer mission objectives, functions, MOE/MOS, and constraints. An integrated approach to product and process development will balance the analysis of requirements by providing understanding and accommodation among the eight primary functions.

Requirements Analysis Questions

Requirements Analysis is a process of inquiry and resolution. The following are typical questions that can initiate the thought process:

- What are the reasons behind the system development?
- What are the customer expectations?
- Who are the users and how do they intend to use the product?
- What do the users expect of the product?
- What is their level of expertise?
- With what environmental characteristics must the system comply?
- What are existing and planned interfaces?
- What functions will the system perform, expressed in customer language?
- What are the constraints (hardware, software, economic, procedural) to which the system must comply?
- What will be the final form of the product: such as model, prototype, or mass production?

This list can start the critical, inquisitive outlook necessary to analyze requirements, but it is only the beginning. A tailored process similar to the one at the end of this chapter must be developed to produce the necessary requirements analysis outputs.

4.3 REQUIREMENTS ANALYSIS OUTPUTS

The requirements that result from requirements analysis are typically expressed from one of three perspectives or views. These have been described as the Operational, Functional, and Physical views. All three are necessary and must be coordinated to fully understand the customers' needs and objectives. All three are documented in the decision database.

Operational View

The Operational View addresses how the system will serve its users. It is useful when establishing requirements of "how well" and "under what condition." Operational view information should be documented in an operational concept document that identifies:

- Operational need definition,
- System mission analysis,
- Operational sequences,
- Operational environments,
- Conditions/events to which a system must respond,
- Operational constraints on system,
- Mission performance requirements,
- User and maintainer roles (defined by job tasks and skill requirements or constraints),

- Structure of the organizations that will operate, support and maintain the system, and

- Operational interfaces with other systems.

Analyzing requirements requires understanding the operational and other life cycle needs and constraints.

Functional View

The Functional View focuses on WHAT the system must do to produce the required operational behavior. It includes required inputs, outputs, states, and transformation rules. The functional requirements, in combination with the physical requirements shown below, are the primary sources of the requirements that will eventually be reflected in the system specification. Functional View information includes:

- System functions,

- System performance,
  - Qualitative — how well
  - Quantitative — how much, capacity
  - Timeliness — how often

- Tasks or actions to be performed,

- Inter-function relationships,

- Hardware and software functional relationships,

- Performance constraints,

- Interface requirements including identification of potential open-system opportunities (potential standards that could promote open systems should be identified),

- Unique hardware or software, and

- Verification requirements (to include inspection, analysis/simulation, demo, and test).

Physical View

The Physical View focuses on HOW the system is constructed. It is key to establishing the physical interfaces among operators and equipment, and technology requirements. Physical View information would normally include:

- Configuration of System:
  - Interface descriptions,
  - Characteristics of information displays and operator controls,
  - Relationships of operators to system/ physical equipment, and
  - Operator skills and levels required to perform assigned functions.

- Characterization of Users:
  - Handicaps (special operating environments), and
  - Constraints (movement or visual limitations).

- System Physical Limitations:
  - Physical limitations (capacity, power, size, weight),
  - Technology limitations (range, precision, data rates, frequency, language),
  - Government Furinished Equipment (GFE), Commercial-Off-the-Shelf (COTS), Nondevelopmental Item (NDI), reusability requirements, and
  - Necessary or directed standards.

4.4 SUMMARY POINTS

- An initial statement of a need is seldom defined clearly.

- A significant amount of collaboration between various life cycle customers is necessary to produce an acceptable requirements document.

- Requirements are a statement of the problem to be solved. Unconstrained and nonintegrated requirements are seldom sufficient for designing a solution.

- Because requirements from different customers will conflict, constraints will limit options, and resources are not unlimited; trade studies must be accomplished in order to select a balanced set of requirements that provide feasible solutions to customer needs.

SUPPLEMENT 4-A

A PROCEDURE FOR REQUIREMENTS ANALYSIS

The following section provides a list of tasks that represents a plan to analyze requirements. Part of this notional process is based on the 15 requirements analysis tasks listed in IEEE P1220. This industry standard and others should be consulted when preparing engineering activities to help identify and structure appropriate activities.

As with all techniques, the student should be careful to tailor; that is, add or subtract, as suits the particular system being developed. Additionally, these tasks, though they build on each other, should not be considered purely sequential. Every task contributes understanding that may cause a need to revisit previous task decisions. This is the nature of all System Engineering activities.

Preparation: Establish and Maintain Decision Database

When beginning a systems engineering process, be sure that a system is in place to record and manage the decision database. The decision database is an historical database of technical decisions and requirements for future reference. It is the primary means for maintaining requirements traceability. This database decision management system must be developed or the existing system must be reviewed and upgraded as necessary to accommodate the new stage of product development. A key part of this database management system is a Requirements Traceability Matrix that maps requirements to subsystems, configuration items, and functional areas.

This must be developed, updated, and reissued on a regular basis. All requirements must be recorded. ***Remember: If it is not recorded, it cannot be an approved requirement!***

The 15 Tasks of IEEE P1220

The IEEE Systems Engineering Standard offers a process for performing Requirements Analysis that comprehensively identifies the important tasks that must be performed. These 15 task areas to be analyzed follow and are shown in Figure 4-3.

1. **Customer expectations**
2. **Project and enterprise constraints**
3. **External constraints**
4. **Operational scenarios**
5. **Measure of effectiveness (MOEs)**
6. **System boundaries**
7. **Interfaces**
8. **Utilization environments**
9. **LIfe cycle**
10. **Functional requirements**
11. **Performance requirements**
12. **Modes of operation**
13. **Technical performance measures**
14. **Physical characteristics**
15. **Human systems integration**

Figure 4-3. IEEE P1220 Requirements Analysis Task Areas

Task 1. Customer Expectations

Define and quantify customer expectations. They may come from any of the eight primary functions, operational requirements documents, mission needs, technology-based opportunity, direct communications with customer, or requirements from a higher system level. The purpose of this task is to determine what the customer wants the system to accomplish, and how well each function must be accomplished. This should include natural and induced environments in which the product(s) of the system must operate or be used, and constraints (e.g. funding, cost, or price objectives, schedule, technology, nondevelopmental and reusable items, physical characteristics, hours of operation per day, on-off sequences, etc.).

Task 2. Project and Enterprise Constraints

Identify and define constraints impacting design solutions. Project specific constraints can include:

- Approved specifications and baselines developed from prior applications of the Systems Engineering Process,
- Costs,
- Updated technical and project plans,
- Team assignments and structure,
- Control mechanisms, and
- Required metrics for measuring progress.

Enterprise constraints can include:

- Management decisions from a preceding technical review,
- Enterprise general specifications,
- Standards or guidelines,
- Policies and procedures,
- Domain technologies, and
- Physical, financial, and human resource allocations to the project.

Task 3. External Constraints

Identify and define external constraints impacting design solutions or implementation of the Systems Engineering Process activities. External constraints can include:

- Public and international laws and regulations,
- Technology base,
- Compliance requirements: industry, international, and other general specifications, standards, and guidelines which require compliance for legal, interoperability, or other reasons,
- Threat system capabilities, and
- Capabilities of interfacing systems.

Task 4. Operational Scenarios

Identify and define operational scenarios that scope the anticipated uses of system product(s). For each operational scenario, define expected:

- Interactions with the environment and other systems, and
- Physical interconnectivities with interfacing systems, platforms, or products.

Task 5. Measures of Effectiveness and Suitability (MOE/MOS)

Identify and define systems effectiveness measures that reflect overall customer expectations and satisfaction. MOEs are related to how well the system must perform the customer's mission. Key MOEs include mission performance, safety, operability, reliability, etc. MOSs are related to how well the system performs in its intended environment and includes measures of supportability, maintainability, ease of use, etc.

Task 6. System Boundaries

Define system boundaries including:

- Which system elements are under design control of the performing activity and which fall outside of their control, and
- The expected interactions among system elements under design control and external and/or higher-level and interacting systems outside the system boundary (including open systems approaches).

Task 7. Interfaces

Define the functional and physical interfaces to external or higher-level and interacting systems, platforms, and/or products in quantitative terms (include open systems approach). Functional and physical interfaces would include mechanical, electrical, thermal, data, control, procedural, and other interactions. Interfaces may also be considered from an internal/external perspective. Internal interfaces are those that address elements inside the boundaries established for the system addressed. These interfaces are generally identified and controlled by the contractor responsible for developing the system. External interfaces, on the other hand, are those which involve entity relationships outside the established boundaries, and these are typically defined and controlled by the government.

Task 8. Utilization Environments

Define the environments for each operational scenario. All environmental factors (natural or induced) which may impact system performance must be identified and defined. Environmental factors include:

- Weather conditions (e.g., rain, snow, sun, wind, ice, dust, fog),
- Temperature ranges,
- Topologies (e.g., ocean, mountains, deserts, plains, vegetation),
- Biological (e.g., animal, insects, birds, fungi),
- Time (e.g., dawn, day, night, dusk), and
- Induced (e.g., vibration, electromagnetic, chemical).

Task 9. Life Cycle Process Concepts

Analyze the outputs of tasks 1-8 to define key life cycle process requirements necessary to develop, produce, test, distribute, operate, support, train, and dispose of system products under development. Use integrated teams representing the eight primary functions. Focus should be on the cost drivers and higher risk elements that are anticipated to impact supportability and affordability over the useful life of the system.

Task 10. Functional Requirements

Define what the system must accomplish or must be able to do. Functions identified through requirements analysis will be further decomposed during functional analysis and allocation.

Task 11. Performance Requirements

Define the performance requirements for each higher-level function performed by the system. Primary focus should be placed on performance requirements that address the MOEs, and other KPPs established in test plans or identified as interest items by oversight authorities.

Task 12. Modes of Operation

Define the various modes of operation for the system products under development. Conditions (e.g., environmental, configuration, operational, etc.) that determine the modes of operation should be included in this definition.

Task 13. Technical Performance Measures (TPMs)

Identify the key indicators of system performance that will be tracked during the design process. Selection of TPMs should be limited to critical

technical thresholds and goals that, if not met, put the project at cost, schedule, or performance risk. TPMs involve tracking the actual versus planned progress of KPPs such that the manager can make judgments about technical progress on a by-exception basis. To some extent TPM selection is phase dependent. They must be reconsidered at each systems engineering process step and at the beginning of each phase.

Task 14. Physical Characteristics

Identify and define required physical characteristics (e.g., color, texture, size, weight, buoyancy) for the system products under development. Identify which physical characteristics are true constraints and which can be changed, based on trade studies.

Task 15. Human Factors

Identify and define human factor considerations (e.g., physical space limits, climatic limits, eye movement, reach, ergonomics) which will affect operation of the system products under development. Identify which human systems integration are constraints and which can be changed based on trade studies.

Follow-on Tasks

The follow-on tasks are related to the iterative nature of the Systems Engineering Process:

Integrate Requirements:

Take an integrated team approach to requirements determination so that conflicts among and between requirements are resolved in ways that result in design requirements that are balanced in terms of both risk and affordability.

Validate Requirements:

During Functional Analysis and Allocation, validate that the derived functional and performance can be traced to the operational requirements.

Verify Requirements:

- Coordinate design, manufacturing, deployment and test processes,
- Ensure that requirements are achievable and testable,
- Verify that the design-to-cost goals are achievable, and
- Verify that the functional and physical architectures defined during Functional Analysis/ Allocation and Synthesis meet the integrated technical, cost, and schedule requirements within acceptable levels of risk.

CHAPTER 5

FUNCTIONAL ANALYSIS AND ALLOCATION

5.1 INTRODUCTION

The purpose of this systems engineering process activity is to transform the functional, performance, interface and other requirements that were identified through requirements analysis into a coherent description of system functions that can be used to guide the Design Synthesis activity that follows. The designer will need to know what the system must do, how well, and what constraints will limit design flexibility.

This is accomplished by arranging functions in logical sequences, decomposing higher-level functions into lower-level functions, and allocating performance from higher- to lower-level functions. The tools used include functional flow block diagrams and timeline analysis; and the product is a functional architecture, i.e., a description of the system—but in terms of functions and performance parameters, rather than a physical description. Functional Analysis and Allocation facilitates traceability from requirements to the solution descriptions that are the outcome of Design Synthesis.

Functions are discrete actions (use action verbs) necessary to achieve the system's objectives. These functions may be stated explicitly, or they may be derived from stated requirements. The functions will ultimately be performed or accomplished through use of equipment, personnel, facilities, software, or a combination.

5.2 FUNCTIONAL ANALYSIS AND ALLOCATION

Functional and performance requirements at any level in the system are developed from higher-level requirements. Functional Analysis and Allocation is repeated to define successively lower-level functional and performance requirements, thus defining architectures at ever-increasing levels of detail. System requirements are allocated and defined in sufficient detail to provide design and verification criteria to support the integrated system design.

This top-down process of translating system-level requirements into detailed functional and performance design criteria includes:

- Defining the system in functional terms, then decomposing the top-level functions into subfunctions. That is, identifying at successively lower levels what actions the system has to do,
- Translating higher-level performance requirements into detailed functional and performance design criteria or constraints. That is, identifying how well the functions have to be performed,
- Identifying and defining all internal and external functional interfaces,
- Identifying functional groupings to minimize and control interfaces (functional partitioning),
- Determining the functional characteristics of existing or directed components in the system and incorporating them in the analysis and allocation,
- Examining all life cycle functions, including the eight primary functions, as appropriate for the specific project,
- Performing trade studies to determine alternative functional approaches to meet requirements, and

- Revisiting the requirements analysis step as necessary to resolve functional issues.

The objective is to identify the functional, performance, and interface design requirements; it is not to design a solution…yet!

Functional Partitioning

Functional partitioning is the process of grouping functions that logically fit with the components likely to be used, and to minimize functional interfaces. Partitioning is performed as part of functional decomposition. It identifies logical groupings of functions that facilitate the use of modular components and open-system designs. Functional partitioning is also useful in understanding how existing equipment or components (including commercial) will function with or within the system.

Requirements Loop

During the performance of the Functional Analysis and Allocation process, it is expected that revisiting the requirements analysis process will be necessary. This is caused by the emergence of functional issues that will require re-examination of the higher-level requirements. Such issues might include directed components or standards that cause functional conflict, identification of a revised approach to functional sequencing, or, most likely, a conflict caused by mutually incompatible requirements.

Figure 5-1 gives an overview of the basic parameters of Functional Analysis and Allocation. The output of the process is the functional architecture. In its most basic form, the functional architecture is a simple hierarchical decomposition of the functions with associated performance requirements. As the architecture definition is refined and made more specific with the performance of the

- **Outputs:**
  - Functional architecture and supporting detail
- **Inputs:**
  - Outputs of the Requirements Analysis
- **Enablers:**
  - Multi-discipline product teams, decision database; Tools & Models, such as QFD, Functional Flow Block Diagrams, IDEF, N2 charts, Requirement Allocation Sheet, Timelines, Data Flow Diagrams, State/Mode Diagrams, Behavior Diagrams
- **Controls:**
  - Constraints; GFE, COTS, & Reusable S/W; System concept & subsystem choices; organizational procedures
- **Activities:**
  - Define system states and modes
  - Define system functions & external interfaces
  - Define functional interfaces
  - Allocate performance requirements to functions
  - Analyze performance
  - Analyze timing and resources
  - Analyze failure mode effects and criticality
  - Define fault detection and recovery behavior
  - Integrate functions

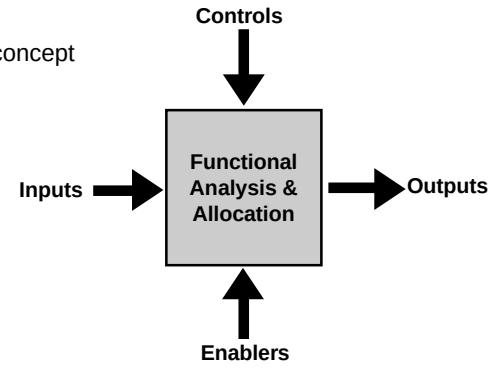


Figure 5-1. Functional Analysis and Allocation

activities listed in Figure 5-1, the functional architecture becomes more detailed and comprehensive. These activities provide a functional architecture with sufficient detail to support the Design Synthesis. They are performed with the aid of traditional tools that structure the effort and provide documentation for traceability. There are many tools available. The following are traditional tools that represent and explain the primary tasks of Functional Analysis and Allocation (several of these are defined and illustrated beginning on page 49):

- Functional flow block diagrams that define task sequences and relationships,
- IDEF0 diagrams that define process and data flows,
- Timeline analyses that define the time sequence of time critical functions, and
- Requirements allocation sheets that identify allocated performance and establish traceability of performance requirements.

5.3 FUNCTIONAL ARCHITECTURE

The functional architecture is a top-down decomposition of system functional and performance requirements. The architecture will show not only the functions that have to be performed, but also the logical sequencing of the functions and performance requirements associated with the functions. It also includes the functional description of existing and government-furnished items to be used in the system. This may require reverse engineering of these existing components.

The functional architecture produced by the Functional Analysis and Allocation process is the detailed package of documentation developed to analyze the functions and allocate performance requirements. It includes the functional flow block diagrams, timeline sheets, requirements allocation sheets, IDEF0 diagrams, and all other documentation developed to describe the functional characteristics of the system. However, there is a basic logic to the functional architecture, which in its preliminary form is presented in the example of Figure 5-2. The Functional Analysis and Allocation process would normally begin with the

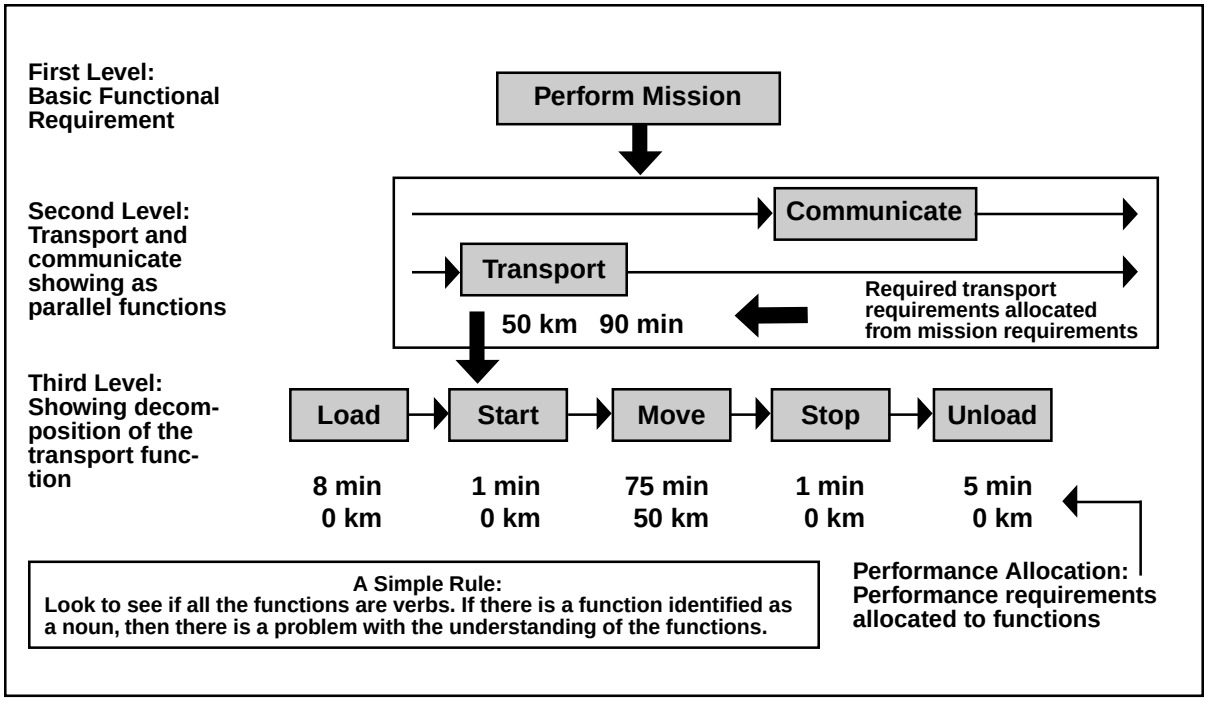


Figure 5-2. Functional Architecture Example

IPT drafting such a basic version of the architecture. This would generally give the IPT an understanding of the scope and direction of the effort.

Functional Architecture Example

The Marine Corps has a requirement to transport troops in squad-level units over a distance of 50 kilometers. Troops must be transported within 90 minutes from the time of arrival of the transport system. Constant communication is required during the transportation of troops. Figure 5-2 illustrates a preliminary functional architecture for this simple requirement.

5.4 SUMMARY POINTS

Functional analysis begins with the output of requirements analysis (that is, the identification of higher-level functional and performance requirements). Functional Analysis and Allocation consists of decomposition of higher-level functions to lower-levels and then allocation of requirements to those functions.

- There are many tools available to support the development of a Functional Architecture, such as: functional-flow block diagrams, timeline analysis sheet, requirements allocation sheet, Integrated Definition, and others.

- Use of the tools illustrated in this chapter is not mandatory, but the process they represent is:

  – Define task sequences and relationships (functional flow block diagram (FFBD)),

  – Define process and data flows (IDEF0 diagrams),

  – Define the time sequence of time-critical functions (timeline analysis sheets (TLS)), and

  – Allocate performance and establish traceability of performance requirements (requirements allocation sheets (RAS)).

SUPPLEMENT 5-A

FUNCTIONAL FLOW BLOCK DIAGRAM

The purpose of the functional flow block diagram (FFBD) is to describe system requirements in functional terms.

Objectives

The FFBD is structured to ensure that:

- All life cycle functions are covered.
- All elements of system are identified and defined (e.g. prime equipment, training, spare parts, data, software, etc.).
- System support requirements are identified to specific system functions.
- Proper sequencing of activities and design relationships are established including critical design interfaces.

Characteristics

The FFBD is functionally oriented—not solution oriented. The process of defining lower-level functions and sequencing relationships is often referred to as functional decomposition. It allows traceability vertically through the levels. It is a key step in developing the functional architecture from which designs may be synthesized.

Figure 5-3 shows the flow-down structure of a set of FFBDs and Figure 5-4 shows the format of an FFBD.

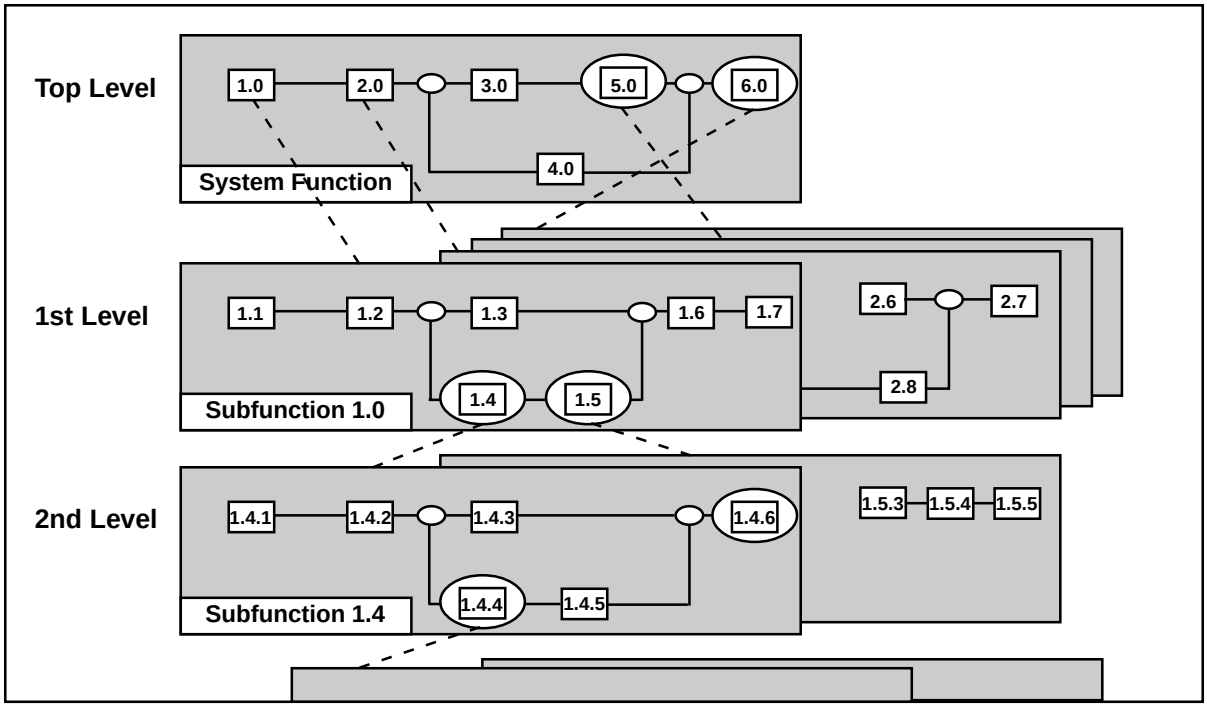


Figure 5-3. FFBD Traceability and Indenture

Key FFBD Attributes

Function block: Each function on an FFBD should be separate and be represented by single box (solid line). Each function needs to stand for definite, finite, discrete action to be accomplished by system elements.

Function numbering: Each level should have a consistent number scheme and provide information concerning function origin. (E.g., top level—1.0, 2.0, 3.0, etc; first indenture (level 2)—1.1, 1.2, 1.3, etc; second indenture (level 3)—1.1.1, 1.1.2, 1.1.3, etc.) These numbers establish identification and relationships that will carry through all Functional Analysis and Allocation activities and facilitate traceability from lower to top levels.

Functional reference: Each diagram should contain a reference to other functional diagrams by using a functional reference (box in brackets).

Flow connection: Lines connecting functions should only indicate function flow and not a lapse in time or intermediate activity.

Flow direction: Diagrams should be laid out so that the flow direction is generally from left to right. Arrows are often used to indicate functional flows.

Summing gates: A circle is used to denote a summing gate and is used when AND/OR is present. AND is used to indicate parallel functions and all conditions must be satisfied to proceed. OR is used to indicate that alternative paths can be satisfied to proceed.

GO and NO-GO paths: "G" and "bar G" are used to denote "go" and "no-go" conditions. These symbols are placed adjacent to lines leaving a particular function to indicate alternative paths.

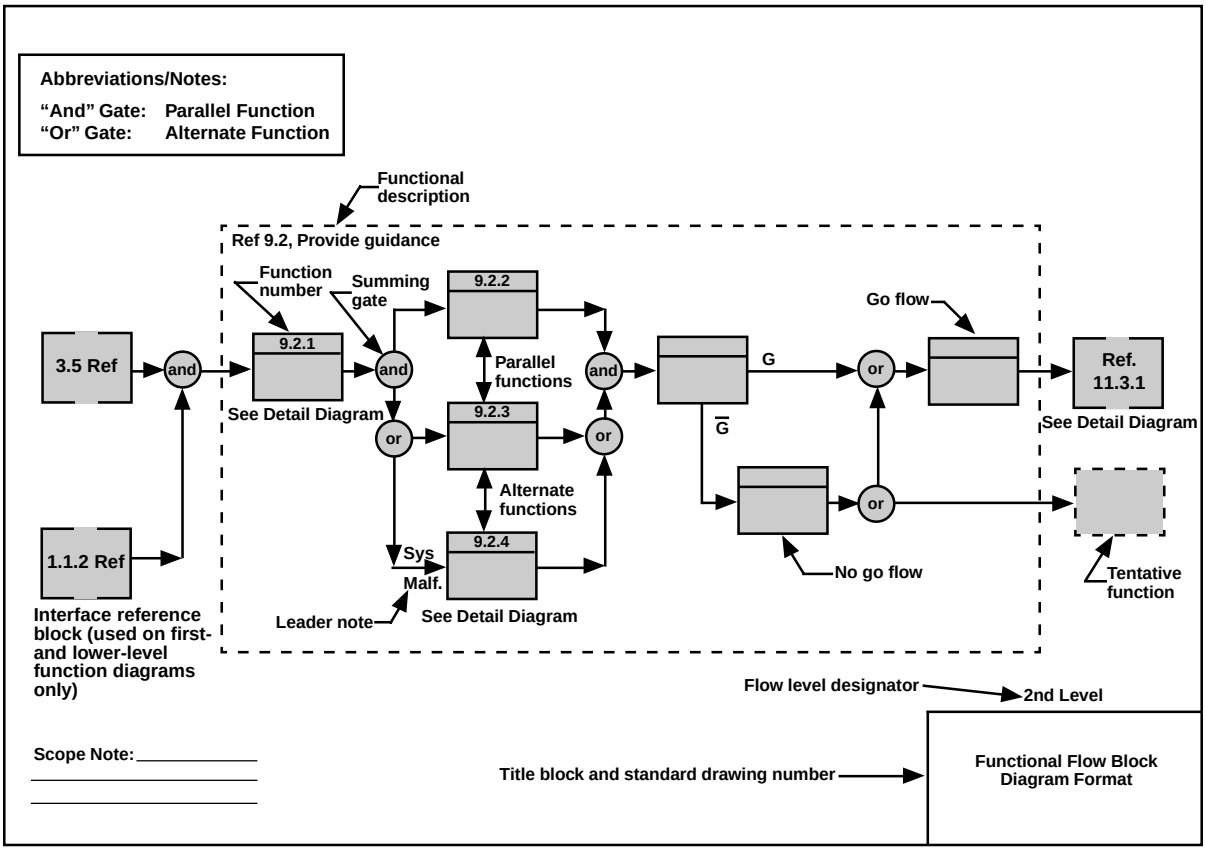


Figure 5-4. Functional Flow Block Diagrams (FFBD) Format

SUPPLEMENT 5-B

IDEF0

Integration Definition for Function Modeling (IDEF0) is a common modeling technique for the analysis, development, re-engineering, and integration of information systems; business processes; or software engineering analysis. Where the FFBD is used to show the functional flow of a product, IDEF0 is used to show data flow, system control, and the functional flow of life cycle processes.

IDEF0 is capable of graphically representing a wide variety of business, manufacturing and other types of enterprise operations to any level of detail. It provides rigorous and precise description, and promotes consistency of usage and interpretation. It is well-tested and proven through many years of use by government and private industry. It can be generated by a variety of computer graphics tools. Numerous commercial products specifically support development and analysis of IDEF0 diagrams and models.

IDEF0 is a model that consists of a hierarchical series of diagrams, text, and glossary cross-referenced to each other. The two primary modeling components are: functions (represented on a diagram by boxes), and data and objects that interrelate those functions (represented by arrows). As shown by Figure 5-5 the position at which the arrow attaches to a box conveys the specific role of the interface. The controls enter the top of the box. The inputs, the data or objects acted upon by the operation, enter the box from the left. The outputs of the operation leave the right-hand side of the box. Mechanism arrows that provide supporting means for performing the function join (point up to) the bottom of the box.

The IDEF0 process starts with the identification of the prime function to be decomposed. This function is identified on a "Top Level Context Diagram," that defines the scope of the particular IDEF0 analysis. An example of a Top Level Context Diagram for an information system management process is shown in Figure 5-6. From this diagram lower-level diagrams are generated. An example of a derived diagram, called a "child" in

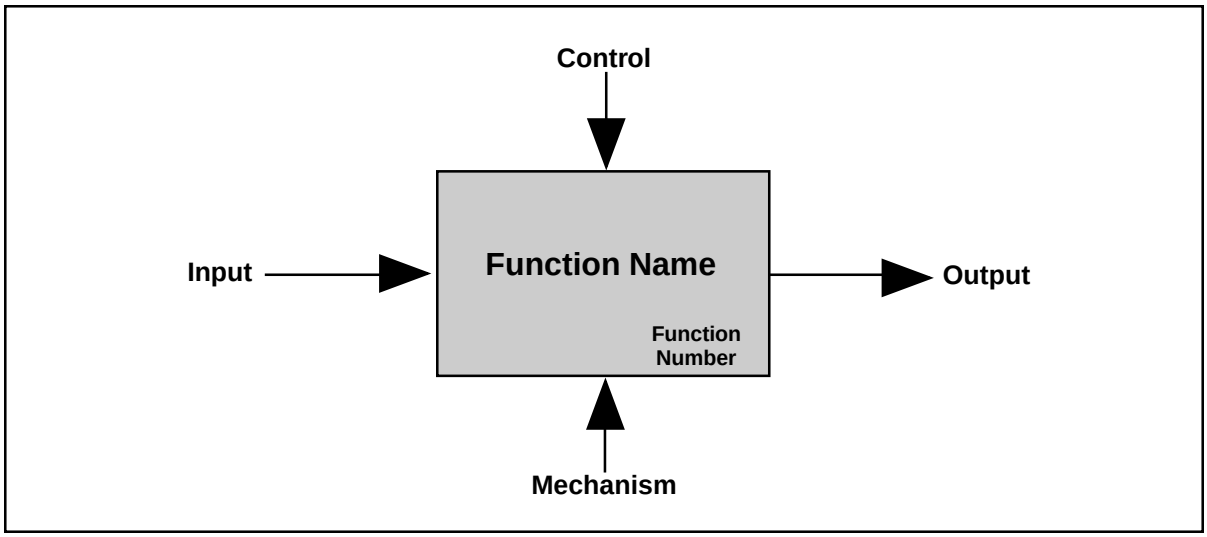


Figure 5-5. Integration Definition for Function Modeling (IDEF0) Box Format

IDEF0 terminology, for a life cycle function is shown in Figure 5-7.

An associated technique, Integration Definition for Information Modeling (IDEF1x), is used to supplement IDEF0 for data intensive systems. The IDEF0 standard, Federal Information Processing Standards Publication 183 (FIPS 183), and the IDEF1x standard (FIPS 184) are maintained by the National Institute of Standards and Technology (NIST).

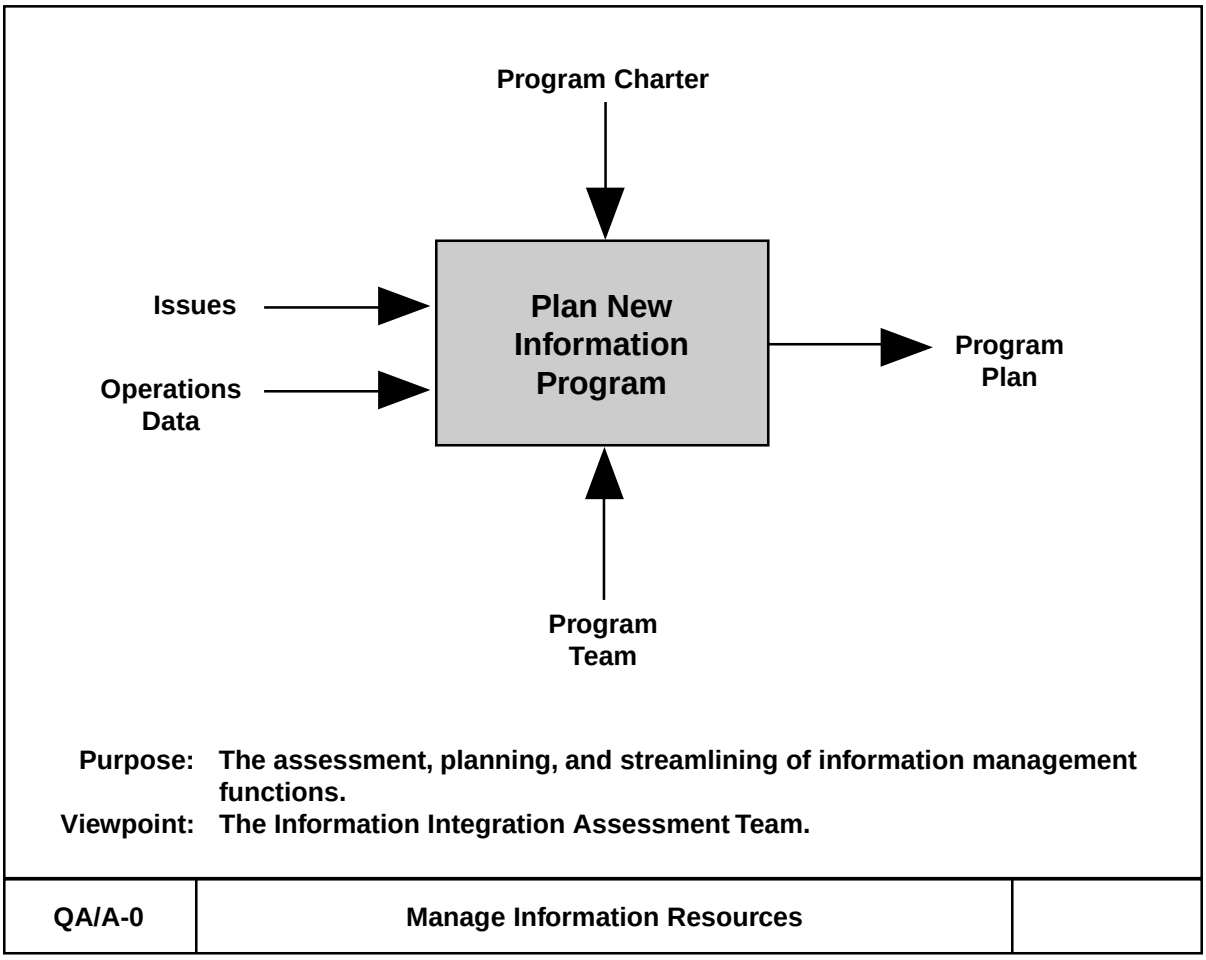


Figure 5-6. Top-Level Context Diagram

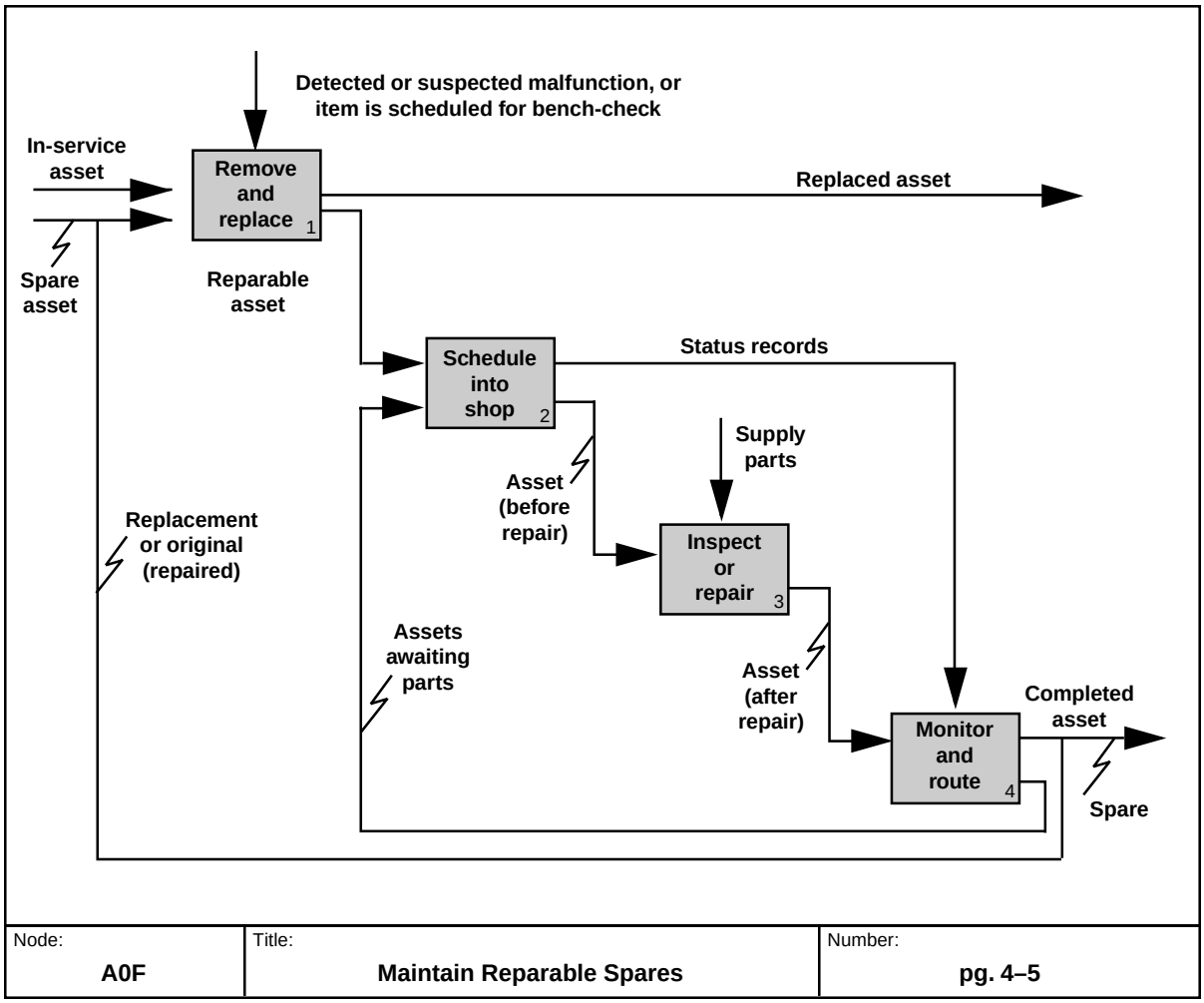


Figure 5-7. IDEF0 Diagram Example

SUPPLEMENT 5-C

TIMELINE ANALYSIS SHEETS

The timeline analysis sheet (TLS) adds detail to defining durations of various functions. It defines concurrency, overlapping, and sequential relationships of functions and tasks. It identifies time critical functions that directly affect system availability, operating time, and maintenance downtime. It is used to identify specific time-related design requirements.

The TLS includes purpose of function and the detailed performance characteristics, criticality of function, and design constraints. It identifies both quantitative and qualitative performance requirements. Initial resource requirements are identified.

Figure 5-8 shows an example of a TLS. The time required to perform function 3.1 and its subfunctions are presented on a bar chart showing how the timelines relate. (Function numbers match the FFBD.)

Function 3.1 Establish and maintain vehicle readiness from 35 hrs to 2 hrs prior to launch.

Function		Hours
Number	Name	30 25 20 15 10 5 4 3 2
3.1.1	Provide ground power	
3.1.2	Provide vehicle air conditioning	
3.1.3	Install and connect batteries	2.5
3.1.4	Install ordnance	7.5
3.1.5	Perform stray voltage checks and connect ordnance	2.6
3.1.6	Load fuel tanks	7.5
3.1.7	Load oxidizer tanks	7.5
3.1.8	Activate guidance system	2.5
3.1.9	Establish propulsion flight pressure	1.0
3.1.10	Telemetry system “on”	2.5

Figure 5-8. Time Analysis Sheet

SUPPLEMENT 5-D

REQUIREMENTS ALLOCATION SHEET

The Requirements Allocation Sheet documents the connection between allocated functions, allocated performance and the physical system. It provides traceability between Functional Analysis and Allocation and Design Synthesis, and shows any disconnects. It is a major tool in maintaining consistency between functional architectures and designs that are based on them. (Function numbers match the FFBD.)

Requirements Allocation Sheet	Functional Flow Diagram Title and No. 2.58.4 Provide Guidance Compartment Cooling	Equipment Identification		
Function Name and No.	Functional Performance and Design Requirements	Facility Rqmnts	Nomen-clature	CI or Detail Spec No.
2.58.4 Provide Guidance Compartment Cooling	The temperature in the guidance compartment must be maintained at the initial calibration temperature of +0.2 Deg F. The initial calibration temperature of the compartment will be between 66.5 and 68.5 Deg F.			
2.58.4.1 Provide Chilled Coolant (Primary)	A storage capacity for 65 gal of chilled liquid coolant (deionized water) is required. The temperature of the stored coolant must be monitored continuously. The stored coolant must be maintained within a temperature range of 40–50 Deg F. for an indefinite period of time. The coolant supplied must be free of obstructive particles 0.5 micron at all times.			

Figure 5-9. Requirements Allocation Sheet (Example)

CHAPTER 6

DESIGN SYNTHESIS

6.1 DESIGN DEVELOPMENT

Design Synthesis is the process by which concepts or designs are developed based on the functional descriptions that are the products of Functional Analysis and Allocation. Design synthesis is a creative activity that develops a physical architecture (a set of product, system, and/or software elements) capable of performing the required functions within the limits of the performance parameters prescribed. Since there may be several hardware and/or software architectures developed to satisfy a given set of functional and performance requirements, synthesis sets the stage for trade studies to select the best among the candidate architectures. The objective of design synthesis is to combine and restructure hardware and software components in such a way as to achieve a design solution capable of satisfying the stated requirements. During concept development, synthesis produces system concepts and establishes basic relationships among the subsystems. During preliminary and detailed design, subsystem and component descriptions are elaborated, and detailed interfaces between all system components are defined.

The physical architecture forms the basis for design definition documentation, such as, specifications, baselines, and work breakdown structures (WBS). Figure 6-1 gives an overview of the basic parameters of the synthesis process.

- **Outputs:**
  - Physical Architecture (Product Elements and Software Code)
  - Decision Database
- **Inputs:**
  - Functional Architecture
- **Enablers:**
  - IPTs, Decision Database, Automated Tools, Models
- **Controls:**
  - Constraints; GFE, COTS, & Reusable S/W; System concept & subsystem choices; organizational procedures
- **Activities:**
  - Allocate functions and constraints to system elements
  - Synthesize system element alternatives
  - Assess technology alternatives
  - Define physical interfaces
  - Define system product WBS
  - Develop life cycle techniques and procedures
  - Integrate system elements
  - Select preferred concept/design

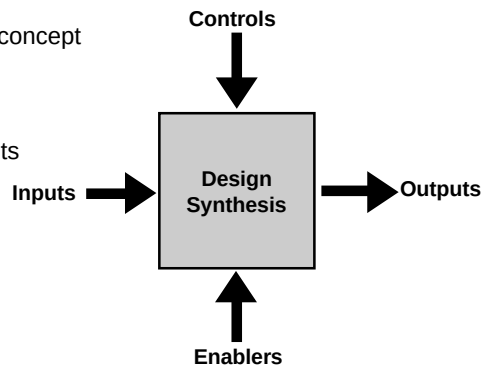


Figure 6-1. Design Synthesis

Characteristics

Physical architecture is a traditional term. Despite the name, it includes software elements as well as hardware elements. Among the characteristics of the physical architecture (the primary output of Design Synthesis) are the following:

- The correlation with functional analysis requires that each physical or software component meets at least one (or part of one) functional requirement, though any component can meet more than one requirement,
- The architecture is justified by trade studies and effectiveness analyses,
- A product WBS is developed from the physical architecture,
- Metrics are developed to track progress among KPPs, and
- All supporting information is documented in a database.

Modular Designs

Modular designs are formed by grouping components that perform a single independent function or single logical task; have single entry and exit points; and are separately testable. Grouping related functions facilitates the search for modular design solutions and furthermore increases the possibility that open-systems approaches can be used in the product architecture.

Desirable attributes of the modular units include low coupling, high cohesion, and low connectivity. Coupling between modules is a measure of their interdependence, or the amount of information shared between two modules. Decoupling modules eases development risks and makes later modifications easier to implement. Cohesion (also called binding) is the similarity of tasks performed within the module. High cohesion is desirable because it allows for use of identical or like (family or series) components, or for use of a single component to perform multiple functions. Connectivity refers to the relationship of internal elements within one module to internal elements within another module. High connectivity is undesirable in that it creates complex interfaces that may impede design, development, and testing.

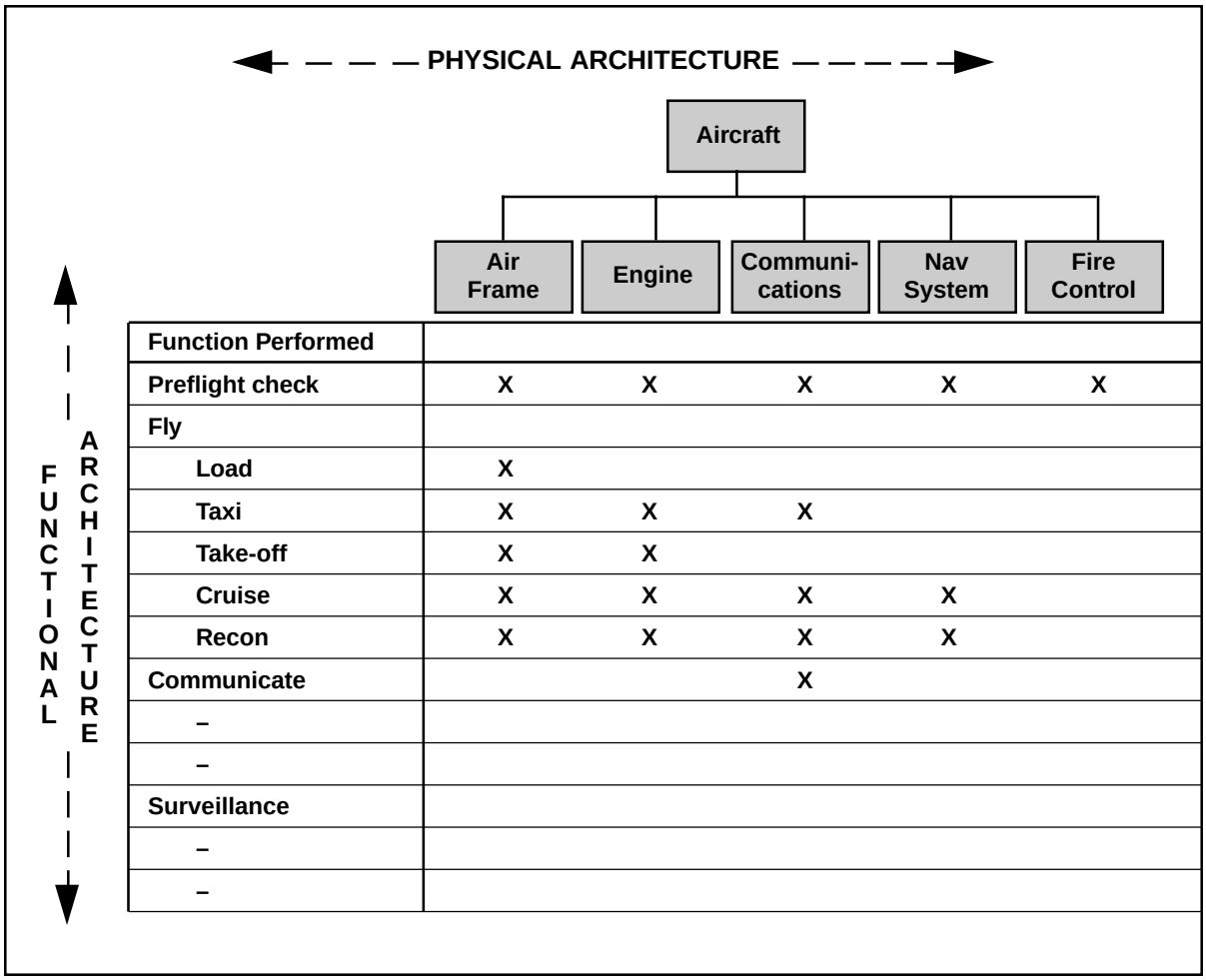
Design Loop

The design loop involves revisiting the functional architecture to verify that the physical architecture developed is consistent with the functional and performance requirements. It is a mapping between the functional and physical architectures. Figure 6-2 shows an example of a simple physical architecture and how it relates to the functional architecture. During design synthesis, re-evaluation of the functional analysis may be caused by the discovery of design issues that require re-examination of the initial decomposition, performance allocation, or even the higher-level requirements. These issues might include identification of a promising physical solution or open-system opportunities that have different functional characteristics than those foreseen by the initial functional architecture requirements.

6.2 SYNTHESIS TOOLS

During synthesis, various analytical, engineering, and modeling tools are used to support and document the design effort. Analytical devices such as trade studies support decisions to optimize physical solutions. Requirements Allocation Sheets (RAS) provide traceability to the functional and performance requirements. Simple descriptions like the Concept Decription Sheet (CDS) help visualize and communicate the system concept. Logic models, such as the Schematic Block Diagram (SBD), establish the design and the interrelationships within the system.

Automated engineering management tools such as Computer-Aided Design (CAD), Computer-Aided-Systems Engineering (CASE), and the Computer-Aided-Engineering (CAE) can help organize, coordinate and document the design effort. CAD generates detailed documentation describing the product design including SBDs, detailed



Function Performed					
Preflight check	X	X	X	X	X
Fly					
Load	X				
Taxi	X	X	X		
Take-off	X	X			
Cruise	X	X	X	X	
Recon	X	X	X	X	
Communicate			X		
–					
–					
Surveillance					
–					
–					

Figure 6–2. Functional/Physical Matrix

drawings, three dimensional and solid drawings, and it tracks some technical performance measurements. CAD can provide significant input for virtual modeling and simulations. It also provides a common design database for integrated design developments. Computer-Aided Engineering can provide system requirements and performance analysis in support of trade studies, analysis related to the eight primary functions, and cost analyses. Computer-Aided Systems Engineering can provide automation of technical management analyses and documentation.

Modeling

Modeling techniques allow the physical product to be visualized and evaluated prior to design decisions. Models allow optimization of hardware and software parameters, permit performance predictions to be made, allow operational sequences to be derived, and permit optimum allocation of functional and performance requirements among the system elements. The traditional logical prototyping used in Design Synthesis is the Schematic Block Diagram.

6.3 SUMMARY POINTS

- Synthesis begins with the output of Functional Analysis and Allocation (the functional architecture). The functional architecture is transformed into a physical architecture by defining physical components needed to perform the functions identified in Functional Analysis and Allocation.

- Many tools are available to support the development of a physical architecture:
  - Define and depict the system concept (CDS),
  - Define and depict components and their relationships (SBD), and
  - Establish traceability of performance requirements to components (RAS).
- Specifications and the product WBS are derived from the physical architecture.

SUPPLEMENT 6-A

CONCEPT DESCRIPTION SHEET

The Concept Description Sheet describes (in textual or graphical form) the technical approach or the design concept, and shows how the system will be integrated to meet the performance and functional requirements. It is generally used in early concept design to show system concepts.

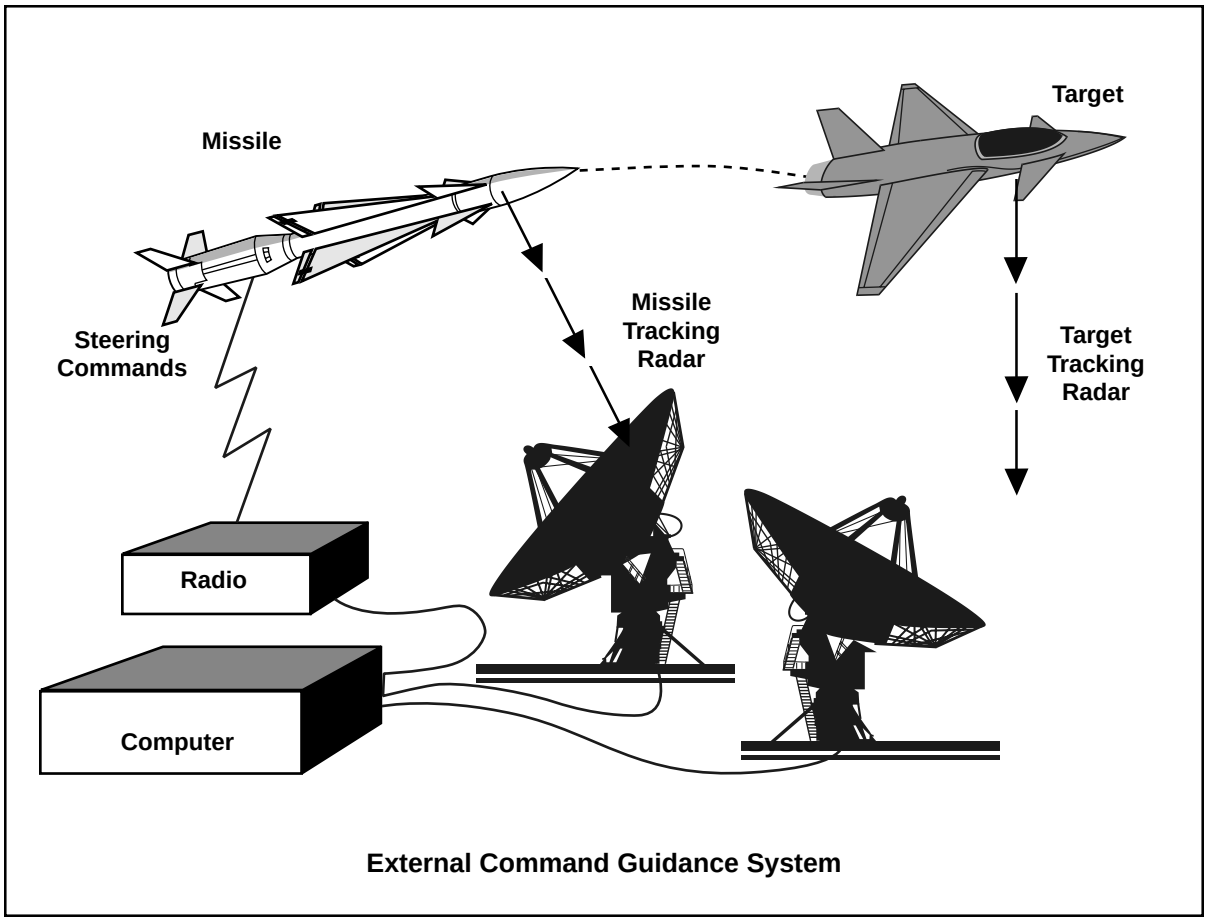


Figure 6-3. Concept Description Sheet Example

SUPPLEMENT 6-B

SCHEMATIC BLOCK DIAGRAMS

The Schematic Block Diagram (SBD) depicts hardware and software components and their interrelationships. They are developed at successively lower levels as analysis proceeds to define lower-level functions within higher-level requirements. These requirements are further subdivided and allocated using the Requirements Allocation Sheet (RAS). SBDs provide visibility of related system elements, and traceability to the RAS, FFBD, and other system engineering documentation. They describe a solution to the functional and performance requirements established by the functional architecture; show interfaces between the system components and between the system components and other systems or subsystems; support traceability between components and their functional origin; and provide a valuable tool to enhance configuration control. The SBD is also used to develop Interface Control Documents (ICDs) and provides an overall understanding of system operations.

A simplified SBD, Figure 6-4, shows how components and the connection between them are presented on the diagram. An expanded version is usually developed which displays the detailed functions performed within each component and a detailed depiction of their interrelationships. Expanded SBDs will also identify the WBS numbers associated with the components.

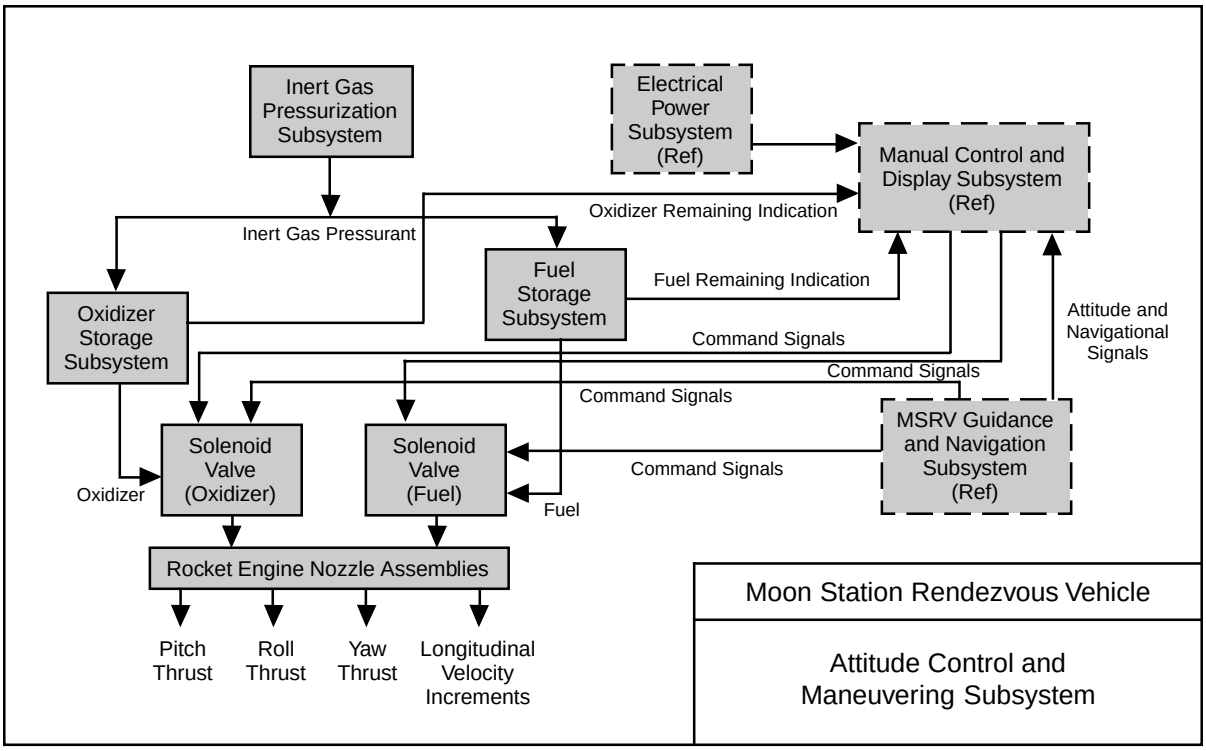


Figure 6-4. Schematic Block Diagram Example

SUPPLEMENT 6-C

REQUIREMENTS ALLOCATION SHEET

The RAS initiated in Functional Analysis and Allocation is expanded in Design Synthesis to document the connection between functional requirements and the physical system. It provides traceability between the Functional Analysis and Allocation and Synthesis activities. It is a major tool in maintaining consistency between functional architectures and the designs that are based on them. (Configuration Item (CI) numbers match the WBS.)

Requirements Allocation Sheet	Functional Flow Diagram Title and No. 2.58.4 Provide Guidance Compartment Cooling		Equipment Identification	
Function Name and No.	**Functional Performance and Design Requirements**	**Facility Rqmnts**	**Nomenclature**	**CI or Detail Spec No.**
2.58.4 Provide Guidance Compartment Cooling	The temperature in the guidance compartment must be maintained at the initial calibration temperature of +0.2 Deg F. The initial calibration temperature of the compartment will be between 66.5 and 68.5 Deg F.		Guidance Compartment Cooling System	3.54.5
2.58.4.1 Provide Chilled Coolant (Primary)	A storage capacity for 65 gal of chilled liquid coolant (deionized water) is required. The temperature of the stored coolant must be monitored continuously. The stored coolant must be maintained within a temperature range of 40–50 Deg F. for an indefinite period of time. The coolant supplied must be free of obstructive particles 0.5 micron at all times.		Guidance Compartment Coolant Storage Subsystem	3.54.5.1

Figure 6-5. Requirements Allocation Sheet (Example)

CHAPTER 7

VERIFICATION

7.1 GENERAL

The Verification process confirms that Design Synthesis has resulted in a physical architecture that satisfies the system requirements. Verification represents the intersection of systems engineering and test and evaluation.

Verification Objectives

The objectives of the Verification process include using established criteria to conduct verification of the physical architecture (including software and interfaces) from the lowest level up to the total system to ensure that cost, schedule, and performance requirements are satisfied with acceptable levels of risk. Further objectives include generating data (to confirm that system, subsystem, and lower level items meet their specification requirements) and validating technologies that will be used in system design solutions. A method to verify each requirement must be established and recorded during requirements analysis and functional allocation activities. (If it can not be verified it can not be a legitimate requirement.) The verification list should have a direct relationship to the requirements allocation sheet and be continually updated to correspond to it.

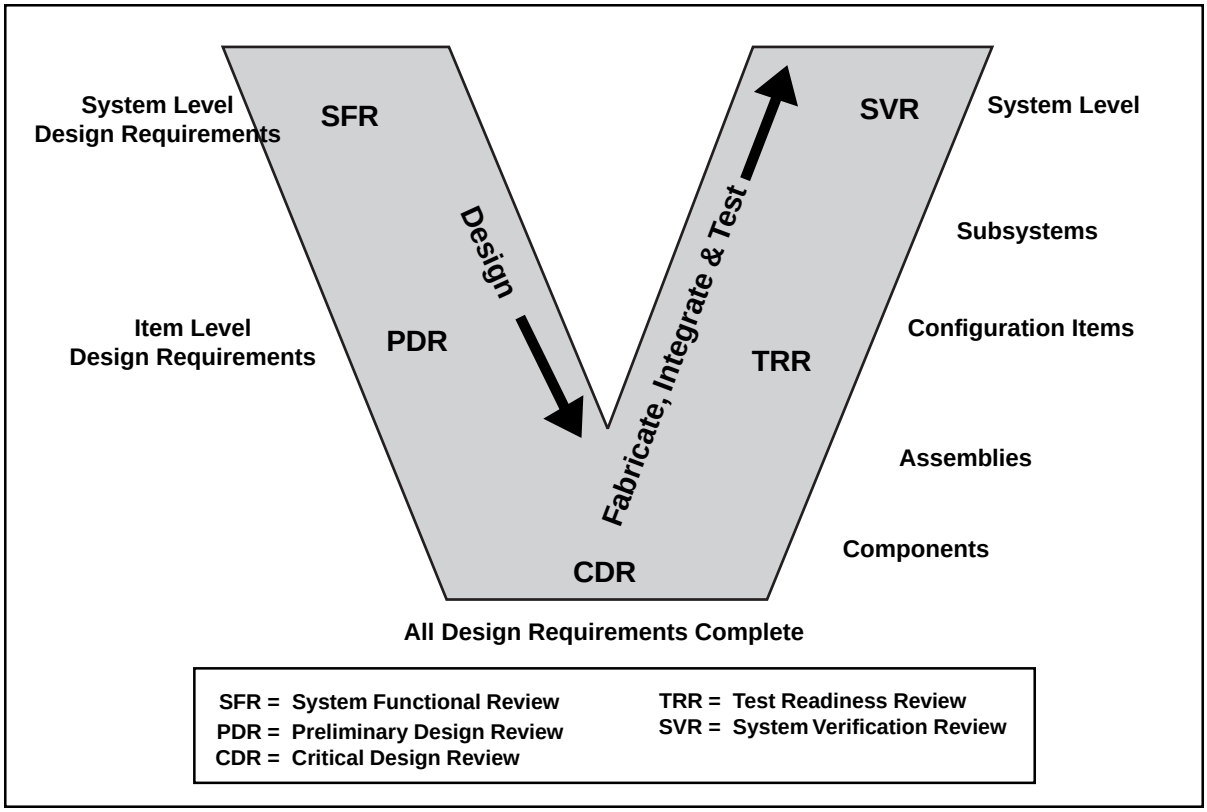


Figure 7-1. Systems Engineering and Verification

Verification Activities

System design solutions are verified by the following types of activities:

1. Analysis – the use of mathematical modeling and analytical techniques to predict the compliance of a design to its requirements based on calculated data or data derived from lower level component or subsystem testing. It is generally used when a physical prototype or product is not available or not cost effective. Analysis includes the use of both modeling and simulation which is covered in some detail in chapter 13,

2. Inspection – the visual examination of the system, component, or subsystem. It is generally used to verify physical design features or specific manufacturer identification,

3. Demonstration – the use of system, subsystem, or component operation to show that a requirement can be achieved by the system. It is generally used for a basic confirmation of performance capability and is differentiated from testing by the lack of detailed data gathering, or

4. Test – the use of system, subsystem, or component operation to obtain detailed data to verify performance or to provide sufficient information to verify performance through further analysis. Testing is the detailed quantifying method of verification, and as described later in this chapter, it is ultimately required in order to verify the system design.

Choice of verification methods must be considered an area of potential risk. Use of inappropriate methods can lead to inaccurate verification. Required defining characteristics, such as key performance parameters (KPPs) are verified by demonstration and/or test. Where total verification by test is not feasible, testing is used to verify key characteristics and assumptions used in design analysis or simulation. Validated models and simulation tools are included as analytical verification methods that complement other methods. The focus and nature of verification activities change as designs progress from concept to detailed designs to physical products.

During earlier design stages, verification focuses on proof of concept for system, subsystem and component levels. During later stages, as the product definition effort proceeds, the focus turns to verifying that the system meets the customer requirements. As shown by Figure 7-1, design is a top-down process while the Verification activity is a bottom-up process. Components will be fabricated and tested prior to the subsystems. Subsystems will be fabricated and tested prior to the completed system.

Performance Verification

Performance requirements must be objectively verifiable, i.e., the requirement must be measurable. Where appropriate, Technical Performance Measurements (TPM) and other management metrics are used to provide insight on progress toward meeting performance goals and requirements. IEEE Standard P1220 provides a structure for Verification activity. As shown in Figure 7-2 the structure is comprehensive and provides a good starting point for Verification planning.

7.2 DOD TEST AND EVALUATION

DoD Test and Evaluation (T&E) policies and procedures directly support the system engineering process of Verification. Testing is the means by which objective judgments are made regarding the extent to which the system meets, exceeds, or fails to meet stated objectives. The purpose of evaluation is to review, analyze, and assess data obtained from testing and other means to aid in making systematic decisions. The purpose of DoD T&E is to verify technical performance, operational effectiveness, operational suitability; and it provides essential information in support of decision making.

Common Types of T&E in DoD

T&E policy requires developmental tests. They confirm that technical requirements have been

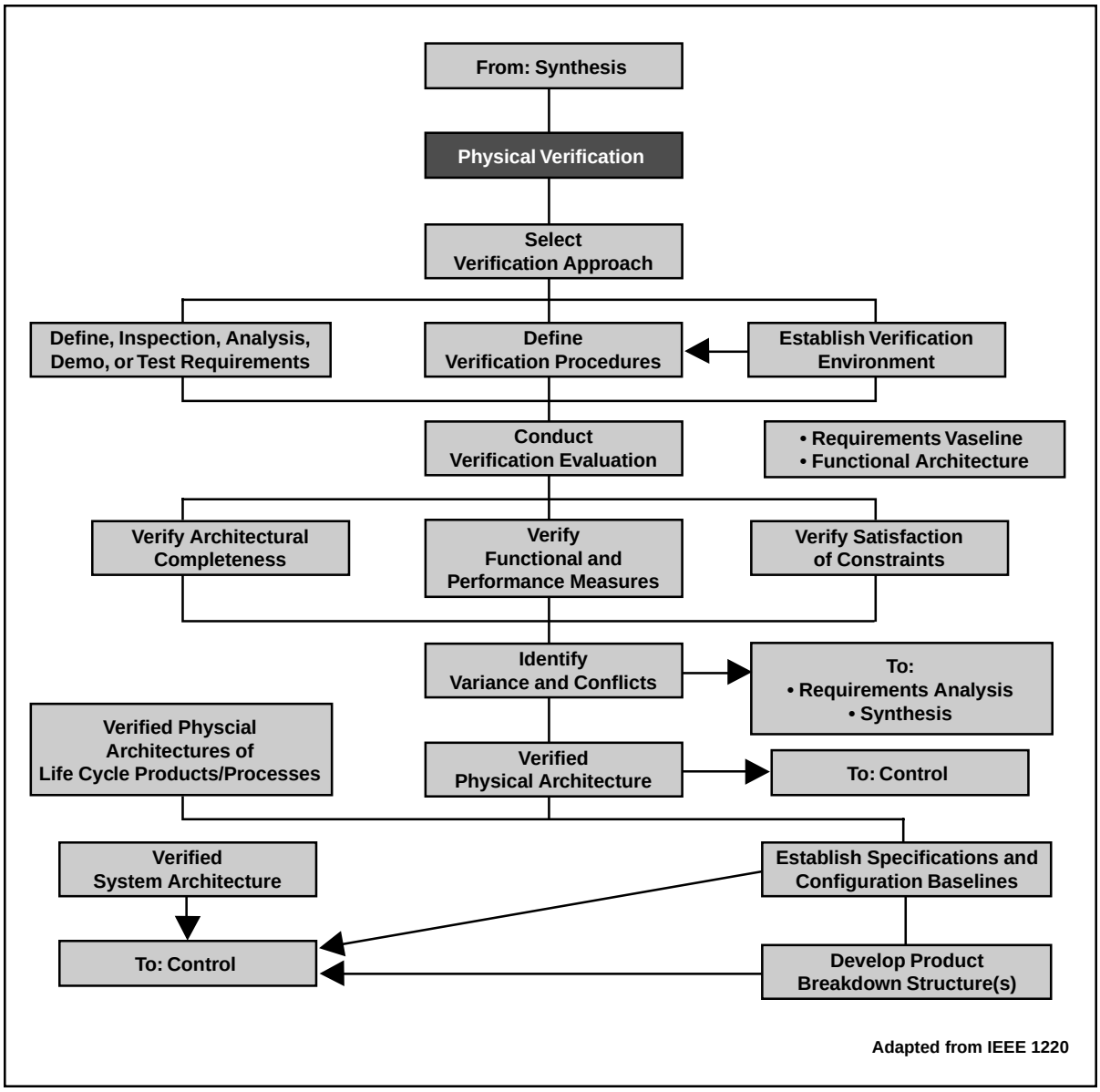


Figure 7-2. Verification Tasks

satisfied, and independent analysis and tests verify the system's operational effectiveness and suitability. DoD T&E traditionally and by directive is categorized as:

- Developmental T&E which focuses primarily on technical achievement,

- Operational T&E which focuses on operational effectiveness and suitability and includes Early Operational Assessments (EOA), Operational Assessment (OA), Initial Operational Test and Evaluation (IOT&E), and Follow-On Operational Test and Evaluation (FOT&E), and

- Live Fire T&E which provides assessment of the vulnerability and lethality of a system by subjecting it to real conditions comparable to the required mission.

T&E

The program office plans and manages the test effort to ensure testing is timely, efficient,

comprehensive and complete—and that test results are converted into system improvements. Test planning will determine the effectiveness of the verification process. Like all systems engineering planning activities, careful attention to test planning can reduce program risk. The key test planning document is the Test and Evaluation Master Plan (TEMP). This document lays out the objectives, schedule, and resources reflecting program office and operational test organization planning decisions. To ensure integration of this effort, the program office organizes a Test Planning Work Group (TPWG) or Test Working Level IPT (WIPT) to coordinate the test planning effort.

Test Planning Work Group/Test WIPT

The TPWG/Test WIPT is intended to facilitate the integration of test requirements and activities through close coordination between the members who represent the material developer, designer community, logistic community, user, operational tester, and other stakeholders in the system development. The team outlines test needs based on system requirements, directs test design, determines needed analyses for each test, identifies potential users of test results, and provides rapid dissemination of test and evaluation results.

Test and Evaluation Master Plan (TEMP)

The Test and Evaluation Master Plan is a mandatory document prepared by the program office. The operational test organization reviews it and provides the operational test planning for inclusion. The TEMP is then negotiated between the program office and operational test organization. After differences are resolved, it is approved at appropriate high levels in the stakeholder organizations. After approval it becomes binding on managers and designers (similar to the binding nature of the Operational Requirements Document (ORD)).

The TEMP is a valuable Verification tool that provides an excellent template for technology, system, and major subsystem-level Verification planning. The TEMP includes a reaffirmation of the user requirements, and to an extent, an interpretation of what those requirements mean in various operational scenarios. Part I of the required TEMP format is *System Introduction*, which provides the mission description, threat assessment, MOEs/MOSs, a system description, and an identification of critical technical parameters. Part II, *Integrated Test Program Summary*, provides an integrated test program schedule and a description of the overall test management process. Part III, *Developmental Test & Evaluation (DT&E) Outline*, lays out an overview of DT&E efforts and a description of future DT&E. Part IV, *Operational Test & Evaluation (OT&E) Outline*, is provided by the operational test organization and includes an OT&E overview, critical operational issues, future OT&E description, and LFT&E description. Part V, *Test & Evaluation Resource Summary*, identifies the necessary physical resources and activity responsibilities. This last part includes such items as test articles, test sites, test instrumentation, test support equipment, threat representation, test targets and other expendables, operational force test support, simulations, models, test-beds, special requirements, funding, and training.

Key Performance Parameters

Every system will have a set of KPPs that are the performance characteristics that *must* be achieved by the design solution. They flow from the operational requirements and the resulting derived MOEs. They can be identified by the user, the decision authority, or the operational tester. They are documented in the TEMP.

Developmental Test and Evaluation

The DT&E verifies that the design solution meets the system technical requirements and the system is prepared for successful OT&E. DT&E activities assess progress toward resolving critical operational issues, the validity of cost-performance tradeoff decisions, the mitigation of acquisition technical risk, and the achievement of system maturity.

DT&E efforts:

- Identify potential operational and technological capabilities and limitations of the alternative concepts and design options being pursued;

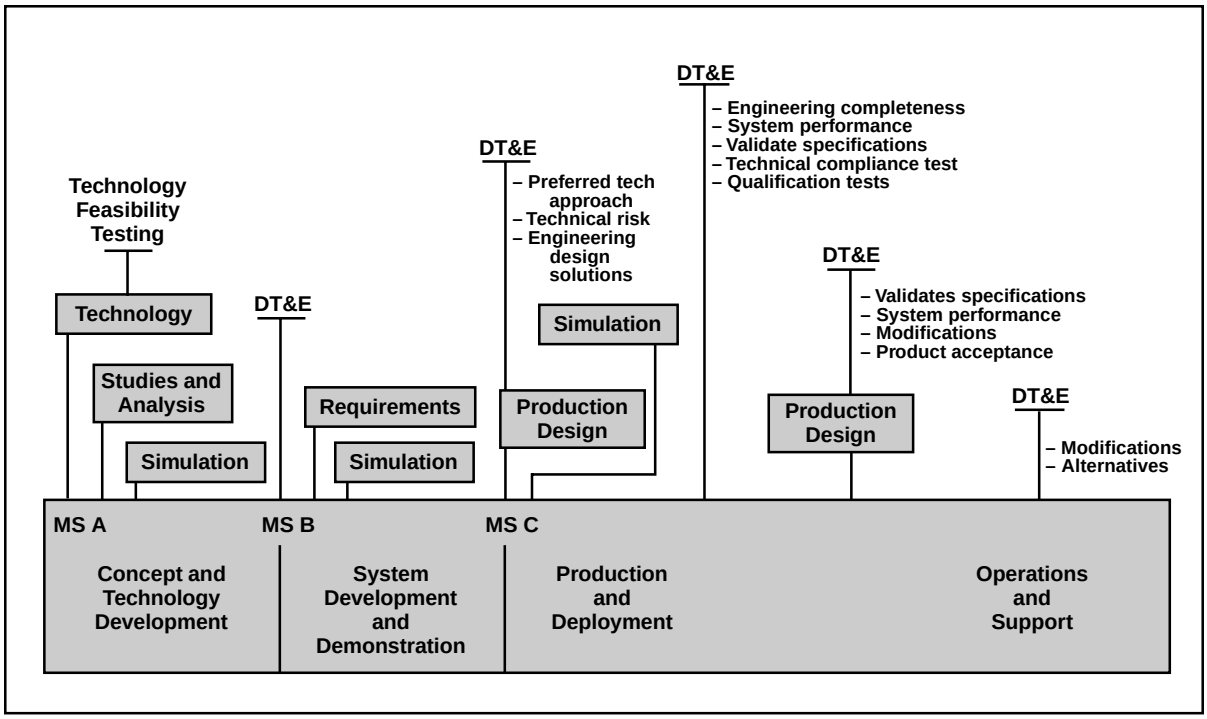


Figure 7-3. DT&E During System Acquisition

- Support the identification of cost-performance tradeoffs by providing analyses of the capabilities and limitations of alternatives;
- Support the identification and description of design technical risks;
- Assess progress toward resolving Critical Operational Issues, mitigating acquisition technical risk, achieving manufacturing process requirements and system maturity;
- Assess validity of assumptions and analysis conclusions; and
- Provide data and analysis to certify the system ready for OT&E, live-fire testing and other required certifications.

Figure 7-3 highlights some of the more significant DT&E focus areas and where they fit in the acquisition life cycle.

Live Fire Test and Evaluation

LFT&E is performed on any Acquisition Category (ACAT) I or II level weapon system that includes features designed to provide protection to the system or its users in combat. It is conducted on a production configured article to provide information concerning potential user casualties, vulnerabilities, and lethality. It provides data that can establish the system's susceptibility to attack and performance under realistic combat conditions.

Operational Test and Evaluation

OT&E programs are structured to determine the operational effectiveness and suitability of a system under realistic conditions, and to determine if the minimum acceptable operational performance requirements as specified in the ORD and reflected by the KPPs have been satisfied. OT&E uses threat-representative forces whenever possible, and employs typical users to operate and maintain the system or item under conditions simulating both combat stress and peacetime conditions. Operational tests will use production or production-

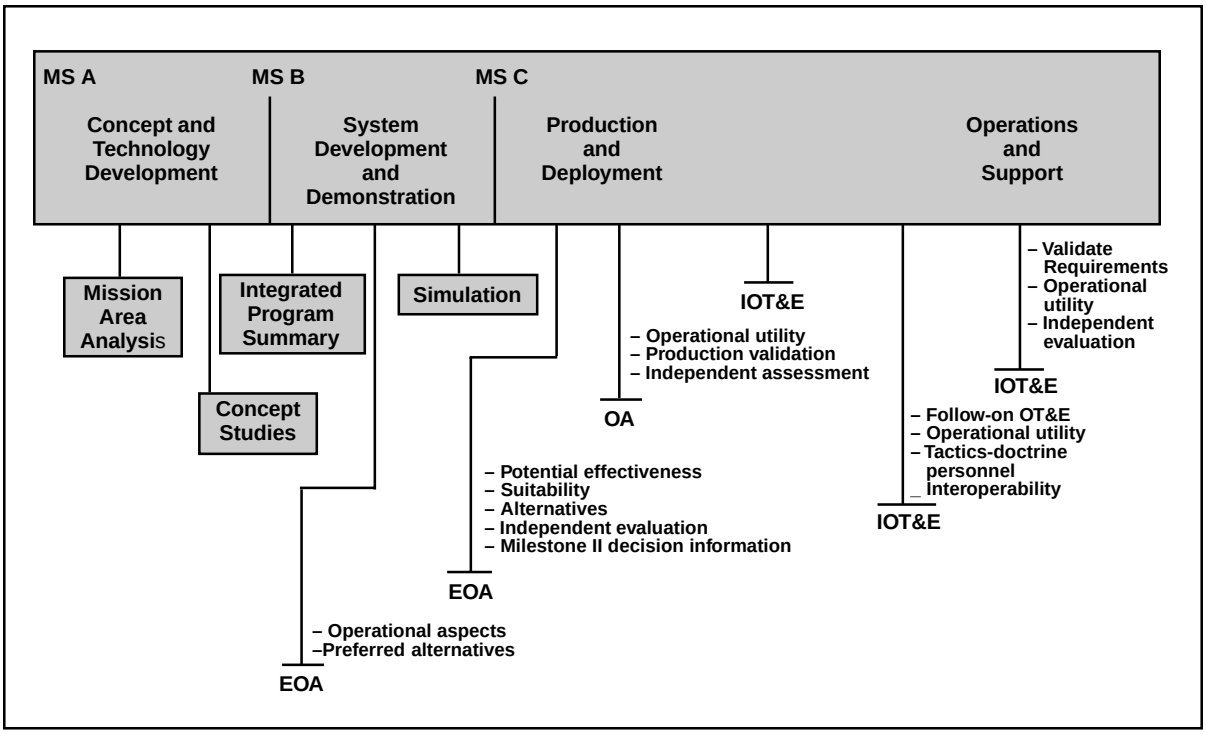


Figure 7-4. OT&E During System Acquisition

representative articles for the operational tests that support the full-rate production decision. Live Fire Tests are usually performed during the operational testing period. Figure 7-4 shows the major activities associated with operational testing and where they fit in the DoD acquisition life cycle.

OT&E Differences

Though the overall objective of both DT&E and OT&E is to verify the effectiveness and suitability of the system, there are distinct differences in their specific objects and focus. DT&E primarily focuses on verifying system technical requirements, while OT&E focuses on verifying operational requirements. DT&E is a program office responsibility that is used to develop the design. OT&E is an independent evaluation of design maturity that is used to determine if the program should proceed to full-rate production. Figure 7-5 lists the major differences between the two.

7.3 SUMMARY POINTS

The Verification activities of the Systems Engineering Process are performed to verify that physical design meets the system requirements.

- DoD T&E policy supports the verification process through a sequence of Developmental, Operational, and Live-Fire tests, analyses, and assessments. The primary management tools for planning and implementing the T&E effort are the TEMP and the integrated planning team.

Development Tests	Operational Tests
• Controlled by program manager • One-on-one tests • Controlled environment • Contractor environment • Trained, experienced operators • Precise performance objectives and threshold measurements • Test to specification • Developmental, engineering, or production representative test article	• Controlled by independent agency • Many-on-many tests • Realistic/tactical environment with operational scenario • No system contractor involvement • User troops recently trained • Performance measures of operational effectiveness and suitability • Test to operational requirements • Production representative test article

Figure 7-5. DT/OT Comparison

CHAPTER 8

SYSTEMS ENGINEERING PROCESS OUTPUTS

8.1 DOCUMENTING REQUIREMENTS AND DESIGNS

Outputs of the systems engineering process consist of the documents that define the system requirements and design solution. The physical architecture developed through the synthesis process is expanded to include enabling products and services to complete the system architecture. *This system level architecture then becomes the reference model for further development of system requirements and documents.* System engineering process outputs include the system and configuration item architectures, specifications, and baselines, and the decision database.

Outputs are dependent on the level of development. They become increasingly technically detailed as system definition proceeds from concept to detailed design. As each stage of system definition is achieved, the information developed forms the input for succeeding applications of the system engineering process.

Architectures: System/Configuration Item

The System Architecture describes the entire system. It includes the physical architecture produced through design synthesis and adds the enabling products and services required for life cycle employment, support, and management. Military Handbook (MIL-HDBK)-881, *Work Breakdown Structures*, provides reference models for weapon systems architectures. As shown by Figure 8-1, MIL-HDBK-881 illustrates the first three levels of typical system architectures. Program Offices can use MIL-HDBK-881 templates during system definition to help develop a top-level architecture tailored to the needs of the specific system considered. The design contractor will normally develop the levels below these first three. Chapter 9 of this text describes the WBS in more detail.

Specifications

A specification is a document that clearly and accurately describes the essential technical requirements for items, materials, or services including the procedures by which it can be determined that the requirements have been met. Specifications help avoid duplication and inconsistencies, allow for accurate estimates of necessary work and resources, act as a negotiation and reference document for engineering changes, provide documentation of configuration, and allow for consistent communication among those responsible for the eight primary functions of Systems Engineering. They provide IPTs a precise idea of the problem to be solved so that they can efficiently design the system and estimate the cost of design alternatives. They provide guidance to testers for verification (qualification) of each technical requirement.

Program-Unique Specifications

During system development a series of specifications are generated to describe the system at different levels of detail. These program unique specifications form the core of the configuration baselines. As shown by Figure 8-2, in addition to referring to different levels within the system hierarchy, these baselines are defined at different phases of the design process.

Initially the system is described in terms of the top-level (system) functions, performance, and interfaces. These technical requirements are derived from the operational requirements established by

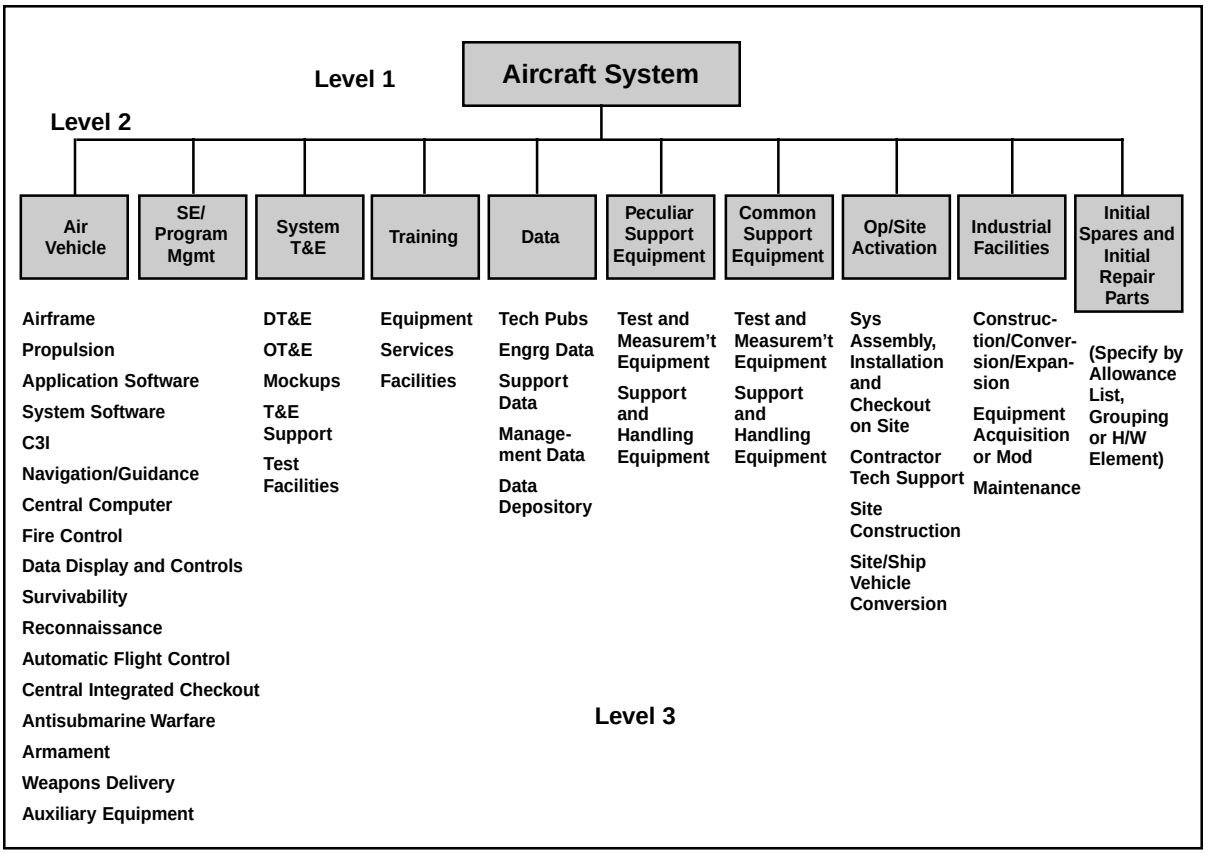


Figure 8-1. Example from MIL-HDBK-881

the user. This system-level technical description is documented in the System Specification, which is the primary documentation of the system-level Functional Baseline. The system requirements are then flowed down (allocated) to the items below the system level, such that a set of design criteria are established for each of those items. These item descriptions are captured in a set of Item Performance Specifications, which together with other interface definitions, process descriptions, and drawings, document the Allocated Baseline (sometimes referred to as the "Design To" baseline). Having baselined the design requirements for the individual items, detailed design follows. Detailed design involves defining the system from top to bottom in terms of the physical entities that will be employed to satisfy the design requirements. When detailed design is complete, a final baseline is defined. This is generally referred to as the Product Baseline, and, depending on the stage of development, may reflect a "Build to" or "As built" description. The Product Baseline is documented by the Technical Data Package, which will include not only Item Detail Specifications, but also, Process and Material Specifications, as well as drawings, parts lists, and other information that describes the final system in full physical detail. Figure 8-3 shows how these specifications relate to their associated baselines.

Role of Specifications

Requirements documents express why the development is needed. Specification documents are an intermediate expression of what the needed system has to do in terms of technical requirements (function, performance, and interface). Design documents (drawings, associated lists, etc.) describe the means by which the design requirements are to be satisfied. Figure 8-4 illustrates how requirements flow down from top-level specifications to design documentation. Preparation of specifications are part of the system engineering process, but also involve techniques that relate to

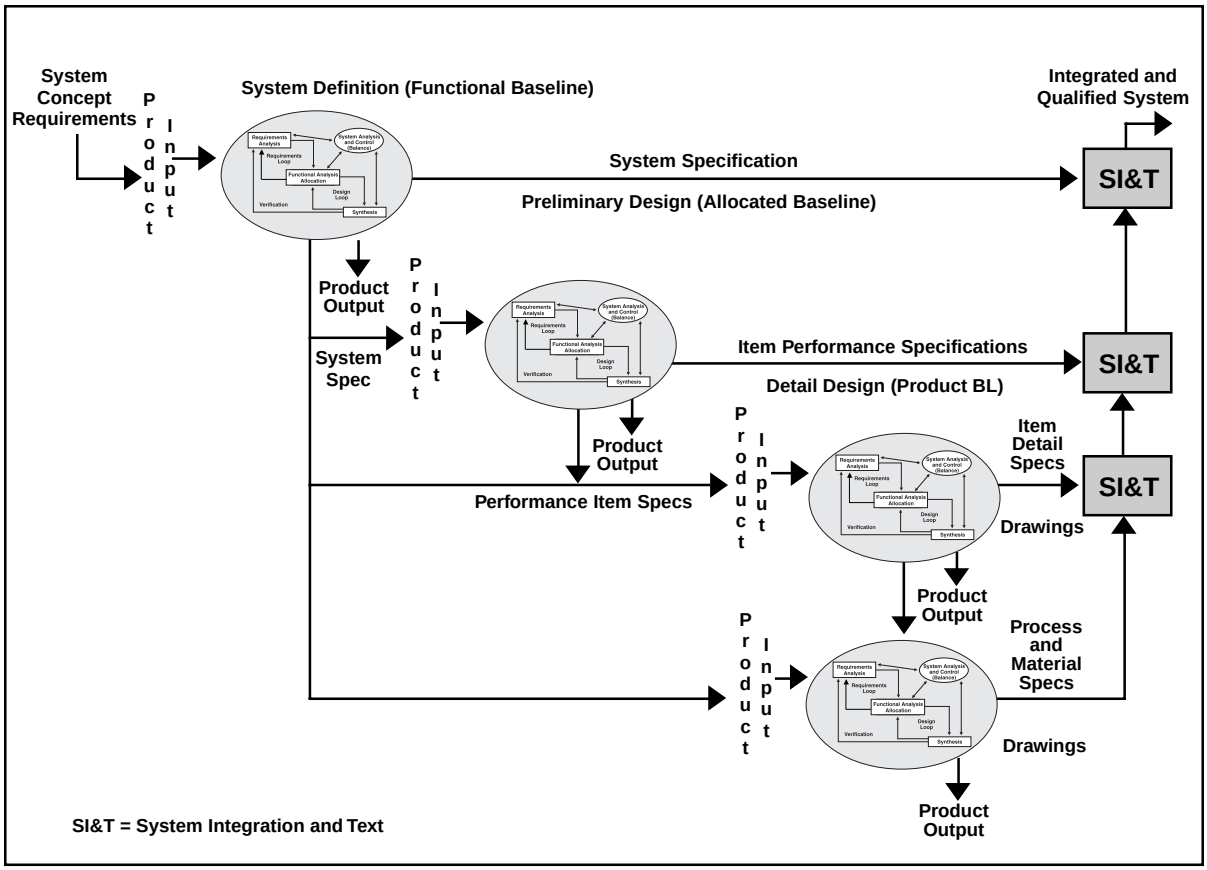


Figure 8-2. Specifications and Levels of Development

Specification	Content	Baseline
System Spec	Defines mission/technical performance requirements. Allocates requirements to functional areas and defines interfaces.	Functional
Item Performance Spec	Defines performance characteristics of CIs and CSCIs. Details design requirements and with drawings and other documents form the Allocated Baseline.	Allocated "Design To"
Item Detail Spec	Defines form, fit, function, performance, and test requirements for acceptance. (Item, process, and material specs start the Product Baseline effort, but the final audited baseline includes all the items in the TDP.)	Product "Build To" or "As Built"
Process Spec	Defines process performed during fabrication.	
Material Spec	Defines production of raw materials or semi-fabricated material used in fabrication.	

Figure 8-3. Specification Types

communication skills, both legal and editorial. Figure 8-5 provides some rules of thumb that illustrate this.

In summary, specifications document what the system has to do, how well it has to do it, and how to verify it can do it.

Baselines

Baselines formally document a product at some given level of design definition. They are references for the subsequent development to follow. Most DoD systems are developed using the three classic baselines described above: functional, allocated, and product. Though the program unique specifications are the dominant baseline documentation, they alone do not constitute a baseline.

Additional documents include both end and enabling product descriptions. End product baseline documents normally include those describing system requirements, functional architecture, physical architecture, technical drawing package, and requirements traceability. Enabling product baseline documents include a wide range of documents that could include manufacturing plans and processes, supportability planning, supply documentation, manuals, training plans and programs, test planning, deployment planning, and others. All enabling products should be reviewed for their susceptibility to impact from system configuration changes. If a document is one that describes a part of a system and could require change if the configuration changes, then most likely it should be included as a baseline document.

Acquisition Program Baselines

Acquisition Program Baselines and Configuration Baselines are related. To be accurate the Program baseline must reflect the realities of the Configuration Baseline, but the two should not be confused. Acquisition Program Baselines are high level assessments of program maturity and viability. Configuration Baselines are system descriptions. Figure 8-6 provides additional clarification.

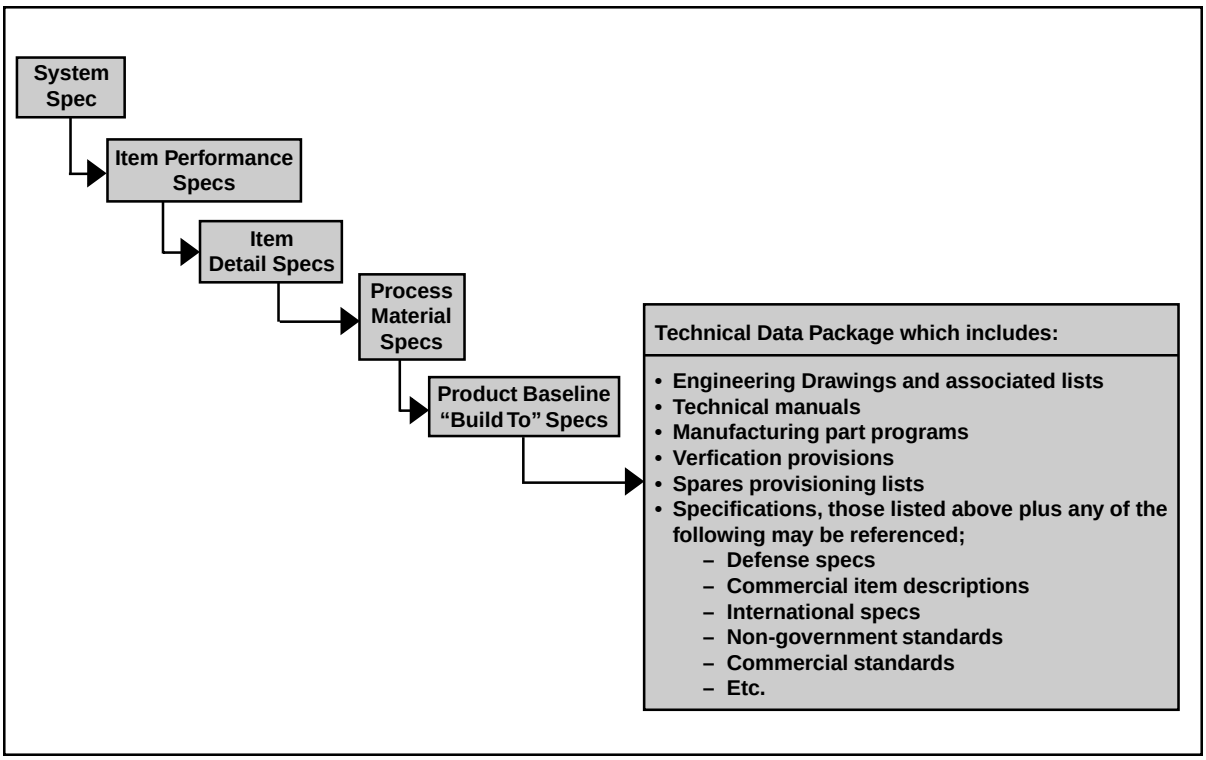


Figure 8-4. How Specifications Lead to Design Documents

- **Use a table of contents and define all abbreviations and acronyms.**
- **Use active voice.**
- **Use "shall" to denote mandatory requirement and "may" or "should" to denote guidance provisions.**
- **Avoid ambiguous provisions, such as "as necessary," "contractor's best practice," "smooth finish," and similar terms.**
- **Use the System Engineering Process to identify requirements. Do not over-specify.**
- **Avoid "tiering." Any mandatory requirement in a document below the first tier, should be stated in the specification.**
- **Only requirement sections of the MIL-STD-491D formats are binding. Do not put requirements in non-binding sections, such as *Scope*, *Documents*, or *Notes*.**
- **Data documentation requirements are specified in a Contract Data Requirements List.**

Figure 8–5. Rules of Thumb for Specification Preparation

Decision Database

The decision database is the documentation that supports and explains the configuration solution decisions. It includes trade studies, cost effectiveness analyses, Quality Function Deployment (QFD) analysis, models, simulations, and other data generated to understand a requirement, develop alternative solutions, or make a choice between them. These items are retained and controlled as part of the Data Management process described in Chapter 10.

8.2 DOD POLICY AND PRACTICE—SPECIFICATIONS AND STANDARDS

DoD uses specifications to communicate product requirements and standards to provide guidance concerning proven methods and practices.

Specifications

DoD uses three basic classifications of specifications: materiel specifications (developed by DoD components), Program-Unique Specifications, and non-DoD specifications.

• **Program Baselines** – **Embody only the most important cost, schedule, and performance objectives and thresholds** – **Threshold breach results in re-evaluation of program at MDA level** – **Selected key performance parameters** – **Specifically evolves over the development cycle and is updated at each major milestone review or program restructure** • **Required on ALL programs for measuring and reporting status**	• **Configuration Baselines** **Identify and define an item's functional and physical characteristics** – ***Functional Baseline* – Describes system level requirements** – ***Allocated Baseline* – Describes design requirements for items below system level** – ***Product Baseline* – Describes product physical detail** • **Documents outputs of Systems Engineering Process**

Figure 8–6. Acquisition Program Baselines and Configuration Baselines

DoD developed specifications describe essential technical requirements for purchase of materiel. Program-Unique Specifications are an integral part of the system development process. Standard practice for preparation of DoD and Program-Unique Specifications is guided by MIL-STD-961D. This standard provides guidance for the development of performance and detail specifications. MIL-STD-961D, Appendix A provides further guidance for the development of Program-Unique Specifications.

Non-DoD specifications and standards approved for DoD use are listed in the *DoD Index of Specifications and Standards* (DoDISS).

DoD Policy (Specifications)

DoD policy is to develop *performance* specifications for procurement and acquisition. In general, detail specifications are left for contractor development and use. Use of a detail specification in DoD procurement or acquisition should be considered only where absolutely necessary, and then only with supporting trade studies and acquisition authority approval.

DoD policy gives preference to the use of commercial solutions to government requirements, rather than development of unique designs. Therefore, the use of commercial item specifications and descriptions should be a priority in system architecture development. Only when no commercial solution is available should government detail specifications be employed.

In the case of re-procurement, where detail specifications and drawings are government owned, standardization or interface requirements may present a need for use of detailed specifications. Trade studies that reflect total ownership costs and the concerns related to all eight primary functions should govern decisions concerning the type of specification used for re-procurement of systems, subsystems, and configuration items. Such trade studies and cost analysis should be preformed prior to the use of detail specifications or the decision to develop and use performance specifications in a reprocurement.

Performance Specifications

Performance Specifications state requirements in terms of the required results with criteria for verifying compliance, but without stating the methods for achieving the required results. In general, performance specifications define products in terms of functions, performance, and interface requirements. They define the functional requirements for the item, the environment in which it must operate, and interface and interchangeability characteristics. The contractor is provided the flexibility to decide how the requirements are best achieved, subject to the constraints imposed by the government, typically through interface requirements. System Specifications and Item Performance Specifications are examples of performance specifications.

Detail Specifications

Detail Specifications, such as Item Detail, Material and Process Specifications, provide design requirements. This can include materials to be used, how a requirement is to be achieved, or how an item is to be fabricated or constructed. If a specification contains both performance and detail requirements, it is considered a Detail Specification, with the following exception: Interface and interchangeability requirements in Performance Specifications may be expressed in detailed terms. For example, a Performance Specification for shoes would specify size requirements in detailed terms, but material or method of construction would be stated in performance terms.

Software Documentation – IEEE/EIA 12207

IEEE/EIA 12207, *Software Life Cycle Processes*, describes the U.S. implementation of the ISO standard on software processes. This standard describes the development of software specifications as one aspect of the software development process.

The process described in IEEE/EIA 12207 for allocating requirements in a top-down fashion and documenting the requirements at all levels parallels the systems engineering process described in this text. The standard requires first that system-level requirements be allocated to software items (or configuration items) and that the software requirements then be documented in terms of functionality, performance, and interfaces, and that qualification requirements be specified. Software item requirements must be traceable to system-level, and be consistent and verifiable.

The developer is then required to decompose each software item into software components and then into software units that can be coded. Requirements are allocated from item level, to component, and finally to unit level. This is the detailed design activity and IEEE/EIA 12207 requires that these allocations of requirements be documented in documents that are referred to as "descriptions," or, if the item is a "stand alone" item, as "specifications." The content of these documents is defined in the IEEE/EIA standard; however, the level of detail required will vary by project. Each project must therefore ensure that a common level of expectation is established among all stakeholders in the software development activity.

Standard Practice for Defense Specifications – MIL-STD-961D

The purpose of MIL-STD-961D is to establish uniform practices for specification preparation, to ensure inclusion of essential requirements, to ensure Verification (qualification) methods are established for each requirement, and to aid in the use and analysis of specification content. MIL-STD-961D establishes the format and content of system, configuration item, software, process and material specifications. These Program-Unique Specifications are developed through application of the systems engineering process and represent a hierarchy as shown in Figure 8-7.

Standards

Standards establish engineering and technical limitations and applications for items, materials, processes, methods, designs, and engineering practices. They are "corporate knowledge" documents describing how to do some process or a

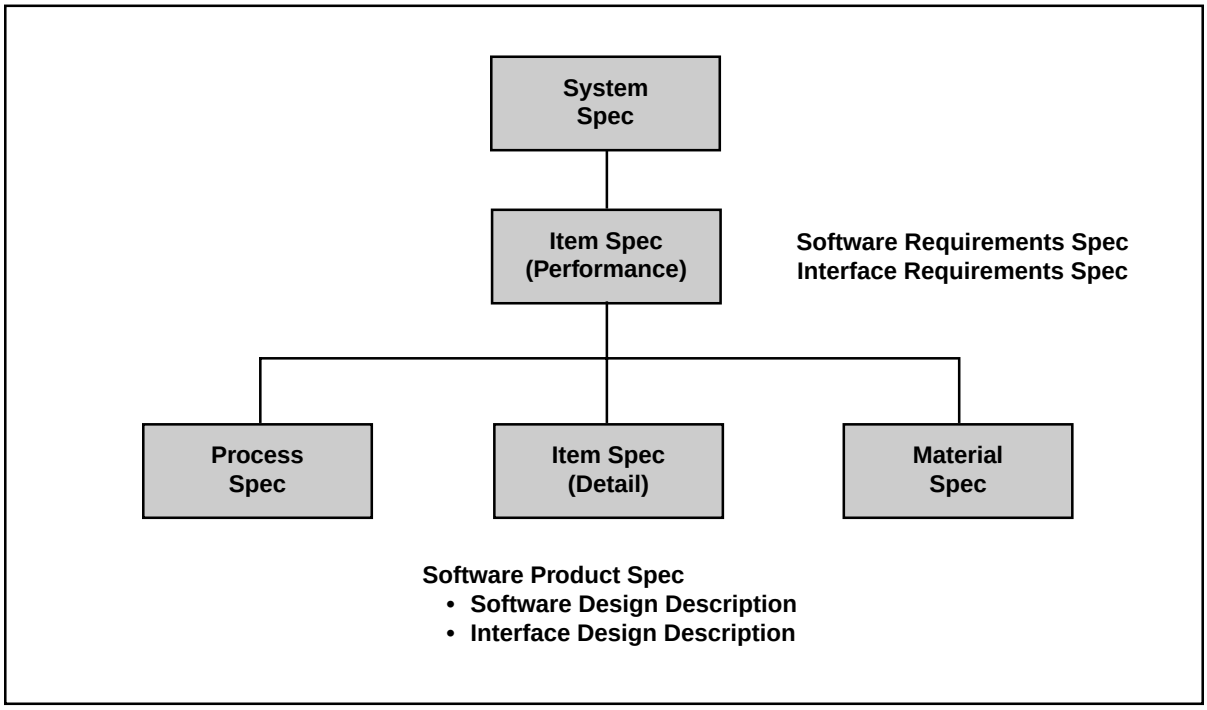


Figure 8–7. Specification Hierarchy

description of a body of knowledge. Standards come from many sources, reflecting the practices or knowledge base of the source. Format and content of Defense Standards, including Handbooks, are governed by MIL-STD-962. Other types of standards in use in DoD include Commercial Standards, Corporate Standards, International Standards, Federal Standards, and Federal Information Processing Standards.

DoD Policy (Standards)

DoD policy does not require standard management approaches or manufacturing processes on contracts. This policy applies to the imposition of both Military Specifications and Standards and, in addition, to the imposition of Commercial and Industry Standards. In general, the preferred approach is to allow contractors to use industry, government, corporate, or company standards they have determined to be appropriate to meet government's needs. The government reviews and accepts the contractor's approach through a contract selection process or a contractual review process.

The government should impose a process or standard only as a last resort, and only with the support of an appropriate trade study analysis. If a specific standard is imposed in a solicitation or contract, a waiver will be required from an appropriate Service authority.

However, there is need on occasion to direct the use of some standards for reasons of standardization, interfaces, and development of open systems. A case in point is the mandated use of the Joint Technical Architecture (JTA) for defining interoperability standards. The JTA sets forth the set of interface standards that are expected to be employed in DoD systems. The JTA is justifiably mandatory because it promotes needed interoperability standardization, establishes supportable interface standards, and promotes the development of open systems.

DoD technical managers should be alert to situations when directed standards are appropriate to their program. Decisions concerning use of directed standards should be confirmed by trade studies and requirements traceability.

DoD Index of Specifications and Standards

The DoDISS lists all international, adopted industry standardization documents authorized for use by the military departments, federal and military specifications and standards. Published in three volumes, it contains over 30,000 documents in 103 Federal Supply Groups broken down into 850 Federal Supply Classes. It covers the total DoD use of specifications and standards, ranging from fuel specifications to international quality standards.

8.3 SUMMARY POINTS

- System Engineering Process Outputs include the system/configuration item architecture, specifications and baselines, and the decision database.

- System/Configuration Item Architectures include the physical architecture and the associated products and services.

- Program-Unique specifications are a primary output of the System Engineering Process. Program-Unique specifications describe what the system or configuration item must accomplish and how it will be verified. Program-Unique specifications include the System, Item Performance, and Item Detail Specifications. The System Specification describes the system requirements, while Item Performance and Item Detail Specifications describe configuration item requirements.

- Configuration baselines are used to manage and control the technical development. Program baselines are used for measuring and supporting program status.

- The Decision Database includes those documents or software that support understanding and decision making during formulation of the configuration baselines.

- DoD policy is to develop *performance* specifications for procurement and acquisition. Use of other than performance specifications in a contract must be justified and approved.

- It is DoD policy not to require standard management approaches or manufacturing processes on contracts.

- Mandatory use of some standard practices are necessary, but must be justified through analysis. A case in point is the mandatory use of the standards listed in the Joint Technical Architecture.

PART 3

SYSTEMS ANALYSIS AND CONTROL

CHAPTER 9

WORK BREAKDOWN STRUCTURE

9.1 INTRODUCTION

The Work Breakdown Structure (WBS) is a means of organizing system development activities based on system and product decompositions. The systems engineering process described in earlier chapters produces system and product descriptions. These product architectures, together with associated services (e.g., program management, systems engineering, etc.) are organized and depicted in a hierarchical tree-like structure that is the WBS. (See Figure 9-1.)

Because the WBS is a direct derivative of the physical and systems architectures it could be considered an output of the systems engineering process. It is being presented here as a Systems Analysis and Control tool because of its essential utility for all aspects of the systems engineering process. It is used to structure development activities, to identify data and documents, and to organize integrated teams, and for other non-technical program management purposes.

WBS Role in DoD Systems Engineering

DoD 5000.2-R requires that a program WBS be established to provide a framework for program and technical planning, cost estimating, resource allocation, performance measurement, and status reporting. The WBS is used to define the total system, to display it as a product-oriented family tree composed of hardware, software, services, data, and facilities, and to relate these elements to each other and to the end product. Program offices are to tailor a program WBS using the guidance provided in MIL-HDBK-881.

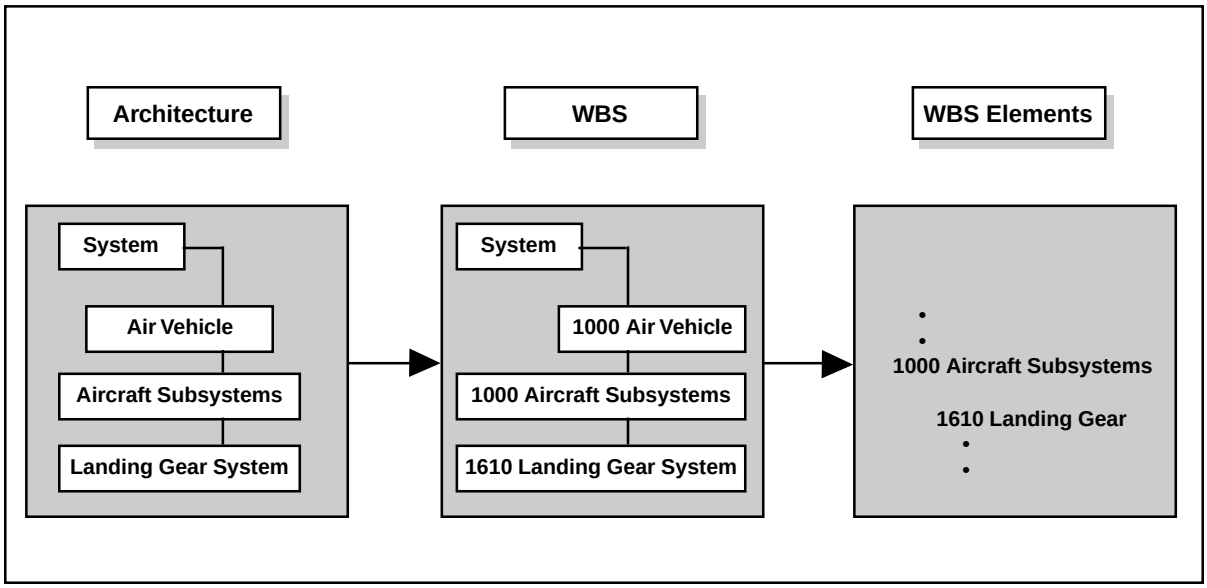


Figure 9–1. Architecture to WBS Flow

The program WBS is developed initially to define the top three levels. As the program proceeds through development and is further defined, program managers should ensure that the WBS is extended to identify all high-cost and high-risk elements for management and reporting, while ensuring the contractor has complete flexibility to extend the WBS below the reporting requirement to reflect how work will be accomplished.

Basic Purposes of the WBS

Organizational:
The WBS provides a coordinated, complete, and comprehensive view of program management. It establishes a structure for organizing system development activities, including IPT design, development, and maintenance.

Business:
It provides a structure for budgets and cost estimates. It is used to organize collection and analysis of detailed costs for earned value reports (Cost Performance Reports or Cost/Schedule Control System Criteria reporting).

Technical:
The WBS establishes a structure for:

- Identifying products, processes, and data,
- Organizing risk management analysis and tracking,
- Enabling configuration and data management. It helps establish interface identification and control.
- Developing work packages for work orders and material/part ordering, and
- Organizing technical reviews and audits.

The WBS is used to group product items for specification development, to develop Statements of Work (SOW), and to identify specific contract deliverables.

WBS – Benefits

The WBS allows the total system to be described through a logical breakout of product elements into work packages. A WBS, correctly prepared, will account for all program activity. It links program objectives and activities with resources, facilitates initial budgets, and simplifies subsequent cost reporting. The WBS allows comparison of various independent metrics and other data to look for comprehensive trends.

It is a foundation for all program activities, including program and technical planning, event schedule definition, configuration management, risk management, data management, specification preparation, SOW preparation, status reporting and problem analysis, cost estimates, and budget formulation.

9.2 WBS DEVELOPMENT

The physical and system architectures are used to prepare the WBS. The architectures should be reviewed to ensure that all necessary products and services are identified, and that the top-down structure provides a continuity of flow down for all tasks. Enough levels must be provided to identify work packages for cost/schedule control purposes. If too few levels are identified, then management visibility and integration of work packages may suffer. If too many levels are identified, then program review and control actions may become excessively time-consuming.

The first three WBS Levels are organized as:
Level 1 – Overall System
Level 2 – Major Element (Segment)
Level 3 – Subordinate Components (Prime Items)

Levels below the first three represent component decomposition down to the configuration item level. In general, the government is responsible for the development of the first three levels, and the contractor(s) for levels below three.

DoD Practice

In accordance with DoD mandatory procedures in DoD 5000.2-R and common DoD practice as established in MIL-HDBK-881, the program office develops a program WBS and a contract WBS for each contract. The program WBS is the WBS that represents the total system, i.e., the WBS that describes the system architecture. The contract WBS is the part of the program WBS that relates to deliverables and tasks of a specific contract.

MIL-HDBK-881 is used by the program office to support the systems engineering process in developing the first three levels of the program WBS, and to provide contractors with guidance for lower level WBS development. As with most standards and handbooks, use of MIL-HDBK-881 cannot be specified as a contract requirement.

Though WBS development is a systems engineering activity, it impacts cost and budget professionals, as well as contracting officers. An integrated team representing these stakeholders should be formed to support WBS development.

WBS Anatomy

A program WBS has an end product part and an enabling product part. The end product part of the system typically consists of the prime mission product(s) delivered to the operational customer. This part of the WBS is based on the physical architectures developed from operational requirements. It represents that part of the WBS involved in product development. Figure 9-2 presents a simple example of a program WBS product part.

The "enabling product" part of the system includes the products and services required to develop, produce, and support the end product(s). This part of the WBS includes the horizontal elements of the system architecture (exclusive of the end products), and identifies all the products and services necessary to support the life cycle needs of the product. Figure 9-3 shows an example of the top three levels of a complete WBS tree.

Contract WBS

A contract WBS is developed by the program office in preparation for contracting for work required to develop the system. It is further developed by the contractor after contract award. The contract WBS is that portion of the program WBS that is specifically being tasked through the contract. A simple example of a contract WBS derived from the program WBS shown in Figure 9-2 is provided by Figure 9-4. Figure 9-4, like Figure 9-2, only includes the product part of the contract WBS. A

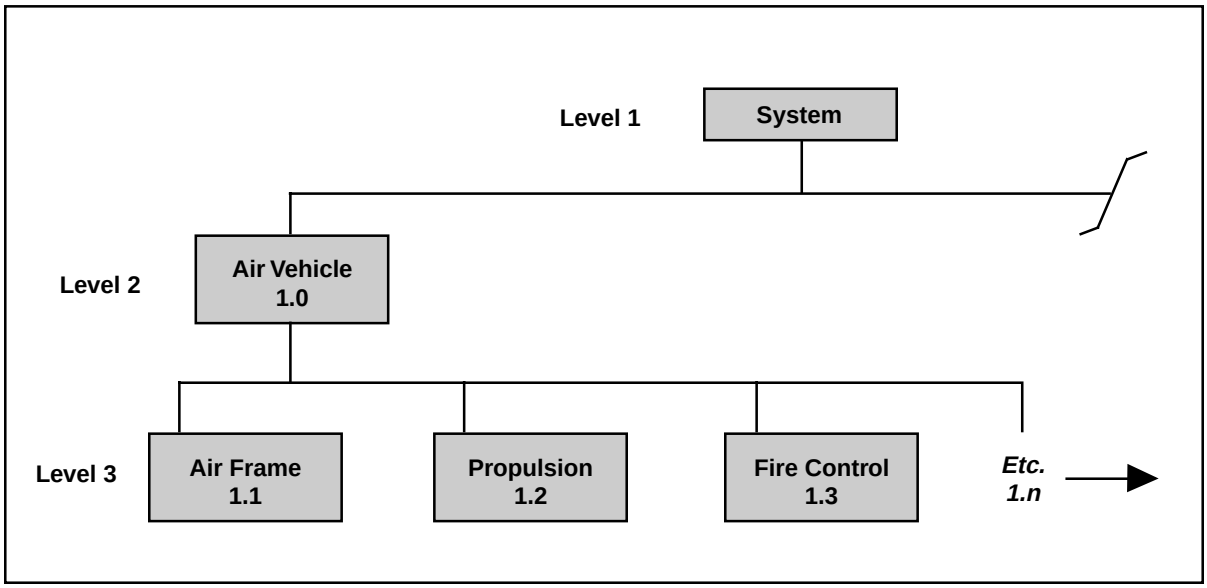


Figure 9-2. Program WBS – The Product Part (Physical Architecture)

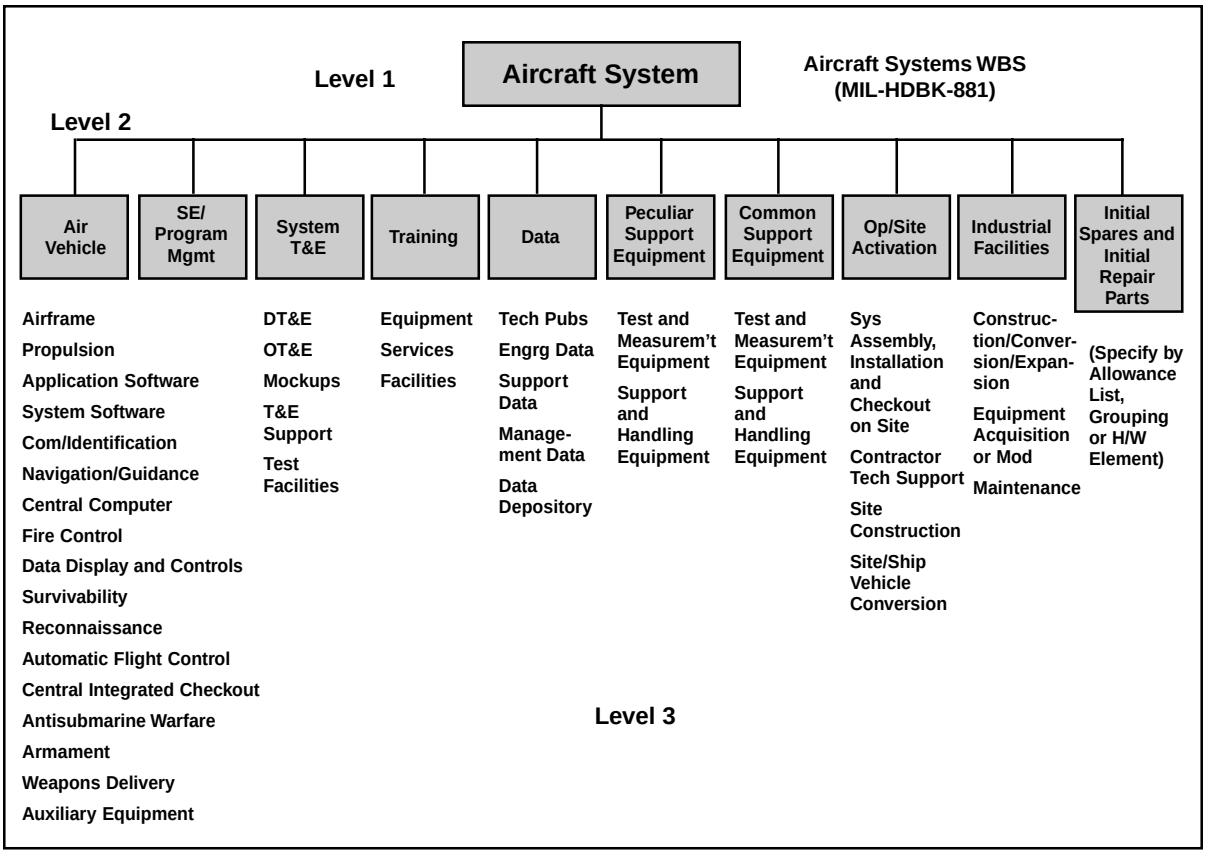


Figure 9-3. The Complete Work Breakdown Structure

complete contract WBS would include associated enabling products, similar to those identified in Figure 9-3. The resulting complete contract WBS is used to organize and identify contractor tasks. The program office's preliminary version is used to develop a SOW for the Request for Proposals.

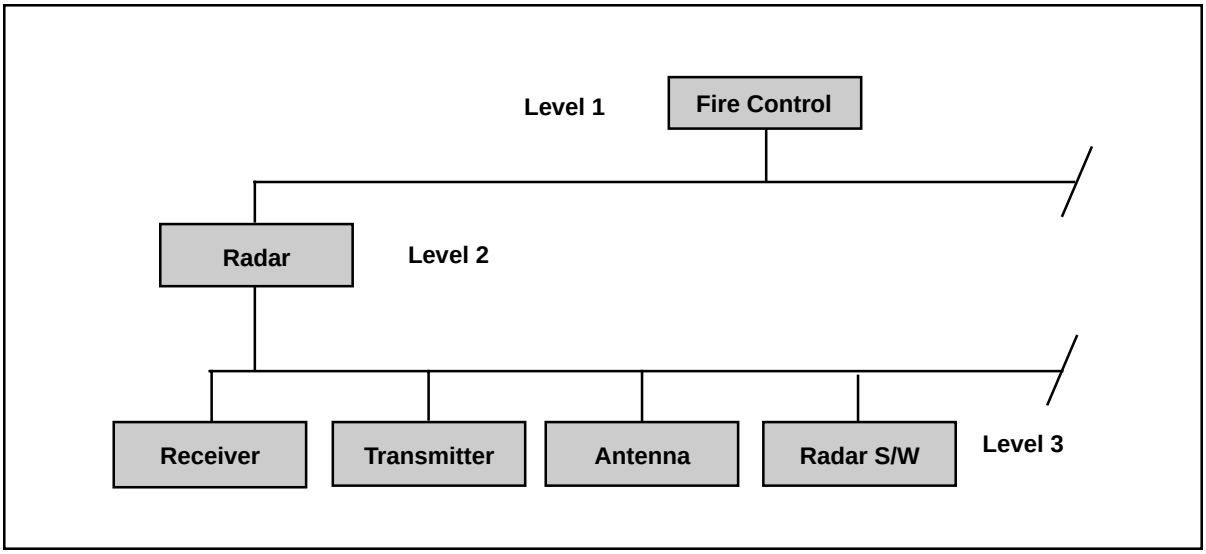


Figure 9–4. Contract WBS

9.3 DESIGNING AND TRACKING WORK

A prime use of the WBS is the design and tracking of work. The WBS is used to establish what work is necessary, a logical decomposition down to work packages, and a method for organizing feedback. As shown by Figure 9-5, the WBS element is matrixed against those organizations in the company responsible for the task. This creates cost accounts and task definition at a detailed level. It allows rational organization of integrated teams and other organizational structures by helping establish what expertise and functional support is required for a specific WBS element. It further allows precise tracking of technical and other management.

WBS Dictionary

As part of the work and cost control use of the WBS, a Work Breakdown Dictionary is developed. For each WBS element a dictionary entry is prepared that describes the task, what costs (activities) apply, and the references to the associated Contract Line Item Numbers and SOW paragraph. An example of a level 2 WBS element dictionary entry is shown as Figure 9-6.

9.4 SUMMARY POINTS

- The WBS is an essential tool for the organization and coordination of systems engineering

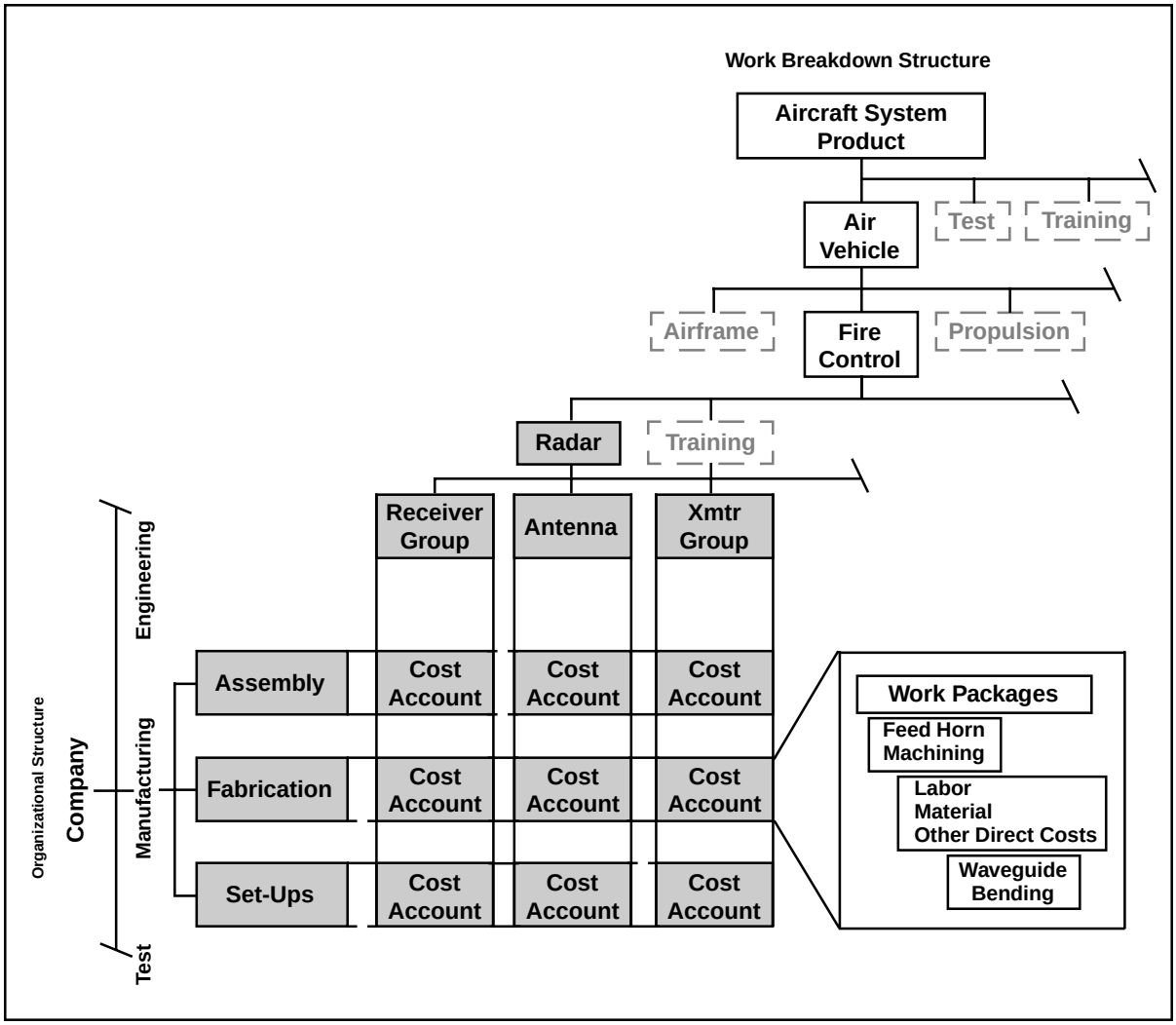


Figure 9-5. WBS Control Matrix

Index Item No. 2		**WBS Level 2**		**CONTRACT NUMBER** F33657-72-C-0923
WBS Element A10100		**WBS Title** Air Vehicle		**Contract Line Item:** 0001, 0001AA, 0001AB, 0001AC, 0001AD 0001AE, 0001AF, 0001AG, 0001AH
Date Chg	**Revision No.**	**Revision Auth**	**Approved**	
Specification No. 689E078780028		**Specification Title:** Prime Item Development Specification for AGM 86A Air Vehicle/ Airframe		

Element Task Description

Technical Content:

The Air Vehicle element task description refers to the effort required to develop, fabricate, integrate and test the airframe segment, portions of the Navigation/Guidance element, and Airborne Development Test Equipment and Airborne Operational Test Equipment and to the integration assembly and check-out of these complete elements, together with the Engine Segment, to produce the complete Air Vehicle. The lower-level elements included and summarized in the Air Vehicle element are:

Airframe Segment (A11100), Navigation/Guidance Segment (A32100), Airborne Development Test Equipment (A61100), and Airborne Operational Test Equipment (A61200).

Cost Description

MPC/PMC	**Work Order/Work Auth**
A10100	See lower level WBS Elements

Cost Content – System Contractor

The cost to be accumulated against this element includes a summarization of all costs required to plan, develop, fabricate, assemble, integrate and perform development testing, analysis and reporting for the air vehicle. It also includes all costs associated with the required efforts in integrating, assembling and checking our GFP required to create this element.

Applicable SOW Paragraph
3.6.2

Figure 9-6. Work Breakdown Dictionary

processes, and it is a product of the systems engineering process.

- Its importance extends beyond the technical community to business professionals and contracting officers. The needs of all stakeholders must be considered in its development. The program office develops the program WBS and a high-level contract WBS for each contract. The contractors develop the lower levels of the contract WBS associated with their contract.

- The system architecture provides the structure for a program WBS. SOW tasks flow from this WBS.

- The WBS provides a structure for organizing IPTs and tracking metrics.

CHAPTER 10

CONFIGURATION MANAGEMENT

10.1 FOUNDATIONS

Configuration Defined

A "configuration" consists of the functional, physical, and interface characteristics of existing or planned hardware, firmware, software or a combination thereof as set forth in technical documentation and ultimately achieved in a product. The configuration is formally expressed in relation to a Functional, Allocated, or Product configuration baseline as described in Chapter 8.

Configuration Management

Configuration management permits the orderly development of a system, subsystem, or configuration item. A good configuration management program ensures that designs are traceable to requirements, that change is controlled and documented, that interfaces are defined and understood, and that there is consistency between the product and its supporting documentation. Configuration management provides documentation that describes what is supposed to be produced, what is being produced, what has been produced, and what modifications have been made to what was produced.

Configuration management is performed on baselines, and the approval level for configuration modification can change with each baseline. In a typical system development, customers or user representatives control the operational requirements and usually the system concept. The developing agency program office normally controls the functional baseline. Allocated and product baselines can be controlled by the program office, the producer, or a logistics agent depending on the life cycle management strategy. This sets up a hierarchy of configuration control authority corresponding to the baseline structure. Since lower level baselines have to conform to a higher-level baseline, changes at the lower levels must be examined to assure they do not impact a higher-level baseline. If they do, they must be approved at the highest level impacted. For example, suppose the only engine turbine assembly affordably available for an engine development cannot provide the continuous operating temperature required by the allocated baseline. Then not only must the impact of the change at the lower level (turbine) be examined, but the change should also be reviewed for possible impact on the functional baseline, where requirements such as engine power and thrust might reside.

Configuration management is supported and performed by integrated teams in an Integrated Product and Process Development (IPPD) environment. Configuration management is closely associated with technical data management and interface management. Data and interface management is essential for proper configuration management, and the configuration management effort has to include them.

DoD Application of Configuration Management

During the development contract, the Government should maintain configuration control of the functional and performance requirements only, giving contractors responsibility for the detailed design. (SECDEF Memo of 29 Jun 94.) This implies government control of the Functional (system requirements) Baseline. Decisions regarding whether or not the government will take control of the lower-level baselines (allocated and product baselines), and when ultimately depends on the

requirements and strategies needed for the particular program. In general, government control of lower-level baselines, if exercised, will take place late in the development program after design has stabilized.

Configuration Management Planning

When planning a configuration management effort you should consider the basics: what has to be done, how should it be done, who should do it, when should it be done, and what resources are required. Planning should include the organizational and functional structure that will define the methods and procedures to manage functional and physical characteristics, interfaces, and documents of the system component. It should also include statements of responsibility and authority, methods of control, methods of audit or verification, milestones, and schedules. EIA IS-649, National Consensus Standard for Configuration Management, and MIL-HDBK-61 can be used as planning guidance.

Configuration Item (CI)

A key concept that affects planning is the configuration item (CI). CI decisions will determine what configurations will be managed. CIs are an aggregation of hardware, firmware, or computer software, or any of their discrete portions, which satisfies an end-use function and is designated for separate configuration management. Any item required for logistic support and designated for separate procurement is generally identified as CI. Components can be designated CIs because of crucial interfaces or the need to be integrated with operation with other components within or outside of the system. An item can be designated CI if it is developed wholly or partially with government funds, including nondevelopmental items (NDI) if additional development of technical data is required. All CIs are directly traceable to the WBS.

Impact of CI Designation

CI designation requires a separate configuration management effort for the CI, or groupings of related CIs. The decision to place an item, or items, under formal configuration control results in:

- Separate specifications,
- Formal approval of changes,
- Discrete records for configuration status accounting,
- Individual design reviews and configuration audits,
- Discrete identifiers and name plates,
- Separate qualification testing, and
- Separate operating and user manuals.

10.2 CONFIGURATION MANAGEMENT STRUCTURE

Configuration management comprises four interrelated efforts:

- Identification,
- Control,
- Status Accounting, and
- Audits.

Also directly associated with configuration management are data management and interface management. Any configuration management planning effort must consider all six elements.

Identification

Configuration Identification consists of documentation of formally approved baselines and specifications, including:

- Selection of the CIs,
- Determination of the types of configuration documentation required for each CI,

- Documenting the functional and physical characteristics of each CI,
- Establishing interface management procedures, organization, and documentation,
- Issuance of numbers and other identifiers associated with the system/CI configuration structure, including internal and external interfaces, and
- Distribution of CI identification and related configuration documentation.

Configuration Documentation

Configuration documentation is technical documentation that identifies and defines the item's functional and physical characteristics. It is developed, approved, and maintained through three distinct evolutionary increasing levels of detail. The three levels of configuration documentation form the three baselines and are referred to as functional, allocated, and product configuration documentation. These provide the specific technical description of a system or its components at any point in time.

Configuration Control

Configuration Control is the systematic proposal, justification, prioritization, evaluation, coordination, approval or disapproval, and implementation of all approved changes in the configuration of a system/CI after formal establishment of its baseline. In other words, it is how a system (and its CIs) change control process is executed and managed.

Configuration Control provides management visibility, ensures all factors associated with a proposed change are evaluated, prevents unnecessary or marginal changes, and establishes change priorities. In DoD it consists primarily of a change process that formalizes documentation and provides a management structure for change approval.

Change Documents Used for Government Controlled Baselines

There are three types of change documents used to control baselines associated with government configuration management: Engineering Change Proposal, Request for Deviation, and Request for Waivers.

- Engineering Change Proposals (ECP) identify need for a permanent configuration change. Upon approval of an ECP a new configuration is established.
- Requests for Deviation or Waiver propose a temporary departure from the baseline. They allow for acceptance of non-conforming material. After acceptance of a deviation or waiver the documented configuration remains unchanged.

Engineering Change Proposal (ECP)

An ECP is documentation that describes and suggests a change to a configuration baseline. Separate ECPs are submitted for each change that has a distinct objective. To provide advanced notice and reduce paperwork, Preliminary ECPs or Advance Change/Study Notices can be used preparatory to issue of a formal ECP. Time and effort for the approval process can be further reduced through use of joint government and contractor integrated teams to review and edit preliminary change proposals.

ECPs are identified as Class I or Class II. Class I changes require government approval before changing the configuration. These changes can result from problems with the baseline requirement, safety, interfaces, operating/servicing capability, preset adjustments, human interface including skill level, or training. Class I changes can also be used to upgrade already delivered systems to the new configuration through use of retrofit, mod kits, and the like. Class I ECPs are also used to change contractual provisions that do not directly impact the configuration baseline; for example, changes affecting cost, warranties, deliveries, or

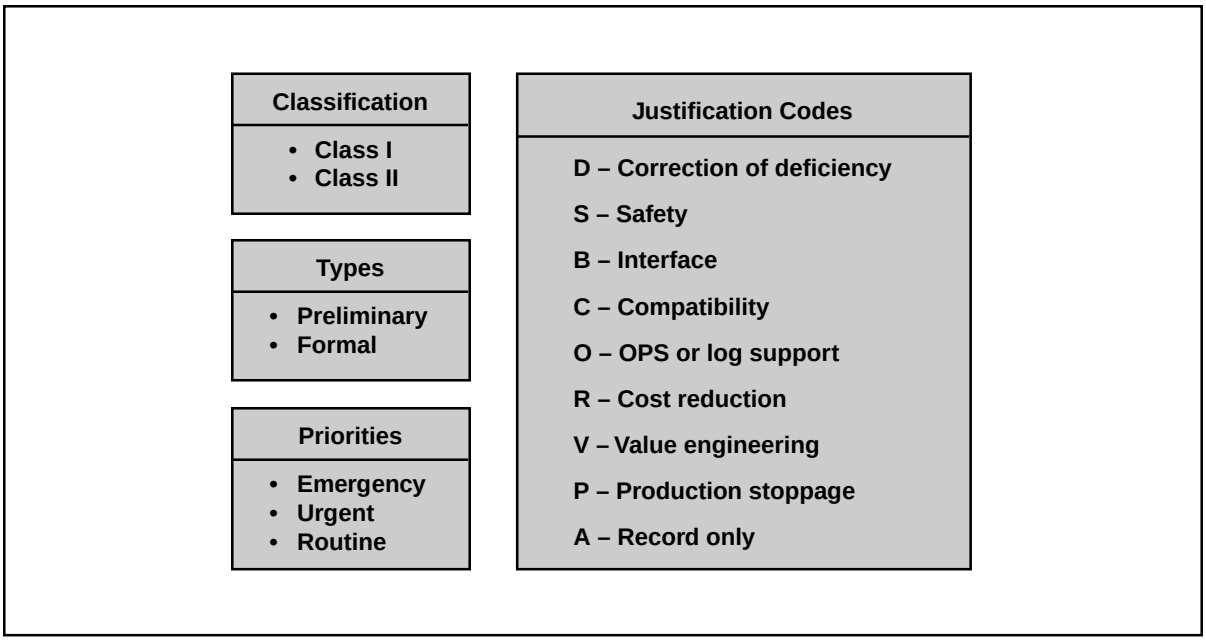


Figure 10-1. ECP Designators

data requirements. Class I ECPs require program office approval, which is usually handled through a formal Configuration Control Board, chaired by the government program manager or delegated representative.

Class II changes correct minor conflicts, typos, and other "housekeeping" changes that basically correct the documentation to reflect the current configuration. Class II applies only if the configuration is not changed when the documentation is changed. Class II ECPs are usually handled by the in-plant government representative. Class II ECPs generally require only that the government concurs that the change is properly classified. Under an initiative by the Defense Contract Management Command (DCMC), contractors are increasingly delegated the authority to make ECP classification decisions.

Figure 10-1 shows the key attributes associated with ECPs. The preliminary ECP, mentioned in Figure 10-1, is a simplified version of a formal ECP that explains the proposed ECP, and establishes an approximate schedule and cost for the change. The expense of an ECP development is avoided if review of the Preliminary ECP indicates the change is not viable. The approach used for preliminary ECPs vary in their form and name. Both Preliminary ECPs and Advanced Change/Study Notices have been used to formalize this process, but forms tailored to specific programs have also been used.

Configuration Control Board (CCB)

A CCB is formed to review Class I ECPs for approval, and make a recommendation to approve or not approve the proposed change. The CCB chair, usually the program manager, makes the final decision. Members advise and recommend, but the authority for the decision rests with the chair. CCB membership should represent the eight primary functions with the addition of representation of the procurement office, program control (budget), and Configuration Control manager, who serves as the CCB secretariat.

The CCB process is shown in Figure 10-2. The process starts with the contractor. A request to the contractor for an ECP or Preliminary ECP is necessary to initiate a government identified configuration change. The secretariat's review process includes assuring appropriate government

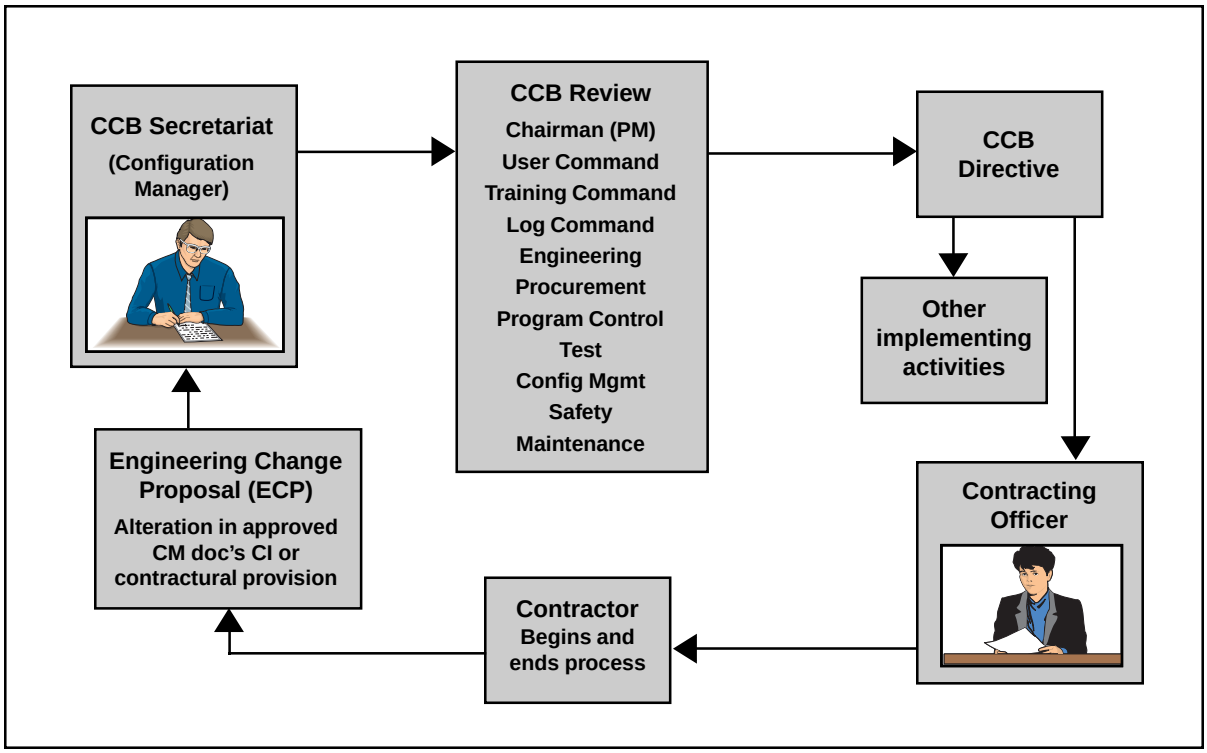


Figure 10-2. Configuration Control Board

contractual and engineering review is done prior to receipt by the CCB.

CCB Management Philosophy

The CCB process is a configuration control process, but it is also a contractual control process. Decisions made by the CCB chair affects the contractual agreement and program baseline as well as the configuration baseline. Concerns over contractual policy, program schedule, and budget can easily come into conflict with concerns relating to configuration management, technical issues, and technical activity scheduling. The CCB technical membership and CCB secretariat is responsible to provide a clear view of the technical need and the impact of alternate solutions to these conflicts. The CCB secretariat is further responsible to see that the CCB is fully informed and prepared, including ensuring that:

- A government/contractor engineering working group has analyzed the ECP and supporting data, prepared comments for CCB consideration, and is available to support the CCB;
- All pertinent information is available for review;
- The ECP has been reviewed by appropriate functional activities; and
- Issues have been identified and addressed.

CCB Documentation

Once the CCB chair makes a decision concerning an ECP, the CCB issues a Configuration Control Board Directive that distributes the decision and identifies key information relating to the implementation of the change:

- Implementation plan (who does what when);
- Contracts affected (prime and secondary);
- Dates of incorporation into contracts;
- Documentation affected (drawings, specifications, technical manuals, etc.), associated cost, and schedule completion date; and

- Identification of any orders or directives needed to be drafted and issued.

Request for Deviation or Waiver

A deviation is a specific written authorization, granted prior to manufacture of an item, to depart from a performance or design requirement for a specific number of units or a specific period of time.

A waiver is a written authorization to accept a CI that departs from specified requirements, but is suitable for use "as is" or after repair.

Requests for deviation and waivers relate to a temporary baseline departure that can affect system design and/or performance. The baseline remains unchanged and the government makes a determination whether the alternative "non-conforming" configuration results in an acceptable substitute. Acceptable substitute usually implies that there will be no impact on support elements, systems affected can operate effectively, and no follow-up or correction is required. The Federal Acquisition Regulations (FAR) requires "consideration" on government contracts when the Government accepts a "non-conforming" unit.

The distinction between Request for Deviation and Request for a Waiver is that a deviation is used *before* final assembly of the affected unit, and a waiver is used *after* final assembly or acceptance testing of the affected unit.

Status Accounting

Configuration Status Accounting is the recording and reporting of the information that is needed to manage the configuration effectively, including:

- A listing of the approved configuration documentation,
- The status of proposed changes, waivers and deviations to the configuration identification,
- The implementation status of approved changes, and
- The configuration of all units, including those in the operational inventory.

Purpose of Configuration Status Accounting

Configuration Status Accounting provides information required for configuration management by:

- Collecting and recording data concerning:
  - Baseline configurations,
  - Proposed changes, and
  - Approved changes.
- Disseminating information concerning:
  - Approved configurations,
  - Status and impact of proposed changes,
  - Requirements, schedules, impact and status of approved changes, and
  - Current configurations of delivered items.

Audits

Configuration Audits are used to verify a system and its components' conformance to their configuration documentation. Audits are key milestones in the development of the system and do not stand alone. The next chapter will show how they fit in the overall process of assessing design maturity.

Functional Configuration Audits (FCA) and the System Verification Review (SVR) are performed in the Production Readiness and LRIP stage of the Production and Development Phase. FCA is used to verify that actual performance of the configuration item meets specification requirements. The SVR serves as system-level audit after FCAs have been conducted.

The Physical Configuration Audit (PCA) is normally held during Rate Production and Development stage as a formal examination of a production representative unit against the draft technical data package (product baseline documentation).

Most audits, whether FCA or PCA, are today approached as a series of "rolling" reviews in which items are progressively audited as they are produced such that the final FCA or PCA becomes

significantly less oppressive and disruptive to the normal flow of program development.

10.3 INTERFACE MANAGEMENT

Interface Management consists of identifying the interfaces, establishing working groups to manage the interfaces, and the group's development of interface control documentation. Interface Management identifies, develops, and maintains the external and internal interfaces necessary for system operation. It supports the configuration management effort by ensuring that configuration decisions are made with full understanding of their impact outside of the area of the change.

Interface Identification

An interface is a functional, physical, electrical, electronic, mechanical, hydraulic, pneumatic, optical, software, or similar characteristic required to exist at a common boundary between two or more systems, products, or components. Normally, in a contractual relationship the procuring agency identifies external interfaces, sets requirements for integrated teams, and provides appropriate personnel for the teams. The contracted design agent or manufacturer manages internal interfaces; plans, organizes, and leads design integrated teams; maintains internal and external interface requirements; and controls interfaces to ensure accountability and timely dissemination of changes.

Interface Control Working Group (ICWG)

The ICWG is the traditional forum to establish official communications link between those responsible for the design of interfacing systems or components. Within the IPPD framework ICWGs can be integrated teams that establish linkage between interfacing design IPTs, or could be integrated into a system-level engineering working group. Membership of ICWGs or comparable integrated teams should include membership from each contractor, significant vendors, and participating government agencies. The procuring program office (external and selected top-level interfaces) or prime contractor (internal interfaces) generally designates the chair.

Interface Control Documentation (ICD)

Interface Control Documentation includes Interface Control Drawings, Interface Requirements Specifications, and other documentation that depicts physical and functional interfaces of related or co-functioning systems or components. ICD is the product of ICWGs or comparable integrated teams, and their purpose is to establish and maintain compatibility between interfacing systems or components.

Open Systems Interface Standards

To minimize the impact of unique interface designs, improve interoperability, maximize the use of commercial components, and improve the capacity for future upgrade, an open-systems approach should be a significant part of interface control planning. The open-systems approach involves selecting industry-recognized specifications and standards to define system internal and external interfaces. An open system is characterized by:

- Increased use of functional partitioning and modular design to enhance flexibility of component choices without impact on interfaces,
- Use of well-defined, widely used, non-proprietary interfaces or protocols based on standards developed or adopted by industry recognized standards institutions or professional societies, and
- Explicit provision for expansion or upgrading through the incorporation of additional or higher performance elements with minimal impact on the system.

DoD mandatory guidance for information technology standards is in the Joint Technical Architecture.

10.4 DATA MANAGEMENT

Data management documents and maintains the database reflecting system life cycle decisions, methods, feedback, metrics, and configuration control. It directly supports the configuration status accounting process. Data Management governs and controls the selection, generation, preparation, acquisition, and use of data imposed on contractors.

Data Required By Contract

Data is defined as recorded information, regardless of form or characteristic, and includes all the administrative, management, financial, scientific, engineering, and logistics information and documentation required for delivery from the contractor. Contractually required data is classified as one of three types:

- Type I: Technical data
- Type II: Non-technical data
- Type III: One-time use data (technical or non-technical)

Data is acquired for two basic purposes:

- Information feedback from the contractor for program management control, and
- Decision making information needed to manage, operate, and support the system (e.g., specifications, technical manuals, engineering drawings, etc.).

Data analysis and management is expensive and time consuming. Present DoD philosophy requires that the contractor manage and maintain significant portions of the technical data, including the Technical Data Package (TDP). Note that this does *not* mean the government isn't paying for its development or shouldn't receive a copy for post-delivery use. Minimize the TDP cost by requesting the contractor's format (for example, accepting the same drawings they use for production), and asking only for details on items developed with government funds.

Data Call for Government Contracts

As part of the development of an Invitation for Bid or Request for Proposals, the program office issues a letter that describes the planned procurement and asks integrated team leaders and effected functional managers to identify and justify their data requirements for that contract. A description of each data item needed is then developed by the affected teams or functional offices, and reviewed by the program office. Data Item Descriptions, located in the Acquisition Management Systems Data List (AMSDL) (see Chapter 8) can be used for guidance in developing these descriptions.

Concurrent with the DoD policy on specifications and standards, there is a trend to avoid use of standard Data Item Descriptions on contracts, and specify the data item with a unique tailored data description referenced in the Contract Data Requirements List.

10.5 SUMMARY POINTS

- Configuration management is essential to control the system design throughout the life cycle.
- Use of integrated teams in an IPPD environment is necessary for disciplined configuration management of complex systems.
- Technical data management is essential to trace decisions and changes and to document designs, processes and procedures.
- Interface management is essential to ensure that system elements are compatible in terms of form, fit, and function.
- Three configuration baselines are managed:
  - Functional (System level)
  - Allocated (Design To)
  - Product (Build To/As Built)

Configuration management is a shared responsibility between the government and the contractor. Contract manager (CM) key elements are Identification, Control, Status Accounting, and Audits.

CHAPTER 11

TECHNICAL REVIEWS AND AUDITS

11.1 PROGRESS MEASUREMENT

The Systems Engineer measures design progress and maturity by assessing its development at key event-driven points in the development schedule. The design is compared to pre-established exit criteria for the particular event to determine if the appropriate level of maturity has been achieved. These key events are generally known as Technical Reviews and Audits.

A system in development proceeds through a sequence of stages as it proceeds from concept to finished product. These are referred to as "levels of development." Technical Reviews are done after each level of development to check design maturity, review technical risk, and determines whether to proceed to the next level of development. Technical Reviews reduce program risk and ease the transition to production by:

- Assessing the maturity of the design/development effort,
- Clarifying design requirements,
- Challenging the design and related processes,
- Checking proposed design configuration against technical requirements, customer needs, and system requirements,
- Evaluating the system configuration at different stages,
- Providing a forum for communication, coordination, and integration across all disciplines and IPTs,
- Establishing a common configuration baseline from which to proceed to the next level of design, and
- Recording design decision rationale in the decision database.

Formal technical reviews are preceded by a series of technical interchange meetings where issues, problems and concerns are surfaced and addressed. The formal technical review is NOT the place for problem solving, but to verify problem solving has been done; it is a process rather than an event!

Planning

Planning for Technical Reviews must be extensive and up-front-and-early. Important considerations for planning include the following:

- Timely and effective attention and visibility into the activities preparing for the review,
- Identification and allocation of resources necessary to accomplish the total review effort,
- Tailoring consistent with program risk levels,
- Scheduling consistent with availability of appropriate data,
- Establishing event-driven entry and exit criteria,
- Where appropriate, conduct of incremental reviews,
- Implementation by IPTs,

- Review of all system functions, and
- Confirmation that all system elements are integrated and balanced.

The maturity of enabling products are reviewed with their associated end product. Reviews should consider the testability, producibility, training, and supportability for the system, subsystem or configuration item being addressed.

The depth of the review is a function of the complexity of the system, subsystem, or configuration item being reviewed. Where design is pushing state-of-the-art technology the review will require a greater depth than if it is for a commercial off-the-shelf item. Items, which are complex or an application of new technology, will require a more detailed scrutiny.

Planning Tip: Develop a check list of pre-review, review, and post-review activities required. Develop check lists for exit criteria and required level of detail in design documentation. Include key questions to be answered and what information must be available to facilitate the review process. Figure 11-1 shows the review process with key activities identified.

11.2 TECHNICAL REVIEWS

Technical reviews are conducted at both the system level and at lower levels (e.g., sub-system). This discussion will focus on the primary system-level reviews. Lower-level reviews may be thought of as events that support and prepare for the system-level events. The names used in reference to

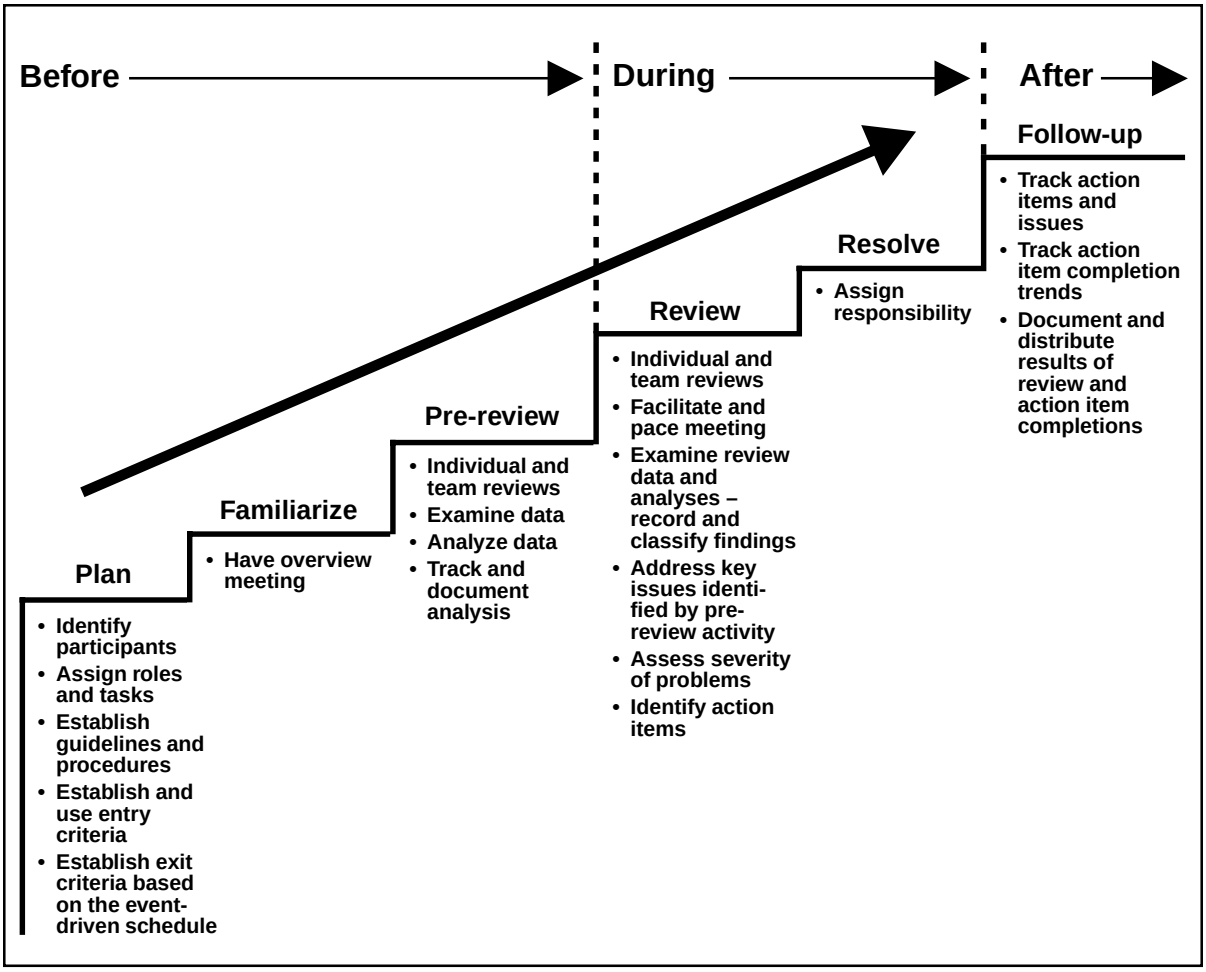


Figure 11-1. Technical Review Process

reviews is unimportant; however, it is important that reviews be held at appropriate points in program development and that both the contractor and government have common expectations regarding the content and outcomes.

Conducting Reviews

Reviews are event-driven, meaning that they are to be conducted when the progress of the product under development merits review. Forcing a review (simply based on the fact that a schedule developed earlier) projected the review at a point in time will jeopardize the review's legitimacy. Do the work ahead of the review event. Use the review event as a confirmation of completed effort. The data necessary to determine if the exit criteria are satisfied should be distributed, analyzed, and analysis coordinated prior to the review. The type of information needed for a technical review would include: specifications, drawings, manuals, schedules, design and test data, trade studies, risk analysis, effectiveness analyses, mock-ups, breadboards, in-process and finished hardware, test methods, technical plans (Manufacturing, Test, Support, Training), and trend (metrics) data. Reviews should be brief and follow a prepared agenda based on the pre-review analysis and assessment of where attention is needed.

Only designated participants should personally attend. These individuals should be those that were involved in the preparatory work for the review and members of the IPTs responsible for meeting the event exit criteria. Participants should include representation from all appropriate government activities, contractor, subcontractors, vendors and suppliers.

A review is the confirmation of a process. New items should not come up at the review. If significant items do emerge, it's a clear sign the review is

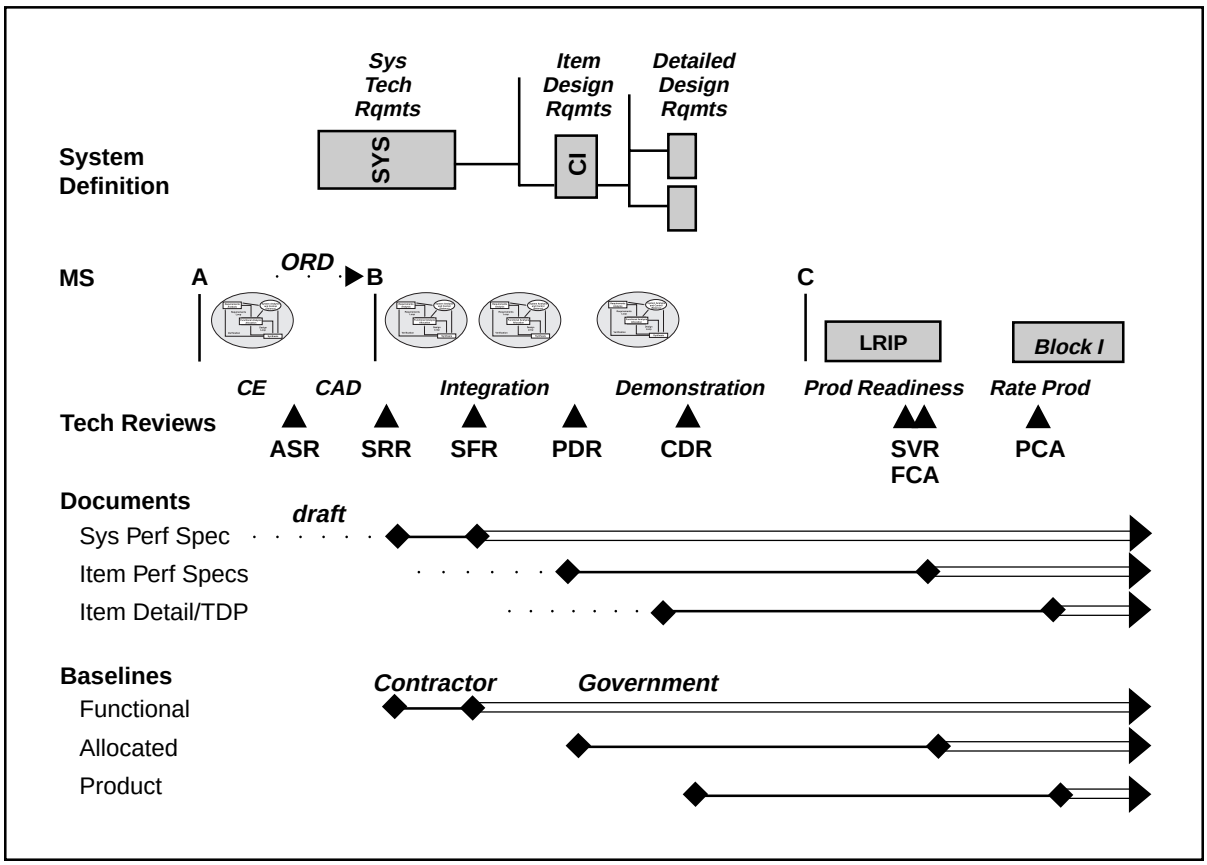


Figure 11-2. Phasing of Technical Reviews

being held prematurely, and project risk has just increased significantly. A poorly orchestrated and performed technical review is a significant indicator of management problems.

Action items resulting from the review are documented and tracked. These items, identified by specific nomenclature and due dates, are prepared and distributed as soon as possible after the review. The action taken is tracked and results distributed as items are completed.

Phasing of Technical Reviews

As a system progresses through design and development, it typically passes from a given level of development to another, more advanced level of development. For example, a typical system will pass from a stage where only the requirements are known, to another stage where a conceptual solution has been defined. Or it may pass from a stage where the design requirements for the primary subsystems are formalized, to a stage where the physical design solutions for those requirements are defined. (See Figure 11-2.)

These stages are the "levels of development" referred to in this chapter. System-level technical reviews are generally timed to correspond to the transition from one level of development to another. The technical review is the event at which the technical manager verifies that the technical maturity of the system or item under review is sufficient to justify passage into the subsequent phase of development, with the concomitant commitment of resources required.

As the system or product progresses through development, the focus of technical assessment takes different forms. Early in the process, the primary focus is on defining the requirements on which subsequent design and development activities will be based. Similarly, technical reviews conducted during the early stages of development are almost always focused on ensuring that the top-level concepts and system definitions reflect the requirements of the user. Once system-level definition is complete, the focus turns to design at sub-system levels and below. Technical reviews during these stages are typically design reviews that establish design requirements and then

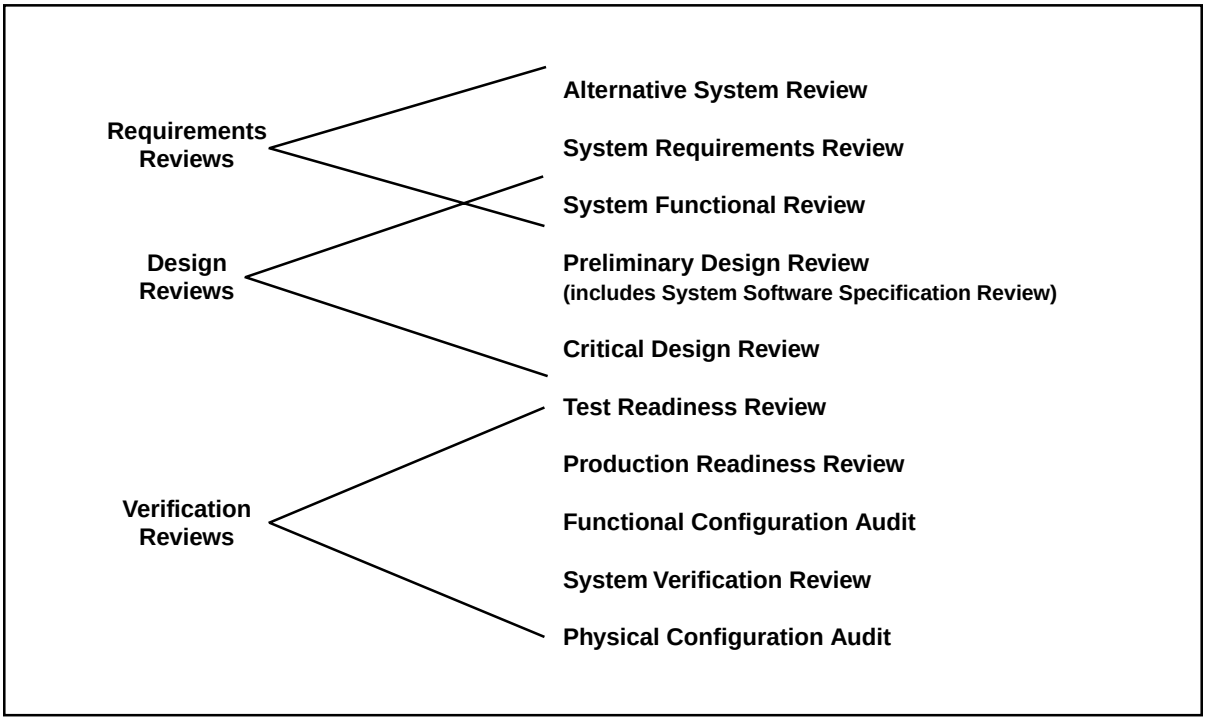


Figure 11-3. Typical System-Level Technical Reviews

verify that physical solutions are consistent with those requirements. In the final stages of development, technical reviews and audits are conducted to verify that the products produced meet the requirements on which the development is based. Figure 11-3 summarizes the typical schedule of system-level reviews by type and focus.

Another issue associated with technical reviews, as well as other key events normally associated with executing the systems engineering process, is when those events generally occur relative to the phases of the DoD acquisition life-cycle process. The timing of these events will vary somewhat from program to program, based upon the explicit and unique needs of the situation; however, Figure 11-4 shows a generalized concept of how the technical reviews normal to systems engineering might occur relative to the acquisition life-cycle phases.

Specific system-level technical reviews are known by many different names, and different engineering standards and documents often use different nomenclature when referring to the same review. The names used to refer to technical reviews are unimportant; however, it is important to have a grasp of the schedule of reviews that is normal to system development and to have an understanding of what is the focus and purpose of those reviews. The following paragraphs outline a schedule of reviews that is complete in terms of assessing technical progress from concept through production. The names used were chosen because they seemed to be descriptive of the focus of the activity. Of course, the array of reviews and the focus of individual reviews is to be tailored to the specific needs of the program under development, so not all programs should plan on conducting all of the following reviews.

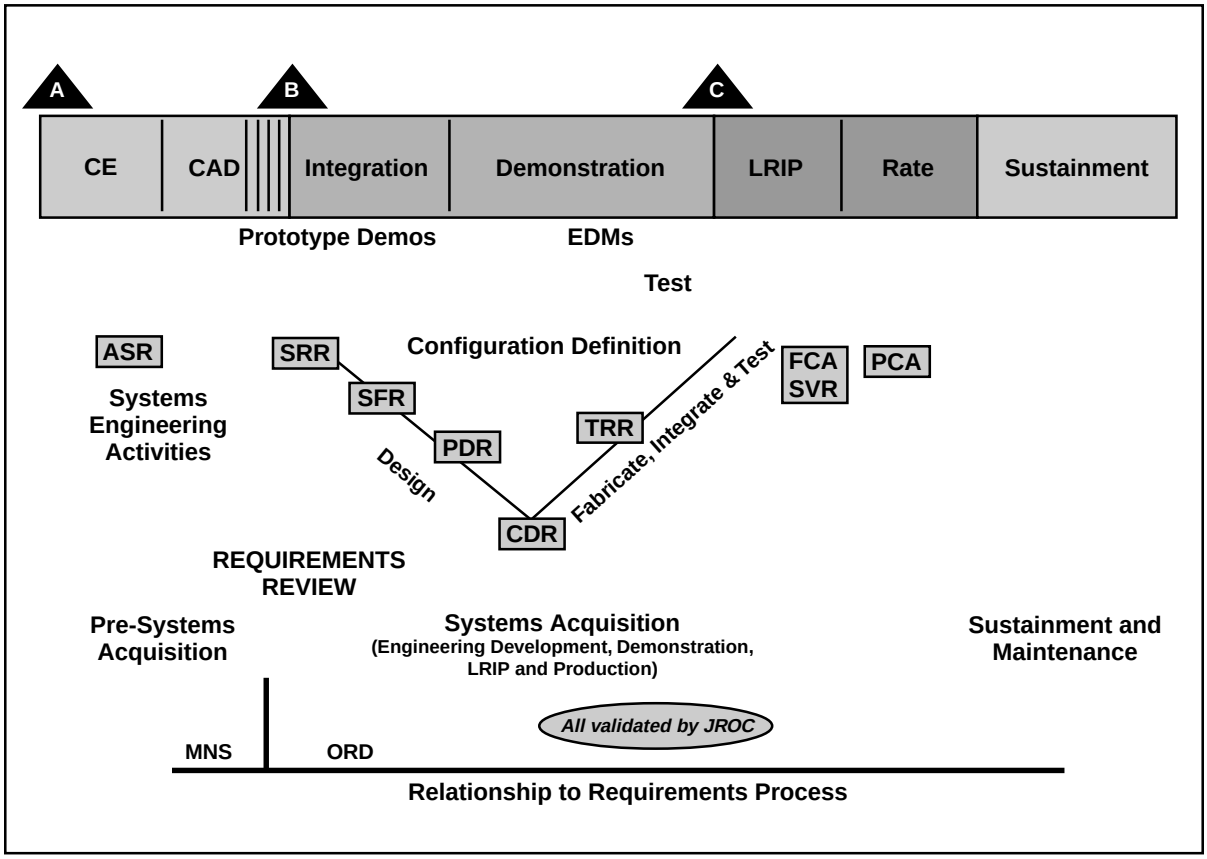


Figure 11-4. Relationship of Systems Engineering Events to Acquisition Life Cycle Phases

Alternative Systems Review (ASR)

After the concept studies are complete a preferred system concept is identified. The associated draft System Work Breakdown Structure, preliminary functional baseline, and draft system specification are reviewed to determine feasibility and risk. Technology dependencies are reviewed to ascertain the level of technology risk associated with the proposed concepts. This review is conducted late during the Concept Exploration stage of the Concept and Technology Development Phase of the acquisition process to verify that the preferred system concept:

- Provides a cost-effective, operationally-effective and suitable solution to identified needs,
- Meets established affordability criteria, and
- Can be developed to provide a timely solution to the need at an acceptable level of risk.

The findings of this review are a significant input to decision review conducted after Concept Exploration to determine where the system should enter in the life-cycle process to continue development. This determination is largely based on technology and system development maturity.

It is important to understand that the path of the system through the life-cycle process will be different for systems of different maturities. Consequently, the decision as whether or not to conduct the technical reviews that are briefly described in the following paragraphs is dependent on the extent of design and development required to bring the system to a level of maturity that justifies producing and fielding it.

System Requirements Review (SRR)

If a system architecture system must be developed and a top-down design elaborated, the system will pass through a number of well-defined levels of development, and that being the case, a well-planned schedule of technical reviews is imperative. The Component Advanced Development stage (the second stage of Concept and Technology Development in the revised acquisition life-cycle process) is the stage during which system-level architectures are defined and any necessary advanced development required to assess and control technical risk is conducted. As the system passes into the acquisition process, i.e., passes a Milestone B and enters System Development and Demonstration, it is appropriate to conduct a SRR. The SRR is intended to confirm that the user's requirements have been translated into system specific technical requirements, that critical technologies are identified and required technology demonstrations are planned, and that risks are well understood and mitigation plans are in place. The draft system specification is verified to reflect the operational requirements.

All relevant documentation should be reviewed, including:

- System Operational Requirements,
- Draft System Specification and any initial draft Performance Item Specifications,
- Functional Analysis (top level block diagrams),
- Feasibility Analysis (results of technology assessments and trade studies to justify system design approach),
- System Maintenance Concept,
- Significant system design criteria (reliability, maintainability, logistics requirements, etc.),
- System Engineering Planning,
- Test and Evaluation Master Plan,
- Draft top-level Technical Performance Measurement, and
- System design documentation (layout drawings, conceptual design drawings, selected supplier components data, etc.).

The SRR confirms that the system-level requirements are sufficiently well understood to permit

the developer (contractor) to establish an initial system level functional baseline. Once that baseline is established, the effort begins to define the functional, performance, and physical attributes of the items below system level and to allocate them to the physical elements that will perform the functions.

System Functional Review (SFR)

The process of defining the items or elements below system level involves substantial engineering effort. This design activity is accompanied by analysis, trade studies, modeling and simulation, as well as continuous developmental testing to achieve an optimum definition of the major elements that make up the system, with associated functionality and performance requirements. This activity results in two major systems engineering products: the final version of the system performance specification and draft versions of the performance specifications, which describe the items below system level (item performance specifications). These documents, in turn, define the system functional baseline and the draft allocated baseline. As this activity is completed, the system has passed from the level of a concept to a well-defined system design, and, as such, it is appropriate to conduct another in the series of technical reviews.

The SFR will typically include the tasks listed below. Most importantly, the system technical description (Functional Baseline) must be approved as the governing technical requirement before proceeding to further technical development. This sets the stage for engineering design and development at the lower levels in the system architecture. The government, as the customer, will normally take control of and manage the system functional baseline following successful completion of the SFR.

The review should include assessment of the following items. More complete lists are found in standards and texts on the subject.

- Verification that the system specification reflects requirements that will meet user expectations.
- Functional Analysis and Allocation of requirements to items below system level,
- Draft Item Performance and some Item Detail Specifications,
- Design data defining the overall system,
- Verification that the risks associated with the system design are at acceptable levels for engineering development,
- Verification that the design selections have been optimized through appropriate trade study analyses,
- Supporting analyses, e.g., logistics, human systems integration, etc., and plans are identified and complete where appropriate,
- Technical Performance Measurement data and analysis, and
- Plans for evolutionary design and development are in place and that the system design is modular and open.

Following the SFR, work proceeds to complete the definition of the design of the items below system level, in terms of function, performance, interface requirements for each item. These definitions are typically captured in item performance specifications, sometimes referred to as prime item development specifications. As these documents are finalized, reviews will normally be held to verify that the design requirements at the item level reflect the set of requirements that will result in an acceptable detailed design, because all design work from the item level to the lowest level in the system will be based on the requirements agreed upon at the item level. The establishment of a set of final item-level design requirements represents the definition of the allocated baseline for the system. There are two primary reviews normally associated with this event: the Software Specification Review (SSR), and the Preliminary Design Review (PDR).

Software Specification Review (SSR)

As system design decisions are made, typically some functions are allocated to hardware items, while others are allocated to software. A separate specification is developed for software items to describe the functions, performance, interfaces and other information that will guide the design and development of software items. In preparation for the system-level PDR, the system software specification is reviewed prior to establishing the Allocated Baseline. The review includes:

- Review and evaluate the maturity of software requirements,
- Validation that the software requirements specification and the interface requirements specification reflect the system-level requirements allocated to software,
- Evaluation of computer hardware and software compatibility,
- Evaluation of human interfaces, controls, and displays
- Assurance that software-related risks have been identified and mitigation plans established,
- Validation that software designs are consistent with the Operations Concept Document,
- Plans for testing, and
- Review of preliminary manuals.

Preliminary Design Review (PDR)

Using the Functional Baseline, especially the System Specification, as a governing requirement, a preliminary design is expressed in terms of design requirements for subsystems and configuration items. This preliminary design sets forth the functions, performance, and interface requirements that will govern design of the items below system level. Following the PDR, this preliminary design (Allocated Baseline) will be put under formal configuration control [usually] by the contractor. The Item Performance Specifications, including the system software specification, which form the core of the Allocated Baseline, will be confirmed to represent a design that meets the System Specification.

This review is performed during the System Development and Demonstration phase. Reviews are held for configuration items (CIs), or groups of related CIs, prior to a system-level PDR. Item Performance Specifications are put under configuration control (Current DoD practice is for contractors to maintain configuration control over Item Performance Specifications, while the government exercises requirements control at the system level). At a minimum, the review should include assessment of the following items:

- Item Performance Specifications,
- Draft Item Detail, Process, and Material Specifications,
- Design data defining major subsystems, equipment, software, and other system elements,
- Analyses, reports, “ility” analyses, trade studies, logistics support analysis data, and design documentation,
- Technical Performance Measurement data and analysis,
- Engineering breadboards, laboratory models, test models, mockups, and prototypes used to support the design, and
- Supplier data describing specific components.

[Rough Rule of Thumb: ~15% of production drawings are released by PDR. This rule is anecdotal and only guidance relating to an “average” defense hardware program.]

Critical Design Review (CDR)

Before starting to build the production line there needs to be verification and formalization of the

mutual understanding of the details of the item being produced. Performed during the System Development and Demonstration phase, this review evaluates the draft Production Baseline ("Build To" documentation) to determine if the system design documentation (Product Baseline, including Item Detail Specs, Material Specs, Process Specs) is satisfactory to start initial manufacturing. This review includes the evaluation of all CIs. It includes a series of reviews conducted for each hardware CI before release of design to fabrication, and each computer software CI before final coding and testing. Additionally, test plans are reviewed to assess if test efforts are developing sufficiently to indicate the Test Readiness Review will be successful. The approved detail design serves as the basis for final production planning and initiates the development of final software code.

[Rough Rule of Thumb: At CDR the design should be at least 85% complete. Many programs use drawing release as a metric for measuring design completion. This rule is anecdotal and only guidance relating to an "average" defense hardware program.]

Test Readiness Review (TRR)

Typically performed during the System Demonstration stage of the System Development and Demonstration phase (after CDR), the TRR assesses test objectives, procedures, and resources testing coordination. Originally developed as a software CI review, this review is increasingly applied to both hardware and software items. The TRR determines the completeness of test procedures and their compliance with test plans and descriptions. Completion coincides with the initiation of *formal* CI testing.

Production Readiness Reviews (PRR)

Performed incrementally during the System Development and Demonstration and during the Production Readiness stage of the Production and Deployment phase, this series of reviews is held to determine if production preparation for the system, subsystems, and configuration items is complete, comprehensive, and coordinated. PRRs are necessary to determine the readiness for production prior to executing a production go-ahead decision. They will formally examine the producibility of the production design, the control over the projected production processes, and adequacy of resources necessary to execute production. Manufacturing risk is evaluated in relationship to product and manufacturing process performance, cost, and schedule. These reviews support acquisition decisions to proceed to Low-Rate Initial Production (LRIP) or Full-Rate Production.

Functional Configuration Audit/ System Verification Review (FCA)/(SVR)

This series of audits and the consolidating SVR re-examines and verifies the customer's needs, and the relationship of these needs to the system and subsystem technical performance descriptions (Functional and Allocated Baselines). They determine if the system produced (including production representative prototypes or LRIP units) is capable of meeting the technical performance requirements established in the specifications, test plans, etc. The FCA verifies that all requirements established in the specifications, associated test plans, and related documents have been tested and that the item has passed the tests, or corrective action has been initiated. The technical assessments and decisions that are made in SVR will be presented to support the full-rate production go-ahead decision. Among the issues addressed:

- Readiness issues for continuing design, continuing verifications, production, training, deployment, operations, support, and disposal have been resolved,
- Verification is comprehensive and complete,
- Configuration audits, including completion of all change actions, have been completed for all CIs,
- Risk management planning has been updated for production,
- Systems Engineering planning is updated for production, and

- Critical achievements, success criteria and metrics have been established for production.

Physical Configuration Audit (PCA)

After full-rate production has been approved, follow-on independent verification (FOT&E) has identified the changes the user requires, and those changes have been corrected on the baseline documents and the production line, then it is time to assure that the product and the product baseline documentation are consistent. The PCA will formalize the Product Baseline, including specifications and the technical data package, so that future changes can only be made through full configuration management procedures. Fundamentally, the PCA verifies the product (as built) is consistent with the Technical Data Package which describes the Product Baseline. The final PCA confirms:

- The subsystem and CI PCAs have been successfully completed,
- The integrated decision database is valid and represents the product,
- All items have been baselined,
- Changes to previous baselines have been completed,
- Testing deficiencies have been resolved and appropriate changes implemented, and
- System processes are current and can be executed.

The PCA is a configuration management activity and is conducted following procedures established in the Configuration Management Plan.

11.3 TAILORING

The reviews described above are based on a complex system development project requiring significant technical evaluation. There are also cases where system technical maturity is more advanced than normal for the phase, for example, where a previous program or an Advanced Technical Concept Demonstration (ACTD) has provided a significant level of technical development applicable to the current program. In some cases this will precipitate the merging or even elimination of acquisition phases. This does not justify elimination of the technical management activities grouped under the general heading of systems analysis and control, nor does it relieve the government program manager of the responsibility to see that these disciplines are enforced. It does, however, highlight the need for flexibility and tailoring to the specific needs of the program under development.

For example, a DoD acquisition strategy that proposes that a system proceed directly into the demonstration stage may skip a stage of the complete acquisition process, but it must not skip the formulation of an appropriate Functional Baseline and the equivalent of an SFR to support the development. Nor should it skip the formulation of the Allocated Baseline and the equivalent of a PDR, and the formulation of the Product Baseline and the equivalent of a CDR. Baselines must be developed sequentially because they document different levels of design requirements and must build on each other. However, the assessment of design and development maturity can be tailored as appropriate for the particular system. Tailored efforts still have to deal with the problem of determining when the design maturity should be assessed, and how these assessments will support the formulation and control of baselines, which document the design requirements as the system matures.

In tailoring efforts, be extremely careful determining the level of system complexity. The system integration effort, the development of a single advanced technology or complex sub-component, or the need for intensive software development may be sufficient to establish the total system as a complex project, even though it appears simple because most subsystems are simple or off-the-shelf.

11.4 SUMMARY POINTS

- Each level of product development is evaluated and progress is controlled by specification development (System, Item Performance, Item Detail, Process, and Material specifications) and technical reviews and audits (ASR, SRR, SDR, SSR, PDR, CDR, TRR, PRR, FCA, SVR, PCA).

- Technical reviews assess development maturity, risk, and cost/schedule effectiveness to determine readiness to proceed.

- Reviews must be planned, managed, and followed up to be effective as an analysis and control tool.

- As the system progresses through the development effort, the nature of design reviews and audits will parallel the technical effort. Initially they will focus on requirements and functions, and later become very product focused.

- After system level reviews establish the Functional Baseline, technical reviews tend to be subsystem and CI focused until late in development when the focus again turns to the system level to determine the system's readiness for production.

CHAPTER 12

TRADE STUDIES

12.1 MAKING CHOICES

Trade Studies are a formal decision making methodology used by integrated teams to make choices and resolve conflicts during the systems engineering process. Good trade study analyses demand the participation of the integrated team; otherwise, the solution reached may be based on unwarranted assumptions or may reflect the omission of important data.

Trade studies identify desirable and practical alternatives among requirements, technical objectives, design, program schedule, functional and performance requirements, and life-cycle costs are identified and conducted. Choices are then made using a defined set of criteria. Trade studies are defined, conducted, and documented at the various levels of the functional or physical architecture in enough detail to support decision making and lead to a balanced system solution. The level of detail of any trade study needs to be commensurate with cost, schedule, performance, and risk impacts.

Both formal and informal trade studies are conducted in any systems engineering activity. Formal trade studies tend to be those that will be used in formal decision forums, e.g., milestone decisions. These are typically well documented and become a part of the decision database normal to systems development. On the other hand, engineering choices at every level involve trade-offs and decisions that parallel the trade study process. Most of these less-formal studies are documented in summary detail only, but they are important in that they define the design as it evolves.

Systems Engineering Process and Trade Studies

Trade studies are required to support decisions throughout the systems engineering process. During requirements analysis, requirements are balanced against other requirements or constraints, including cost. Requirements analysis trade studies examine and analyze alternative performance and functional requirements to resolve conflicts and satisfy customer needs.

During functional analysis and allocation, functions are balanced with interface requirements, dictated equipment, functional partitioning, requirements flowdown, and configuration items designation considerations. Trade studies are conducted within and across functions to:

- Support functional analyses and allocation of performance requirements and design constraints,
- Define a preferred set of performance requirements satisfying identified functional interfaces,
- Determine performance requirements for lower-level functions when higher-level performance and functional requirements can not be readily resolved to the lower-level, and
- Evaluate alternative functional architectures.

During design synthesis, trade studies are used to evaluate alternative solutions to optimize cost, schedule, performance, and risk. Trade studies are conducted during synthesis to:

- Support decisions for new product and process developments versus non-developmental products and processes;
- Establish system, subsystem, and component configurations;
- Assist in selecting system concepts, designs, and solutions (including people, parts, and materials availability);
- Support materials selection and make-or-buy, process, rate, and location decisions;
- Examine proposed changes;
- Examine alternative technologies to satisfy functional or design requirements including alternatives for moderate- to high- risk technologies;
- Evaluate environmental and cost impacts of materials and processes;
- Evaluate alternative physical architectures to select preferred products and processes; and
- Select standard components, techniques, services, and facilities that reduce system life-cycle cost and meet system effectiveness requirements.

During early program phases, for example, during Concept Exploration and functional baseline development, trade studies are used to examine alternative system-level concepts and scenarios to help establish the system configuration. During later phases, trade studies are used to examine lower-level system segments, subsystems, and end items to assist in selecting component part designs. Performance, cost, safety, reliability, risk, and other effectiveness measures must be traded against each other and against physical characteristics.

12.2 TRADE STUDY BASICS

Trade studies (trade-off analyses) are processes that examine viable alternatives to determine which is preferred. It is important that there be criteria established that are acceptable to all members of the integrated team as a basis for a decision. In addition, there must be an agreed-upon approach to measuring alternatives against the criteria. If these principles are followed, the trade study should produce decisions that are rational, objective, and repeatable. Finally, trade study results must be such that they can be easily communicated to customers and decision makers. If the results of a trade study are too complex to communicate with ease, it is unlikely that the process will result in timely decisions.

Trade Study Process

As shown by Figure 12-1, the process of trade-off analysis consists of defining the problem, bounding the problem, establishing a trade-off methodology (to include the establishment of decision criteria), selecting alternative solutions, determining the key characteristics of each alternative, evaluating the alternatives, and choosing a solution:

- Defining the problem entails developing a problem statement including any constraints. Problem definition should be done with extreme care. *After all, if you don't have the right problem, you won't get the right answer.*
- Bounding and understanding the problem requires identification of system requirements that apply to the study.
- Conflicts between desired characteristics of the product or process being studied, and the limitations of available data. Available databases should be identified that can provide relevant, historical "actual" information to support evaluation decisions.
- Establishing the methodology includes choosing the mathematical method of comparison, developing and quantifying the criteria used for comparison, and determining weighting factors (if any). Use of appropriate models and methodology will dictate the rationality, objectivity, and repeatability of the study. Experience has shown that this step can be easily abused

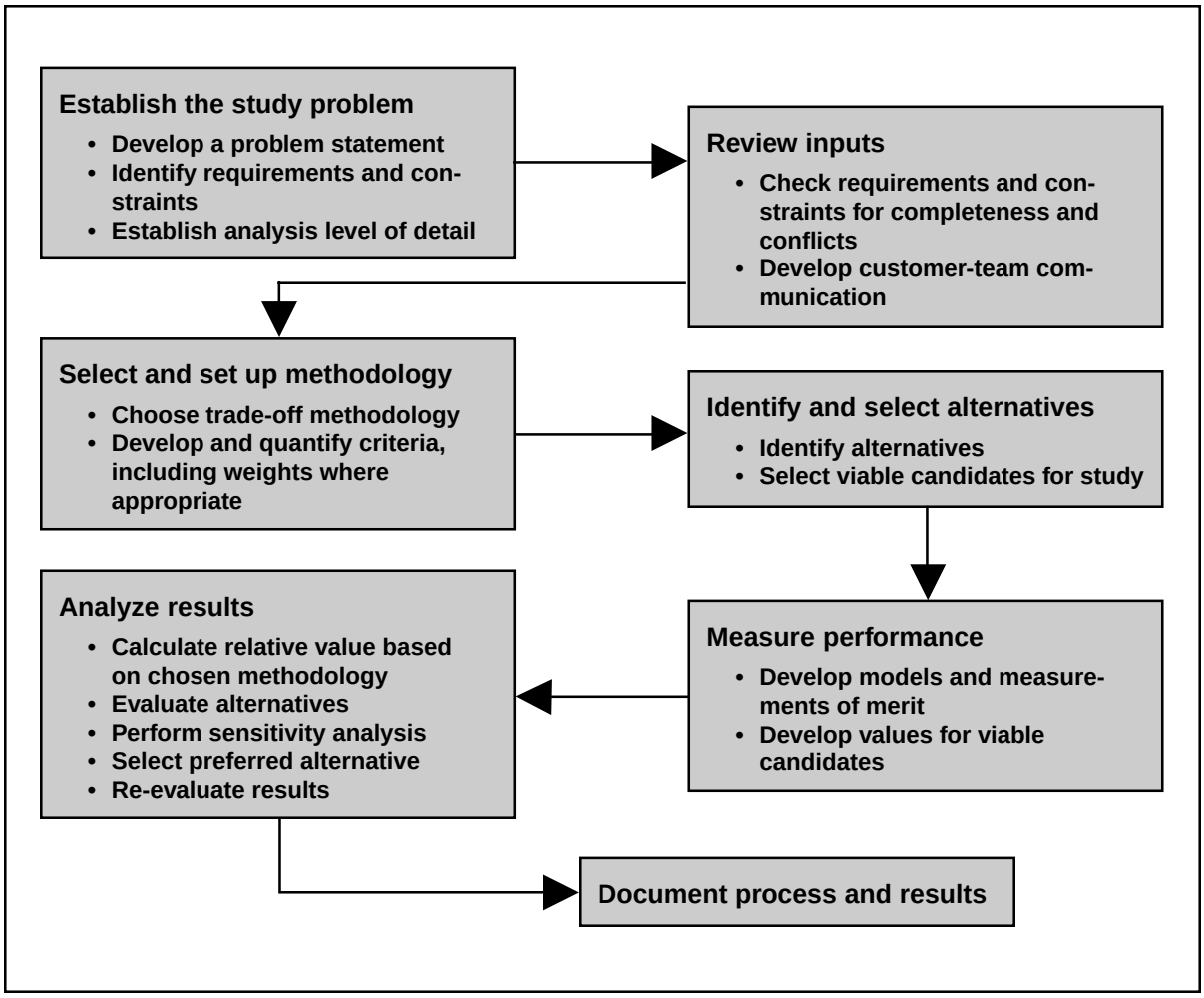


Figure 12-1. Trade Study Process

through both ignorance and design. To the extent possible the chosen methodology should compare alternatives based on true value to the customer and developer. Trade-off relationships should be relevant and rational. Choice of utility or weights should answer the question, "what is the actual value of the increased performance, based on what rationale?"

- Selecting alternative solutions requires identification of all the potential ways of solving the problem and selecting those that appear viable. The number of alternatives can drive the cost of analysis, so alternatives should normally be limited to clearly viable choices.

- Determining the key characteristics entails deriving the data required by the study methodology for each alternative.

- Evaluating the alternatives is the analysis part of the study. It includes the development of a trade-off matrix to compare the alternatives, performance of a sensitivity analysis, selection of a preferred alternative, and a re-evaluation (sanity check) of the alternatives and the study process. Since weighting factors and some "quantified" data can have arbitrary aspects, the sensitivity analysis is crucial. If the solution can be changed with relatively minor changes in data input, the study is probably invalid, and

the methodology should be reviewed and revised. After the above tasks are complete, a solution is chosen, documented, and recorded in the database.

Cost Effectiveness Analyses

Cost effectiveness analyses are a special case trade study that compares system or component performance to its cost. These analyses help determine affordability and relative values of alternate solutions. Specifically, they are used to:

- Support identification of affordable, cost optimized mission and performance requirements,
- Support the allocation of performance to an optimum functional structure,
- Provide criteria for the selection of alternative solutions,
- Provide analytic confirmation that designs satisfy customer requirements within cost constraints, and
- Support product and process verification.

12.3 SUMMARY POINTS

- The purpose of trade studies is to make better and more informed decisions in selecting best alternative solutions.
- Initial trade studies focus on alternative system concepts and requirements. Later studies assist in selecting component part designs.
- Cost effectiveness analyses provide assessments of alternative solution performance relative to cost.

SUPPLEMENT 12-A

UTILITY CURVE METHODOLOGY

The utility curve is a common methodology used in DoD and industry to perform trade-off analysis. In DoD it is widely used for cost effectiveness analysis and proposal evaluation.

Utility Curve

The method uses a utility curve, Figure 12-2, for each of the decision factors to normalize them to ease comparison. This method establishes the relative value of the factor as it increases from the minimum value of the range. The curve shows can show a constant value relationship (straight line), increasing value (concave curve), decreasing value (convex curve), or a stepped value.

Decision Matrix

Each of the decision factors will also have relative value between them. These relative values are used to establish weighting factors for each decision factor. The weighting factors prioritize the decision factors and allow direct comparison between them. A decision matrix, similar to Figure 12-3, is generated to evaluate the relative value of the alternative solutions. In the case of Figure 12-3 range is given a weight of 2.0, speed a weight of 1.0, and payload a weight of 2.5. The utility values for each of the decision factors are multiplied by the appropriate weight. The weighted values for each alternative solution are added to obtain a total score for each solution. The solution with the highest score becomes the preferred solution. For the transport analysis of Figure 12-3 the apparent preferred solution is System 3.

Sensitivity

Figure 12-3 also illustrates a problem with the utility curve method. Both the utility curve and

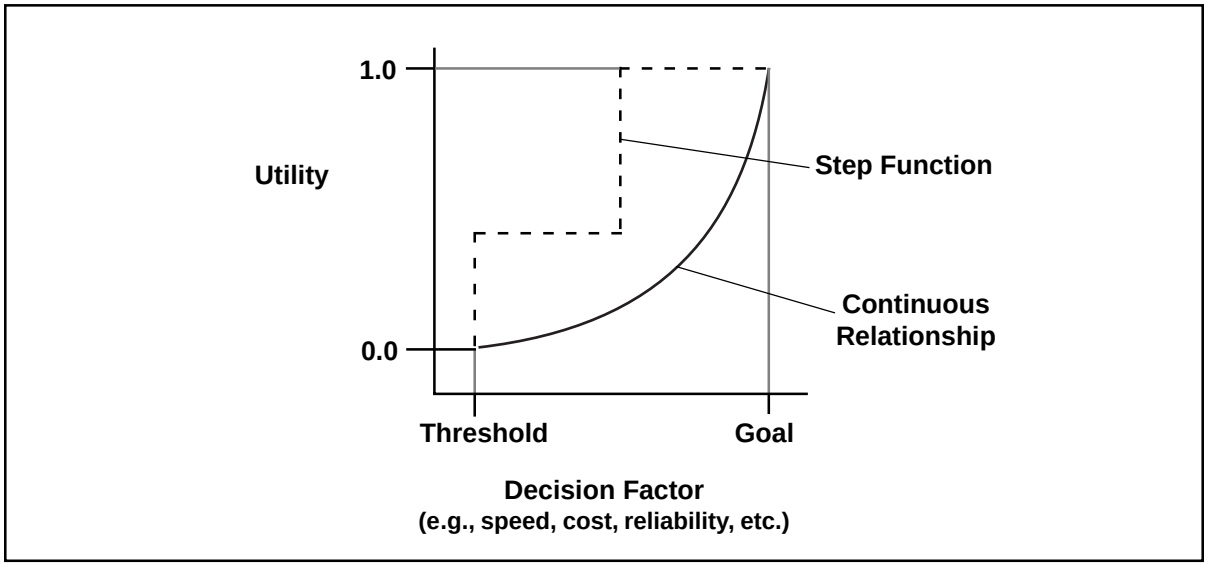


Figure 12-2. Utility Curve

weighting factors contain a degree of judgment that can vary between evaluators. Figure 12-3 shows three systems clustered around 3.8, indicating that a small variation in the utility curve or weighting factor could change the results. In the case of Figure 12-3, a sensitivity analysis should be performed to determine how solutions change as utility and weighting change. This will guide the evaluator in determining how to adjust evaluation criteria to eliminate the problem's sensitivity to small changes. In the case of Figure 12-3 the solution could be as simple as re-evaluating weighting factors to express better the true value to the customer. For example, if the value of range is considered to be less and payload worth more than originally stated, then System 4 may become a clear winner.

Notes

When developing or adjusting utility curves and weighting factors, communication with the customers and decision makers is essential. Most sensitivity problems are not as obvious as Figure 12-3. Sensitivity need not be apparent in the alternatives' total score. To ensure study viability, sensitivity analysis should always be done to examine the consequences of methodology choice. (Most decision support software provides a sensitivity analysis feature.)

Decision Factors / Alternatives	Range Wt. = 2.0		Speed Wt. = 1.0		Payload Wt. = 2.5		Weighted Total
	U	W	U	W	U	W	
Transport System 1	.8	1.6	.7	.7	.6	1.5	3.8
Transport System 2	.7	1.4	.9	.9	.4	1.0	3.3
Transport System 3	.6	1.2	.7	.7	.8	2.0	3.9
Transport System 4	.5	1.0	.5	.5	.9	2.25	3.75

Key: U = Utility value
W = Weighted value

Figure 12-3. Sample Decision Matrix

CHAPTER 13

MODELING AND SIMULATION

13.1 INTRODUCTION

A model is a physical, mathematical, or logical representation of a system entity, phenomenon, or process. A simulation is the implementation of a model over time. A simulation brings a model to life and shows how a particular object or phenomenon will behave. It is useful for testing, analysis or training where real-world systems or concepts can be represented by a model.

Modeling and simulation (M&S) provides virtual duplication of products and processes, and represents those products or processes in readily available and operationally valid environments. Use of models and simulations can reduce the cost and risk of life cycle activities. As shown by Figure 13-1, the advantages are significant throughout the life cycle.

Modeling, Simulation, and Acquisition

Modeling and simulation has become a very important tool across all acquisition-cycle phases and all applications: requirements definition; program management; design and engineering;

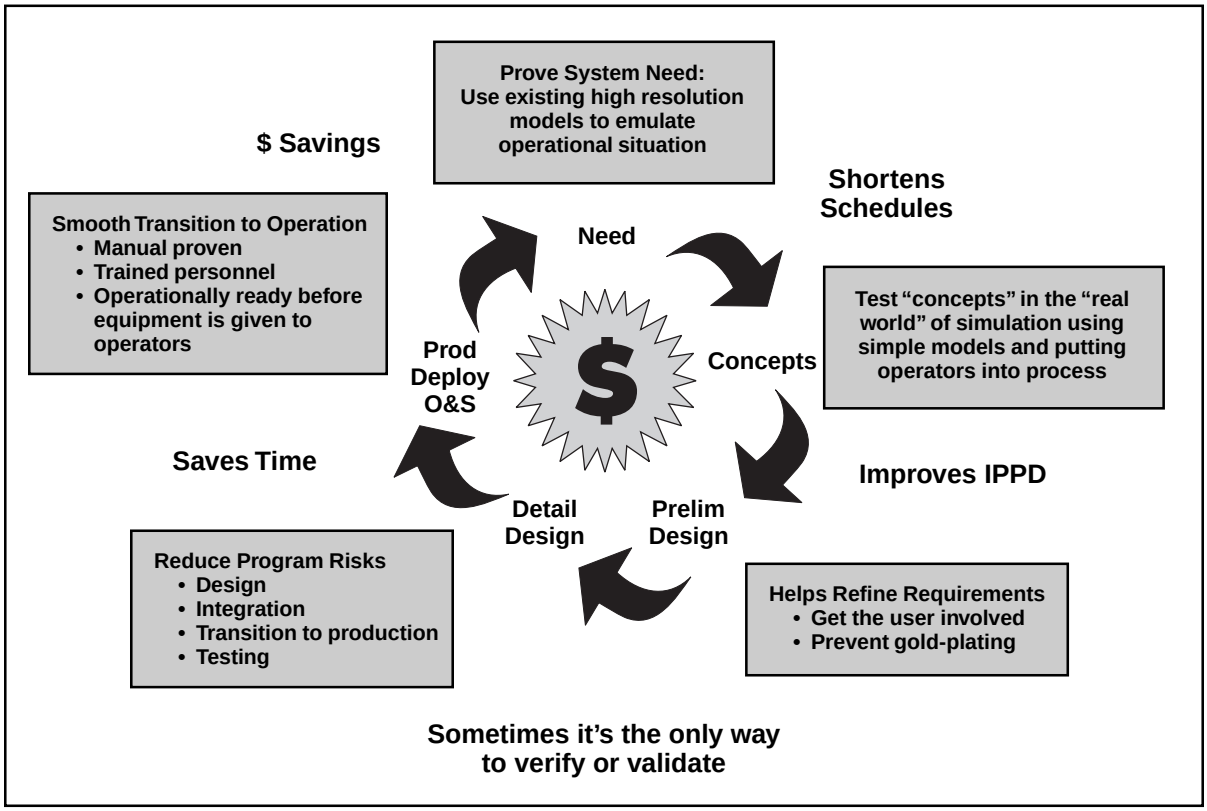


Figure 13-1. Advantages of Modeling and Simulation

efficient test planning; result prediction; supplement to actual test and evaluation; manufacturing; and logistics support. With so many opportunities to use M&S, its four major benefits; cost savings, accelerated schedule, improved product quality and cost avoidance can be achieved in any system development when appropriately applied. DoD and industry around the world have recognized these opportunities, and many are taking advantage of the increasing capabilities of computer and information technology. M&S is now capable of prototyping full systems, networks, interconnecting multiple systems and their simulators so that simulation technology is moving in every direction conceivable.

13.2 CLASSES OF SIMULATIONS

The three classes of models and simulations are virtual, constructive, and live:

- **Virtual** simulations represent systems both physically and electronically. Examples are aircraft trainers, the Navy's Battle Force Tactical Trainer, Close Combat Tactical Trainer, and built-in training.

- **Constructive** simulations represent a system and its employment. They include computer models, analytic tools, mockups, IDEF, Flow Diagrams, and Computer-Aided Design/ Manufacturing (CAD/CAM).

- **Live** simulations are simulated operations with real operators and real equipment. Examples are fire drills, operational tests, and initial production run with soft tooling.

Virtual Simulation

Virtual simulations put the human-in-the-loop. The operator's physical interface with the system is duplicated, and the simulated system is made to perform as if it were the real system. The operator is subjected to an environment that looks, feels, and behaves like the real thing. The more advanced version of this is the virtual prototype, which allows the individual to interface with a virtual mockup operating in a realistic computer-generated environment. A virtual prototype is a computer-based simulation of a system or subsystem with a degree of functional realism that is comparable to that of a physical prototype.

Constructive Simulations

The purpose of systems engineering is to develop descriptions of system solutions. Accordingly, constructive simulations are important products in all key system engineering tasks and activities. Of special interest to the systems engineer are Computer-Aided Engineering (CAE) tools. Computer-aided tools can allow more in-depth and complete analysis of system requirements early in design. They can provide improved communication because data can be disseminated rapidly to several individuals concurrently, and because design changes can be incorporated and distributed expeditiously. Key computer-aided engineering tools are CAD, CAE, CAM, Continuous Acquisition and Life Cycle Support, and Computer-Aided Systems Engineering:

Computer-Aided Design (CAD). CAD tools are used to describe the product electronically to facilitate and support design decisions. It can model diverse aspects of the system such as how components can be laid out on electrical/electronic circuit boards, how piping or conduit is routed, or how diagnostics will be performed. It is used to lay out systems or components for sizing, positioning, and space allocating using two- or three-dimensional displays. It uses three-dimensional "solid" models to ensure that assemblies, surfaces, intersections, interfaces, etc., are clearly defined. Most CAD tools automatically generate isometric and exploded views of detailed dimensional and assembly drawings, and determine component surface areas, volumes, weights, moments of inertia, centers of gravity, etc. Additionally, many CAD tools can develop three-dimensional models of facilities, operator consoles, maintenance workstations, etc., for evaluating man-machine interfaces. CAD tools are available in numerous varieties, reflecting different degrees of capabilities, fidelity, and cost. The commercial CAD/CAM product, Computer-Aided Three-Dimensional

Interactive Application (CATIA), was used to develop the Boeing 777, and is a good example of current state-of-the-art CAD.

Computer-Aided Engineering (CAE). CAE provides automation of requirements and performance analyses in support of trade studies. It normally would automate technical analyses such as stress, thermodynamic, acoustic, vibration, or heat transfer analysis. Additionally, it can provide automated processes for functional analyses such as fault isolation and testing, failure mode, and safety analyses. CAE can also provide automation of life-cycle-oriented analysis necessary to support the design. Maintainability, producibility, human factor, logistics support, and value/cost analyses are available with CAE tools.

Computer-Aided Manufacturing (CAM). CAM tools are generally designed to provide automated support to both production process planning and to the project management process. Process planning attributes of CAM include establishing Numerical Control parameters, controlling machine tools using pre-coded instructions, programming robotic machinery, handling material, and ordering replacement parts. The production management aspect of CAM provides management control over production-relevant data, uses historical actual costs to predict cost and plan activities, identifies schedule slips or slack on a daily basis, and tracks metrics relative to procurement, inventory, forecasting, scheduling, cost reporting, support, quality, maintenance, capacity, etc. A common example of a computer-based project planning and control tool is Manufacturing Resource Planning II (MRP II). Some CAM programs can accept data direct from a CAD program. With this type of tool, generally referred to as CAD/CAM, substantial CAM data is automatically generated by importing the CAD data directly into the CAM software.

Computer-Aided Systems Engineering (CASE). CASE tools provide automated support for the Systems Engineering and associated processes. CASE tools can provide automated support for integrating system engineering activities, performing the systems engineering tasks outlined in previous chapters, and performing the systems analysis and control activities. It provides technical management support and has a broader capability than either CAD or CAE. An increasing variety of CASE tools are available, as competition brings more products to market, and many of these support the commercial "best Systems Engineering practices."

Continuous Acquisition and Life Cycle Support (CALS). CALS relates to the application of computerized technology to plan and implement support functions. The emphasis is on information relating to maintenance, supply support, and associated functions. An important aspect of CALS is the importation of information developed during design and production. A key CALS function is to support the maintenance of the system configuration during the operation and support phase. In DoD, CALS supports activities of the logistics community rather than the specific program office, and transfer of data between the CAD or CAM programs to CALS has been problematic. As a result there is current emphasis on development of standards for compatible data exchange. Formats of import include: two- and three-dimensional models (CAD), ASCII formats (Technical Manuals), two-dimensional illustrations (Technical Manuals), and Engineering Drawing formats (Raster, Aperture cards). These formats will be employed in the Integrated Data Environment (IDE) that is mandated for use in DoD program offices.

Live Simulation

Live simulations are simulated operations of real systems using real people in realistic situations. The intent is to put the system, including its operators, through an operational scenario, where some conditions and environments are mimicked to provide a realistic operating situation. Examples of live simulations range from fleet exercises to fire drills.

Eventually live simulations must be performed to validate constructive and virtual simulations. However, live simulations are usually costly, and trade studies should be performed to support the balance of simulation types chosen for the program.

13.3 HARDWARE VERSUS SOFTWARE

Though current emphasis is on software M&S, the decision of whether to use hardware, software, or a combined approach is dependent on the complexity of the system, the flexibility needed for the simulation, the level of fidelity required, and the potential for reuse. Software capabilities are increasing, making software solutions cost effective for large complex projects and repeated processes. Hardware methods are particularly useful for validation of software M&S, simple or one-time projects, and quick checks on changes of production systems. M&S methods will vary widely in cost. Analysis of the cost-versus-benefits of potential M&S methods should be performed to support planning decisions.

13.4 VERIFICATION, VALIDATION, AND ACCREDITATION

How can you trust the model or simulation? Establish confidence in your model or simulation through formal verification, validation, and accreditation (VV&A). VV&A is usually identified with software, but the basic concept applies to hardware as well. Figure 13-2 shows the basic differences between the terms (VV&A).

More specifically:

- **Verification** is the process of determining that a model implementation accurately represents the developer's conceptual description and specifications that the model was designed to.

- **Validation** is the process of determining the manner and degree to which a model is an accurate representation of the real world from the perspective of the intended uses of the model, and of establishing the level of confidence that should be placed on this assessment.

- **Accreditation** is the formal certification that a model or simulation is acceptable for use for a specific purpose. Accreditation is conferred by the organization best positioned to make the judgment that the model or simulation in question is acceptable. That organization may be an operational user, the program office, or a contractor, depending upon the purposes intended.

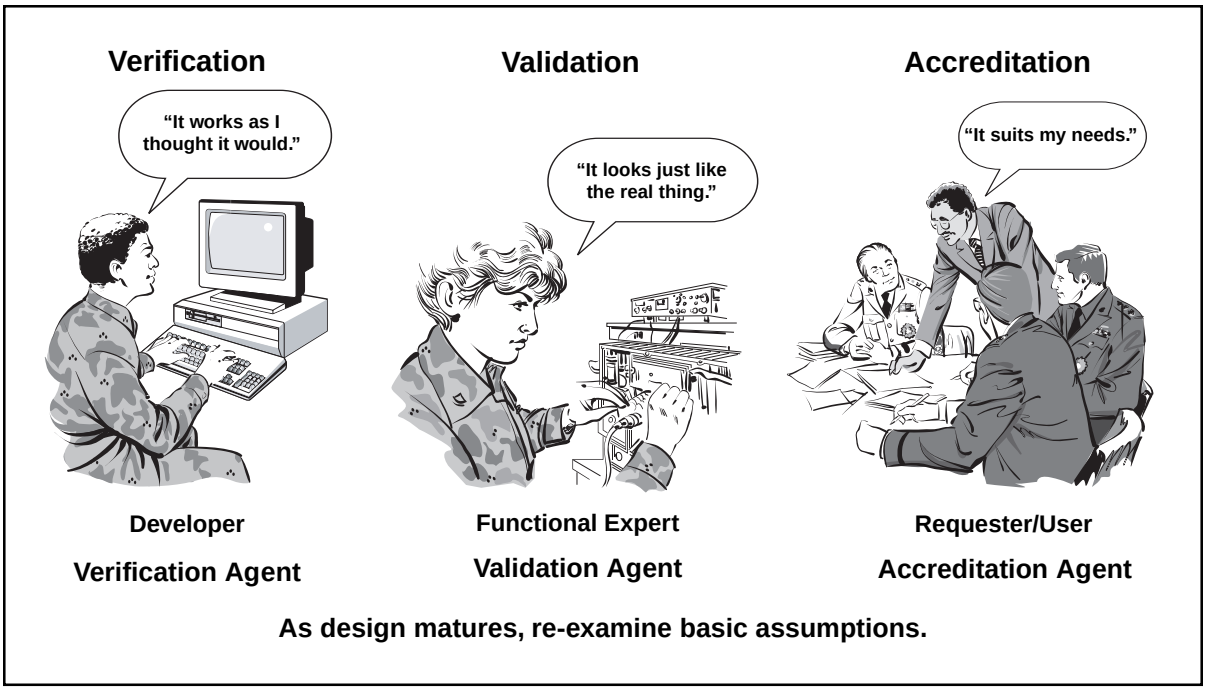


Figure 13-2. Verification, Validation, and Accreditation

VV&A is particularly necessary in cases where:

- Complex and critical interoperability is being represented,
- Reuse is intended,
- Safety of life is involved, and
- Significant resources are involved.

VV&A Currency

VV&A is applied at initial development and use. The VV&A process is required for all DoD simulations and should be redone whenever existing models and simulations undergo a major upgrade or modification. Additionally, whenever the model or simulation violates its documented methodology or inherent boundaries that were used to validate or verify by its different use, then VV&A must be redone. Accreditation, however, may remain valid for the specific application unless revoked by the Accreditation Agent, as long as its use or what it simulates doesn't change.

13.5 CONSIDERATIONS

There are a number of considerations that should enter into decisions regarding the acquisition and employment of modeling and simulation in defense acquisition management. Among these are such concerns as cost, fidelity, planning, balance, and integration.

Cost Versus Fidelity

Fidelity is the degree to which aspects of the real world are represented in M&S. It is the foundation for development of the model and subsequent VV&A. Cost effectiveness is a serious issue with simulation fidelity, because fidelity can be an aggressive cost driver. The correct balance between cost and fidelity should be the result of simulation need analysis. M&S designers and VV&A agents must decide when enough is enough. Fidelity needs can vary throughout the simulation. This variance should be identified by analysis and planned for.

Note of caution: Don't confuse the quality of the display with the quality of meeting simulation needs! An example of fidelity is a well-known flight simulator using a PC and simple joystick versus a full 6-degree of freedom fully-instrumented aircraft cockpit. Both have value at different stages of flight training, but obviously vary significantly in cost from thousands of dollars to millions. This cost difference is based on fidelity, or degree of real-world accuracy.

Planning

Planning should be an inherent part of M&S, and, therefore, it must be proactive, early, continuous, and regular. Early planning will help achieve balance and beneficial reuse and integration. With computer and simulation technologies evolving so rapidly, planning is a dynamic process. It must be a continuing process, and it is important that the appropriate simulation experts be involved to maximize the use of new capabilities. M&S activities should be a part of the integrated teaming and involve all responsible organizations. Integrated teams must develop their M&S plans and insert them into the overall planning process, including the TEMP, acquisition strategy, and any other program planning activity.

M&S planning should include:

- Identification of activities responsible for each VV&A element of each model or simulation, and
- Thorough VV&A estimates, formally agreed to by all activities involved in M&S, including T&E commitments from the developmental testers, operational testers, and separate VV&A agents.

Those responsible for the VV&A activities must be identified as a normal part of planning. Figure 13-2 shows the developer as the verification agent, the functional expert as the validation agent, and the user as the accreditation agent. In general this is appropriate for virtual simulations. However, the manufacturer of a constructive simulation would usually be expected to justify or warrantee their

program's use for a particular application. The question of who should actually accomplish VV&A is one that is answered in planning. VV&A requirements should be specifically called out in tasking documents and contracts. When appropriate, VV&A should be part of the contractor's proposal, and negotiated prior to contract award.

Balance

Balance refers to the use of M&S across the phases of the product life cycle and across the spectrum of functional disciplines involved. The term may further refer to the use of hardware versus software, fidelity level, VV&A level, and even use versus non-use. Balance should always be based on cost effectiveness analysis. Cost effectiveness analyses should be comprehensive; that is, M&S should be properly considered for use in all parallel applications and across the complete life cycle of the system development and use.

Integration

Integration is obtained by designing a model or simulation to inter-operate with other models or simulations for the purpose of increased performance, cost benefit, or synergism. Multiple benefits or savings can be gained from increased synergism and use over time and across activities. Integration is achieved through reuse or upgrade of legacy programs used by the system, or of the proactive planning of integrated development of new simulations. In this case integration is accomplished through the planned utilization of models, simulations, or data for multiple times or applications over the system life cycle. The planned upgrade of M&S for evolving or parallel uses supports the application of open systems architecture to the system design. M&S efforts that are established to perform a specific function by a specific contractor, subcontractor, or government activity will tend to be sub-optimized. To achieve

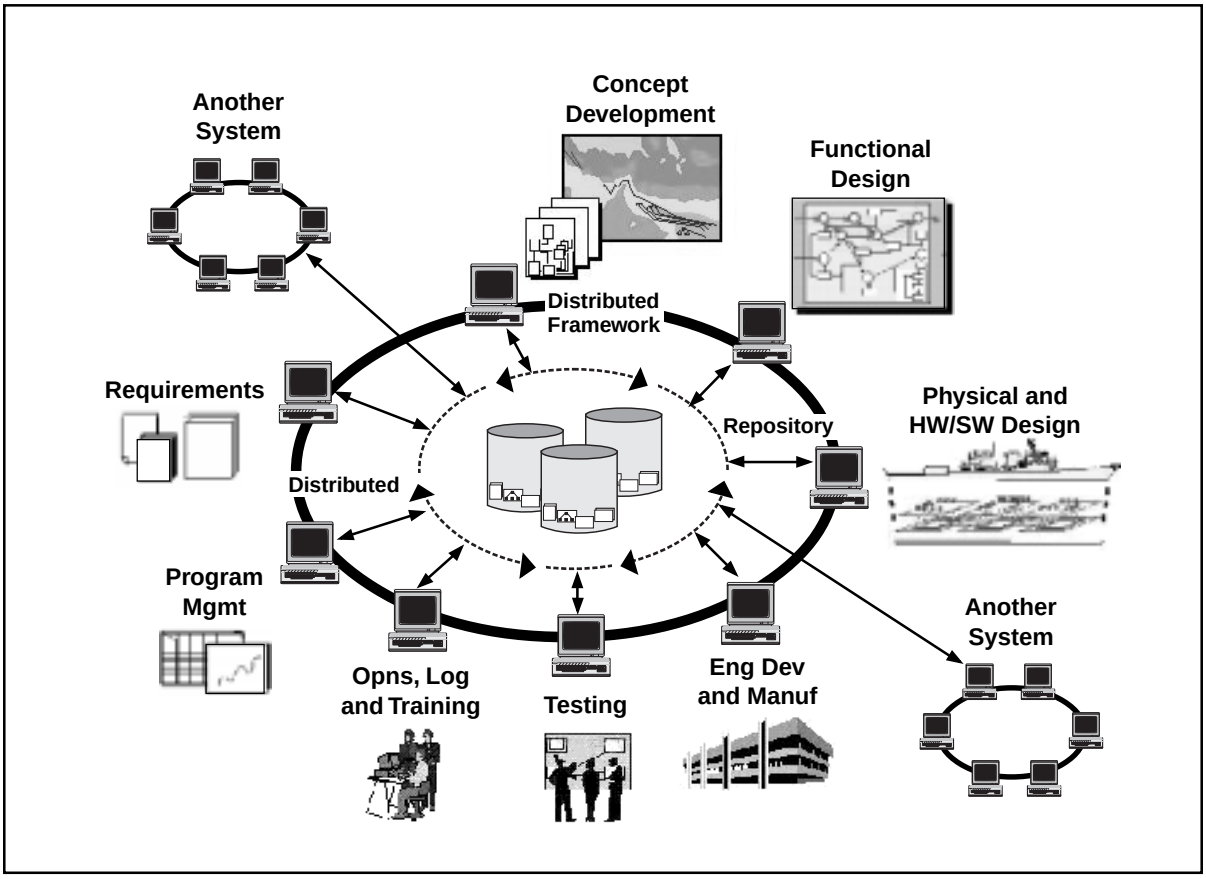


Figure 13-3. A Robust Integrated Use of Simulation Technology

integration M&S should be managed at least at the program office level.

The Future Direction

DoD, the Services, and their commands have strongly endorsed the use of M&S throughout the acquisition life cycle. The supporting simulation technology is also evolving as fast as computer technology changes, providing greater fidelity and flexibility. As more simulations are interconnected, the opportunities for further integration expand. M&S successes to date also accelerate its use. The current focus is to achieve open systems of simulations, so they can be plug-and-play across the spectrum of applications. From concept analysis through disposal analysis, programs may use hundreds of different simulations, simulators and model analysis tools. Figure 13-3 shows conceptually how an integrated program M&S would affect the functions of the acquisition process.

A formal DoD initiative, Simulation Based Acquisition (SBA), is currently underway. The SBA vision is to advance the implementation of M&S in the DoD acquisition process toward a robust, collaborative use of simulation technology that is integrated across acquisition phases and programs. The result will be programs that are much better integrated in an IPPD sense, and which are much more efficient in the use of time and dollars expended to meet the needs of operational users.

13.6 SUMMARY

- M&S provides virtual duplication of products and processes, and represent those products or processes in readily available and operationally valid environments.
- M&S should be applied throughout the system life cycle in support of systems engineering activities.
- The three classes of models and simulations are virtual, constructive, and live.
- Establish confidence in your model or simulation through formal VV&A.
- M&S planning should be an inherent part of Systems Engineering planning, and, therefore, pro-active, early, continuous, and regular.
- A more detailed discussion of the use and management of M&S in DoD acquisition is available in the DSMC publication *Systems Acquisition Manager's Guide for the Use of Models and Simulations.*
- An excellent second source is the DSMC publication, *Simulation Based Acquisition – A New Approach*. It surveys applications of increasing integration of simulation in current DoD programs and the resulting increasing benefits through greater integration.

CHAPTER 14

METRICS

14.1 METRICS IN MANAGEMENT

Metrics are measurements collected for the purpose of determining project progress and overall condition by observing the change of the measured quantity over time. Management of technical activities requires use of three basic types of metrics:

- Product metrics that track the development of the product,
- Earned Value which tracks conformance to the planned schedule and cost, and
- Management process metrics that track management activities.

Measurement, evaluation and control of metrics is accomplished through a system of periodic reporting must be planned, established, and monitored to assure metrics are properly measured, evaluated, and the resulting data disseminated.

Product Metrics

Product metrics are those that track key attributes of the design to observe progress toward meeting customer requirements. Product metrics reflect three basic types of requirements: operational performance, life-cycle suitability, and affordability. The key set of systems engineering metrics are the Technical Performance Measurements (TPM.) TPMs are product metrics that track design progress toward meeting customer performance requirements. They are closely associated with the system engineering process because they directly support traceability of operational needs to the design effort. TPMs are derived from Measures of Performance (MOPs) which reflect system requirements. MOPs are derived from Measures of Effectiveness (MOEs) which reflect operational performance requirements.

The term "metric" implies quantitatively measurable data. In design, the usefulness of metric data is greater if it can be measured at the configuration item level. For example, weight can be estimated at all levels of the WBS. Speed, though an extremely important operational parameter, cannot be allocated down through the WBS. It cannot be measured, except through analysis and simulation, until an integrated product is available. Since weight is an important factor in achieving speed objectives, and weight can be measured at various levels as the system is being developed, weight may be the better choice as a metric. It has a direct impact on speed, so it traces to the operational requirement, but, most importantly, it can be allocated throughout the WBS and progress toward achieving weight goals may then be tracked through development to production.

Measures of Effectiveness and Suitability

Measures of Effectiveness (MOEs) and Measures of Suitability (MOSs) are measures of operational effectiveness and suitability in terms of operational outcomes. They identify the most critical performance requirements to meet system-level mission objectives, and will reflect key operational needs in the operational requirements document.

Operational effectiveness is the overall degree of a system's capability to achieve mission success considering the total operational environment. For example, weapon system effectiveness would consider environmental factors such as operator organization, doctrine, and tactics; survivability; vulnerability; and threat characteristics. MOSs, on the other hand, would measure the extent to which the system integrates well into the operation

environment and would consider such issues as supportability, human interface compatibility, and maintainability.

Measures of Performance

MOPs characterize physical or functional attributes relating to the execution of the mission or function. They quantify a technical or performance requirement directly derived from MOEs and MOSs. MOPs should relate to these measures such that a change in MOP can be related to a change in MOE or MOS. MOPs should also reflect key performance requirements in the system specification. MOPs are used to derive, develop, support, and document the performance requirements that will be the basis for design activities and process development. They also identify the critical technical parameters that will be tracked through TPMs.

Technical Performance Measurements

TPMs are derived directly from MOPs, and are selected as being critical from a periodic review and control standpoint. TPMs help assess design progress, assess compliance to requirements throughout the WBS, and assist in monitoring and tracking technical risk. They can identify the need for deficiency recovery, and provide information to support cost-performance sensitivity assessments. TPMs can include range, accuracy, weight, size, availability, power output, power required, process time, and other product characteristics that relate directly to the system operational requirements.

TPMs traceable to WBS elements are preferred, so elements within the system can be monitored as well as the system as a whole. However, some necessary TPMs will be limited to the system or subsystem level. For example, the specific fuel consumption of an engine would be a TPM necessary to track during the engine development, but it is not allocated throughout the WBS. It is reported as a single data item reflecting the performance of the engine as a whole. In this case the metric will indicate that the design approach is consistent with the required performance, but it may not be useful as an early warning device to indicate progress toward meeting the design goal. A more detailed discussion of TPMs is available as Supplement A to this chapter.

Example of Measures

MOE: The vehicle must be able to drive fully loaded from Washington, DC, to Tampa on one tank of fuel.

MOP: Vehicle range must be equal to or greater than 1,000 miles.

TPM: Fuel consumption, vehicle weight, tank size, drag, power train friction, etc.

Suitability Metrics

Tracking metrics relating to operational suitability and other life cycle concerns may be appropriate to monitor progress toward an integrated design. Operational suitability is the degree to which a system can be placed satisfactorily in field use considering availability, compatibility, transportability, interoperability, reliability, usage rates, maintainability, safety, human factors, documentation, training, manpower, supportability, logistics, and environmental impacts. These suitability parameters can generate product metrics that indicate progress toward an operationally suitable system. For example, factors that indicate the level of automation in the design would reflect progress toward achieving manpower quantity and quality requirements. TPMs and suitability product metrics commonly overlap. For example, Mean Time Between Failure (MBTF) can reflect both effectiveness or suitability requirements.

Suitability metrics would also include measurements that indicate improvement in the producibility, testability, degree of design simplicity, and design robustness. For example, tracking number of parts, number of like parts, and number of wearing parts provides indicators of producibility, maintainability, and design simplicity.

Product Affordability Metrics

Estimated unit production cost can be tracked during the design effort in a manner similar to the TPM approach, with each CI element reporting an estimate based on current design. These estimates are combined at higher WBS levels to provide subsystem and system cost estimates. This provides a running engineering estimate of unit production cost, tracking of conformance to Design-to-Cost (DTC) goals, and a method to isolate design problems relating to production costs.

Life cycle affordability can be tracked through factors that are significant in parametric life cycle cost calculations for the particular system. For example, two factors that reflect life cycle cost for most transport systems are fuel consumption and weight, both of which can be tracked as metrics.

Timing

Product metrics are tied directly to the design process. Planning for metric identification, reporting, and analysis is begun with initial planning in the concept exploration phase. The earliest systems engineering planning should define the management approach, identify performance or characteristics to be measured and tracked, forecast values for those performances or characteristics, determine when assessments will be done, and establish the objectives of assessment.

Implementation is begun with the development of the functional baseline. During this period, systems engineering planning will identify critical technical parameters, time phase planned profiles with tolerance bands and thresholds, reviews or audits or events dependent or critical for achievement of planned profiles, and the method of estimation. During the design effort, from functional to product baseline, the plan will be implemented and continually updated by the systems engineering process. To support implementation, contracts should include provision for contractors to provide measurement, analysis, and reporting. The need to track product metrics ends in the production phase, usually concurrent with the establishment of the product (as built) baseline.

DoD and Industry Policy on Product Metrics

Analysis and control activities shall include performance metrics to measure technical development and design, actual versus planned; and to measure [the extent to which systems meet requirements]. DoD 5000.2-R.

The performing activity establishes and implements TPM to evaluate the adequacy of evolving solutions to identify deficiencies impacting the ability of the system to satisfy a designated value for a technical parameter. EIA IS-632, Section 3.

The performing activity identifies the technical performance measures which are key indicators of system performance...should be limited to critical MOPs which, if not met put the project at cost, schedule, or performance risk. IEEE 1220, Section 6.

14.2 EARNED VALUE

Earned Value is a metric reporting system that uses cost-performance metrics to track the cost and schedule progress of system development against a projected baseline. It is a “big picture” approach and integrates concerns related to performance, cost, and schedule. Referring to Figure 14-1, if we think of the line labeled BCWP (budgeted cost of work performed) as the value that the contractor has “earned,” then deviations from this baseline indicate problems in either cost or schedule. For example, if actual costs vary from budgeted costs, we have a cost variance; if work performed varies from work planned, we have a schedule variance. The projected performance is based on estimates of appropriate cost and schedule to perform the work required by each WBS element. When a variance occurs the system engineer can pinpoint WBS elements that have potential technical development problems. Combined with product metrics, earned value is a powerful technical management tool for detecting and understanding development problems.

Relationships exist between product metrics, the event schedule, the calendar schedule, and Earned

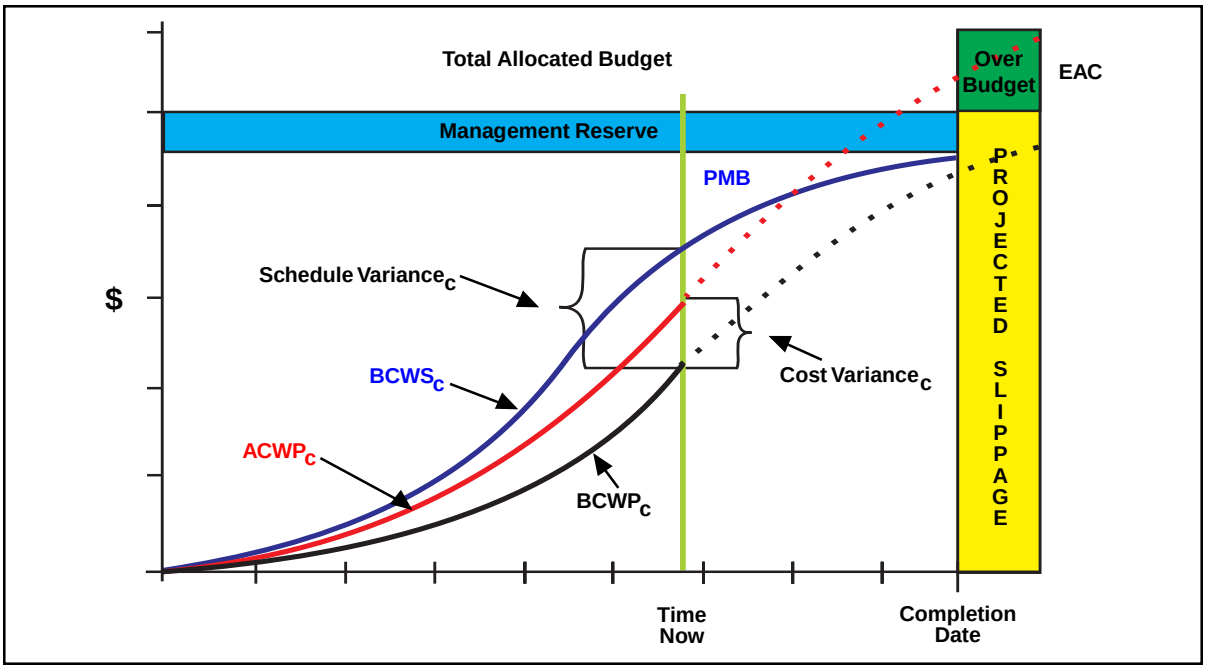


Figure 14-1. Earned Value Concept

Value:

- The Event Schedule includes tasks for each event/exit criteria that must be performed to meet key system requirements, which are directly related to product metrics.

- The Calendar (Detail) Schedule includes time frames established to meet those same product metric-related objectives (schedules).

- Earned Value includes cost/schedule impacts of not meeting those objectives, and, when correlated with product metrics, can identify emerging program and technical risk.

14.3 PROCESS METRICS

Management process metrics are measurements taken to track the process of developing, building, and introducing the system. They include a wide range of potential factors and selection is program unique. They measure such factors as availability of resources, activity time rates, items completed, completion rates, and customer or team satisfaction.

Examples of these factors are: number of trained personnel onboard, average time to approve/disapprove ECPs, lines of code or drawings released, ECPs resolved per month, and team risk identification or feedback assessments. Selection of appropriate metrics should be done to track key management activities. Selection of these metrics is part of the systems engineering planning process.

How Much Metrics?

The choice of the amount and depth of metrics is a planning function that seeks a balance between risk and cost. It depends on many considerations, including system complexity, organizational complexity, reporting frequency, how many contractors, program office size and make up, contractor past performance, political visibility, and contract type.

14.4 SUMMARY POINTS

- Management of technical activities requires use of three basic types of metrics: product metrics that track the development of the product, earned value which tracks conformance to the

planned schedule and cost, and management process metrics that track management activities.

- Measurement, evaluation and control of metrics is accomplished through a system of periodic reporting that must be planned, established, and monitored to assure metrics are measured properly, evaluated, and the resulting data disseminated.

- TPMs are performance based product metrics that track progress through measurement of key technical parameters. They are important to the systems engineering process because they connect operational requirements to measurable design characteristics and help assess how well the effort is meeting those requirements. TPMs are required for all programs covered by DoD 5000.2-R.

SUPPLEMENT 14-A

TECHNICAL PERFORMANCE MEASUREMENT

Technical Performance Measurement (TPM) is an analysis and control technique that is used to: (1) project the probable performance of a selected technical parameter over a period of time, (2) record the actual performance observed of the selected parameter, and (3) through comparison of actual versus projected performance, assist the manager in decision making. A well thought out program of technical performance measures provides an early warning of technical problems and supports assessments of the extent to which operational requirements will be met, as well as assessments of the impacts of proposed changes in system performance.

TPMs generally take the form of both graphic displays and narrative explanations. The graphic, an example of which is shown in Figure 14-2, shows the projected behavior of the selected parameter as a function of time, and further shows actual observations, so that deviations from the planned profile can be assessed. The narrative portion of the report should explain the graphic, addressing the reasons for deviations from the planned profile, assessing the seriousness of those deviations, explaining actions underway to correct the situation if required, and projecting future performance, given the current situation.

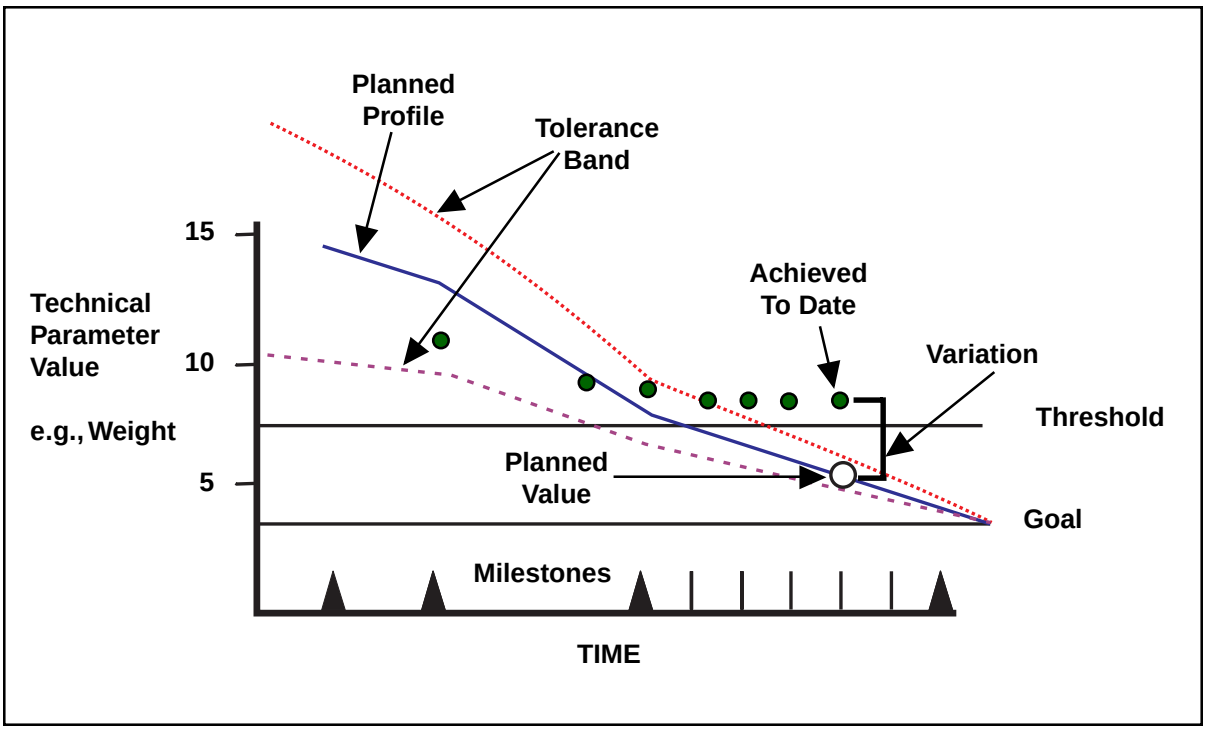


Figure 14-2. Technical Performance Measurement – The Concept

Parameters to be tracked are typically based on the combined needs of the government and the contractor. The government program office will need a set of TPMs which provide visibility into the technical performance of key elements of the WBS, especially those which are cost drivers on the program, lie on the critical path, or which represent high risk items.

The TPMs selected for delivery to the government are expected to be traceable to the needs of the operational user. The contractor will generally track more items than are reported to the government, as the contractor needs information at a more detailed level than does the government program office.

TPM reporting to the government is a contractual issue, and those TPMs on which the government receives reports are defined as contract deliverables in the contract data requirements list. Which parameters are selected for reporting depends on a number of issues, among which are resources to purchase TPMs, the availability of people to review and follow the items, the complexity of the system involved, the phase of development, and the contractor's past experience with similar systems.

A typical TPM graphic will take a form somewhat like that previously shown. The actual form of the projected performance profile and whether or not tolerance bands are employed will be a function of the parameter selected and the needs of the program office.

Another important consideration is the relationship between the TPM program and risk management. Generally, the parameters selected for tracking should be related to the risk areas on the program. If a particular element of the design has been identified as a risk area, then parameters should be selected which will enable the manager to track progress in that area. For example, if achieving a required aircraft range is considered to be critical and a risk area, then tracking parameters that provide insight into range would be selected, such as aircraft weight, specific fuel consumption, drag, etc. Furthermore, there should be consistency between TPMs and the Critical Technical Parameters associated with formal testing, although the TPM program will not normally be limited just to those parameters identified as critical for test purposes.

Government review and follow up of TPMs are appropriate on a periodic basis when submitted by the contractor, and at other major technical events such as at technical reviews, test events, and program management reviews.

While TPMs are expected to be traceable to the needs of the user, they must be concrete technical parameters that can be projected and tracked. For example, an operational user may have a requirement for survivability under combat conditions. Survivability is not, in and of itself, a measurable parameter, but there are important technical parameters that determine survivability, such as radar cross section (RCS) and speed. Therefore, the technical manager might select and track RCS and speed as elements for TPM reporting. The decision on selection of parameters for TPM tracking must also take into consideration the extent to which the parameter behavior can be projected (profiled over a time period) and whether or not it can actually be measured. If the parameter cannot be profiled, measured, or is not critical to program success, then the government, in general, should not select it for TPM tracking. The WBS structure makes an excellent starting point for consideration of parameters for TPM tracking (see Figure 14-3).

A substantial effort has taken place in recent years to link TPMs with Earned Value Management in a way that would result in earned value calculations that reflect the risks associated with achieving technical performance. The approach used establishes statistical probability of achieving a projected level of performance on the TPM profile based on a statistical analysis of actual versus planned performance. Further information is available on the Internet at http://www.acq.osd.mil/api/tpm/.

In summary, TPMs are an important tool in the program manager's systems analysis and control toolkit. They provide an early warning about deviations in key technical parameters, which, if not controlled, can impact system success in meeting user needs. TPMs should be an integral part of both

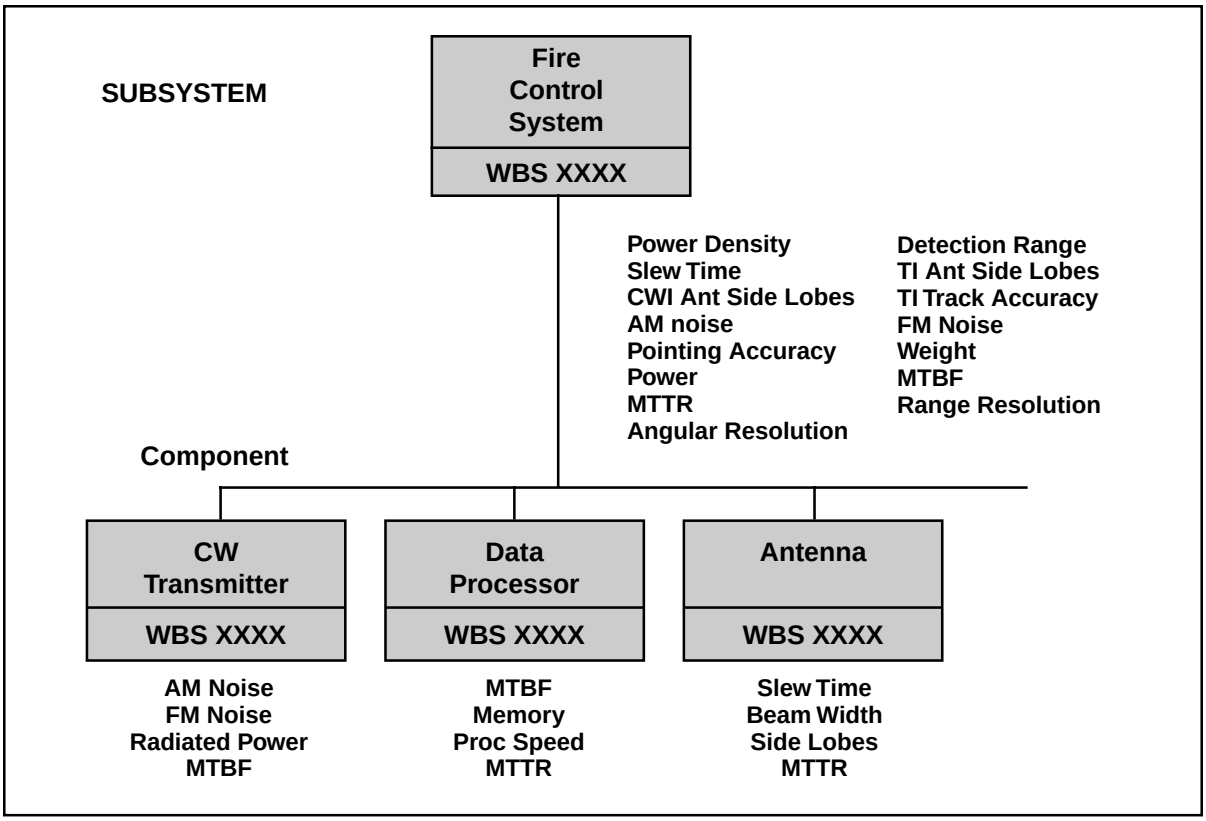


Figure 14-3. Shipboard Fire Control System (Partial)

periodic program reporting and management follow-up, as well as elements for discussion in technical reviews and program management reviews. By thoughtful use of a good program of TPM, the manager, whether technically grounded or not, can make perceptive judgments about system technical performance and can follow up on contractor plans and progress when deviations occur.

Relevant Terms

Achievement to date – Measured or estimated progress plotted and compared with planned progress by designated milestone date.

Current estimate – Expected value of a technical parameter at contract completion.

Planned value – Predicted value of parameter at a given point in time.

Planned profile – Time phased projected planned values.

Tolerance band – Management alert limits representing projected level of estimating error.

Threshold – Limiting acceptable value, usually contractual.

Variance – Difference between the planned value and the achievement-to-date derived from analysis, test, or demonstration.

CHAPTER 15

RISK MANAGEMENT

15.1 RISK AS REALITY

Risk is inherent in all activities. It is a normal condition of existence. Risk is the potential for a negative future reality that may or may not happen. Risk is defined by two characteristics of a possible negative future event: probability of occurrence (whether something will happen), and consequences of occurrence (how catastrophic if it happens). If the probability of occurrence is not known then one has *uncertainty*, and the risk is undefined.

Risk is not a problem. It is an understanding of the level of threat due to *potential* problems. A problem is a consequence that has already occurred.

In fact, knowledge of a risk is an opportunity to avoid a problem. Risk occurs whether there is an attempt to manage it or not. Risk exists whether you acknowledge it, whether you believe it, whether if it is written down, or whether you understand it. Risk does not change because you hope it will, you ignore it, or your boss's expectations do not reflect it. Nor will it change just because it is contrary to policy, procedure, or regulation. Risk is neither good nor bad. It is just how things are. Progress and opportunity are companions of risk. In order to make progress, risks must be understood, managed, and reduced to acceptable levels.

Types of Risk in a Systems Engineering Environment

Systems engineering management related risks could be related to the system products or to the process of developing the system. Figure 15-1 shows the decomposition of system development risks.

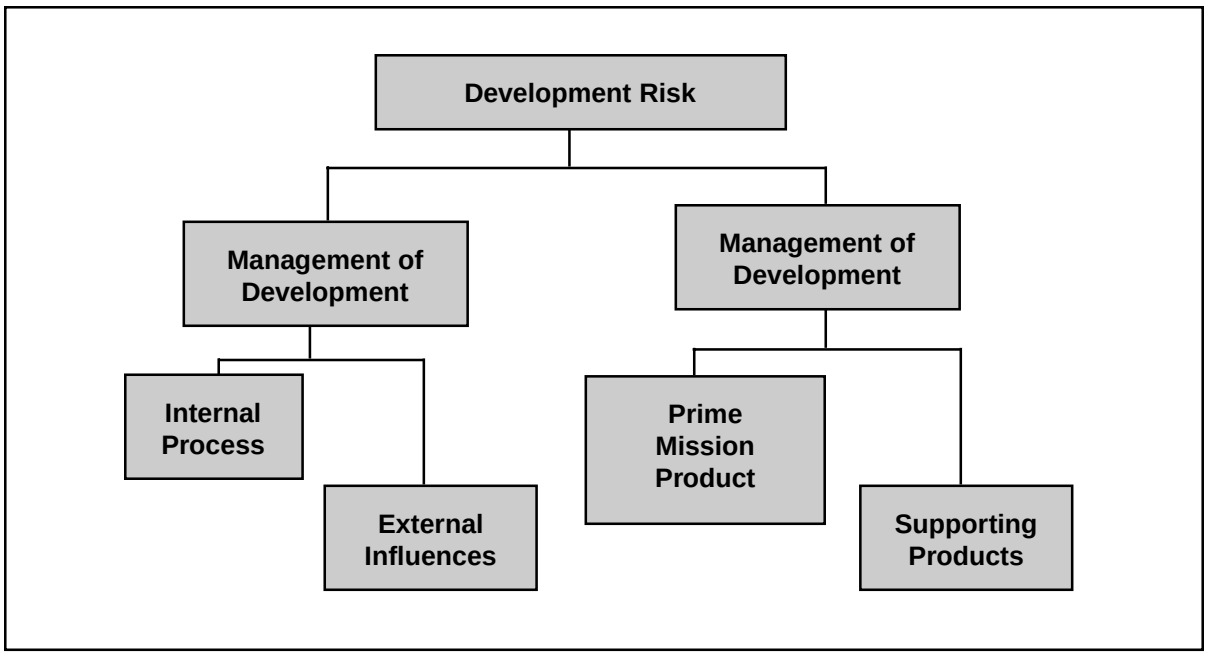


Figure 15-1. Risk Hierarchy

Risks related to the system development generally are traceable to achieving life cycle customer requirements. Product risks include both end product risks that relate to the basic performance and cost of the system, and to enabling products that relate to the products that produce, maintain, support, test, train, and dispose of the system.

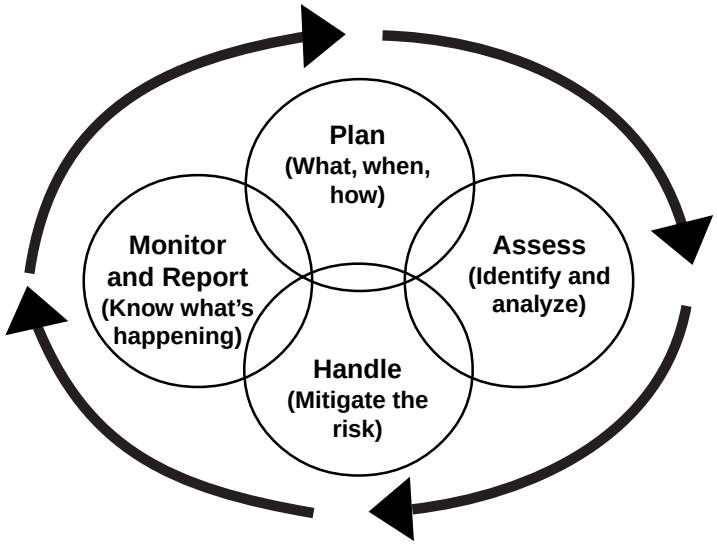
Risks relating to the management of the development effort can be technical management risk or risk caused by external influences. Risks dealing with the internal technical management include those associated with schedules, resources, work flow, on time deliverables, availability of appropriate personnel, potential bottlenecks, critical path operations and the like. Risks dealing with external influences include resource availability, higher authority delegation, level of program visibility, regulatory requirements, and the like.

15.2 RISK MANAGEMENT

Risk management is an organized method for identifying and measuring risk and for selecting, developing, and implementing options for the handling of risk. It is a process, not a series of events. Risk management depends on risk management planning, early identification and analysis of risks, continuous risk tracking and reassessment, early implementation of corrective actions, communication, documentation, and coordination. Though there are many ways to structure risk management, this book will structure it as having four parts: Planning, Assessment, Handling, and Monitoring. As depicted in Figure 15-2 all of the parts are interlocked to demonstrate that after initial planning the parts begin to be dependent on each other. Illustrating this, Figure 15-3 shows the key control and feedback relationships in the process.

Risk Planning

Risk Planning is the continuing process of developing an organized, comprehensive approach to risk management. The initial planning includes establishing a strategy; establishing goals and objectives; planning assessment, handling, and monitoring activities; identifying resources, tasks, and responsibilities; organizing and training risk management IPT members; establishing a method to track risk items; and establishing a method to



A Continuous Interlocked Process—Not an Event

Figure 15-2. Four Elements of Risk Management

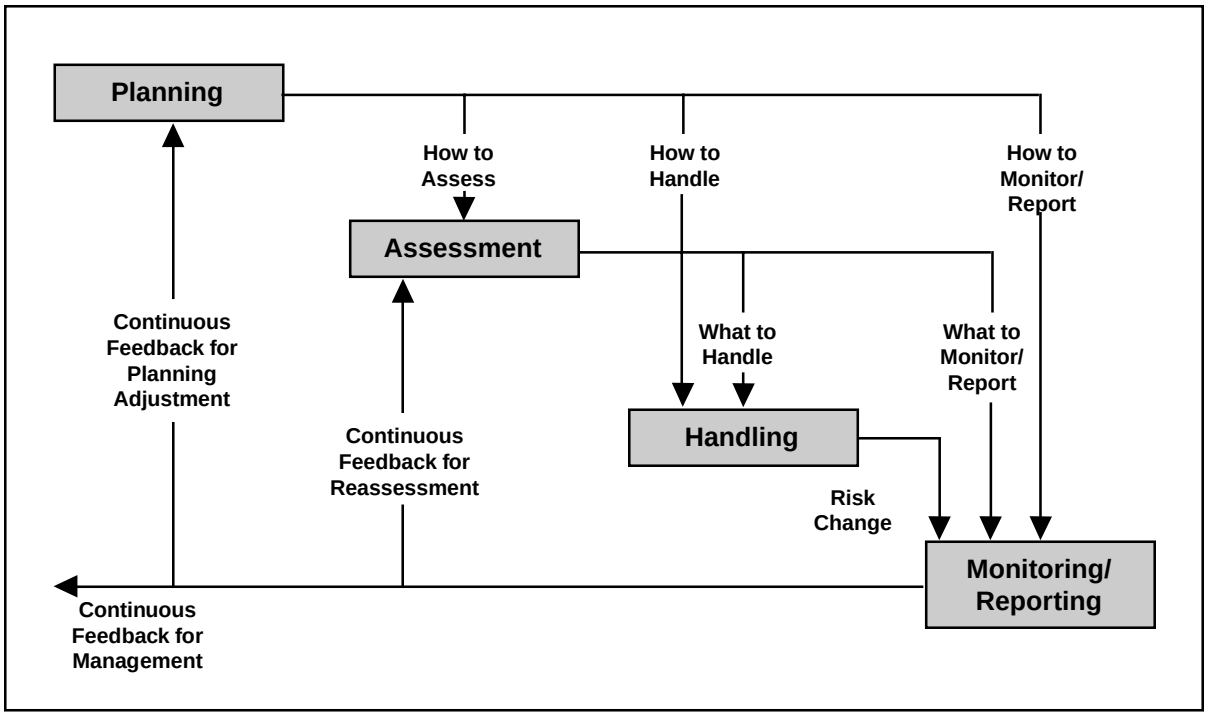


Figure 15-3. Risk Management Control and Feedback

document and disseminate information on a continuous basis.

In a systems engineering environment risk planning should be:

- Inherent (imbedded) in systems engineering planning and other related planning, such as producibility, supportability, and configuration management;
- A documented, continuous effort;
- Integrated among all activities;
- Integrated with other planning, such as systems engineering planning, supportability analysis, production planning, configuration and data management, etc.;
- Integrated with previous and future phases; and
- Selective for each Configuration Baseline.

Risk is altered by time. As we try to control or alter risk, its probability and/or consequence will change. Judgment of the risk impact and the method of handling the risk must be reassessed and potentially altered as events unfold. Since these events are continually changing, the planning process is a continuous one.

Risk Assessment

Risk assessment consists of *identifying* and *analyzing* the risks associated with the life cycle of the system.

Risk Identification Activities

Risk identification activities establish what risks are of concern. These activities include:

- Identifying risk/uncertainty sources and drivers,
- Transforming uncertainty into risk,
- Quantifying risk,
- Establishing probability, and
- Establishing the priority of risk items.

As shown by Figure 15-4 the initial identification process starts with an identification of potential risk items in each of the four risk areas. Risks related to the system performance and supporting products are generally organized by WBS and initially determined by expert assessment of teams and individuals in the development enterprise. These risks tend to be those that require follow-up quantitative assessment. Internal process and external influence risks are also determined by expert assessment within the enterprise, as well as through the use of risk area templates similar to those found in DoD 4245.7-M. The DoD 4245.7-M templates describe the risk areas associated with system acquisition management processes, and provide methods for reducing traditional risks in each area. These templates should be tailored for specific program use based on expert feedback.

After identifying the risk items, the risk level should be established. One common method is through the use of a matrix such as shown in Figure 15-5. Each item is associated with a block in the matrix to establish relative risk among them. On such a graph risk increases on the diagonal and provides a method for assessing relative risk. Once the relative risk is known, a priority list can be established and risk analysis can begin.

Risk identification efforts can also include activities that help define the probability or consequences of a risk item, such as:

- Testing and analyzing uncertainty away,
- Testing to understand probability and consequences, and
- Activities that quantify risk where the qualitative nature of high, moderate, low estimates are insufficient for adequate understanding.

Risk Analysis Activities

Risk analysis activities continue the assessment process by refining the description of identified risk event through isolation of the cause of risk, determination of the full impact of risk, and the

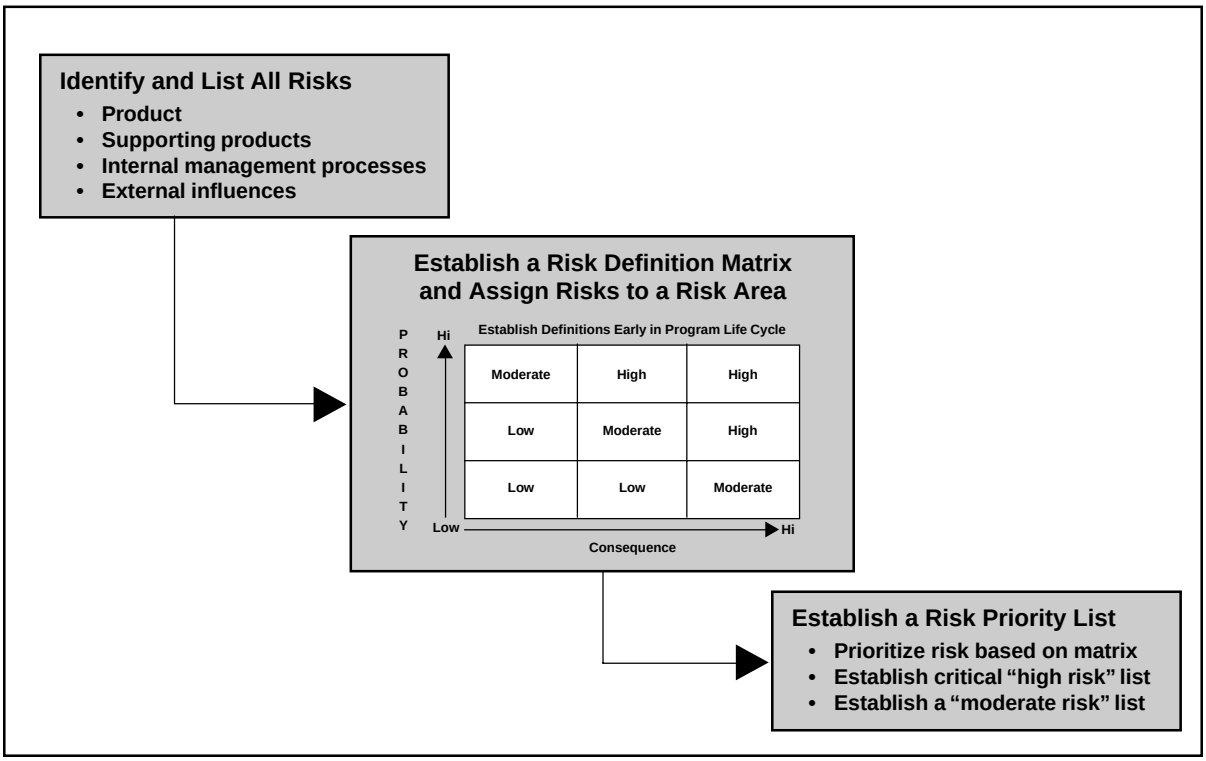


Figure 15-4. Initial Risk Identificaiton

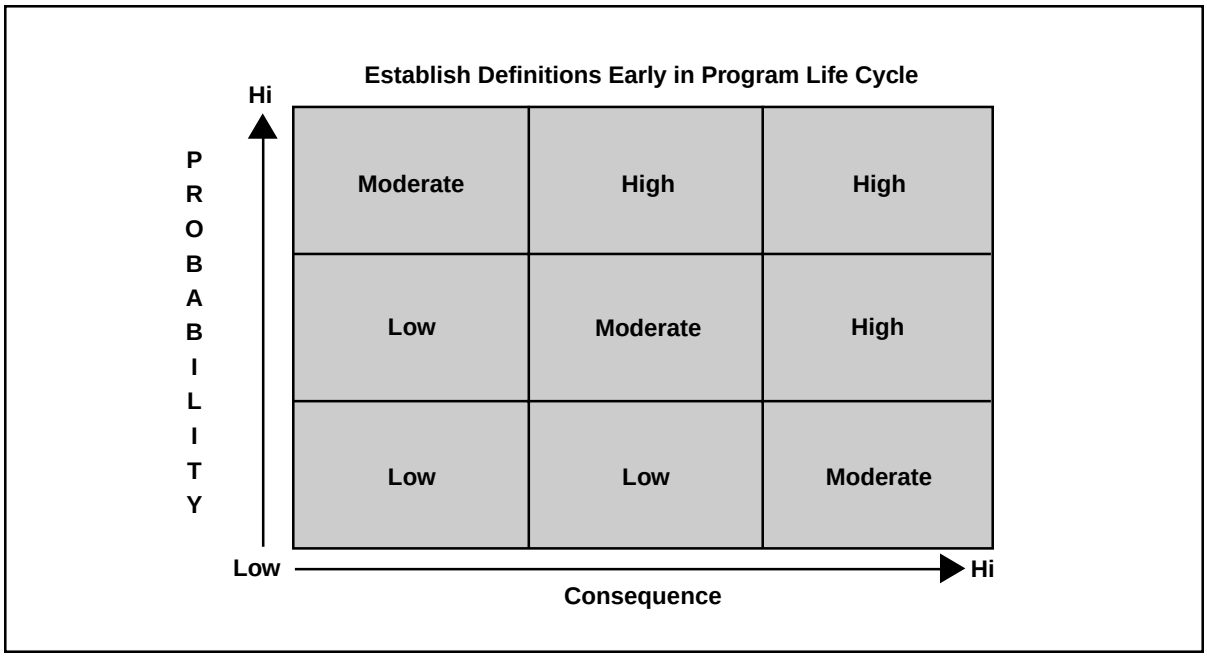


Figure 15-5. Simple Risk Matrix

determination and choose of alternative courses of action. They are used to determine what risk should be tracked, what data is used to track risk, and what methods are used to handle the risk.

Risk analysis explores the options, opportunities, and alternatives associated with the risk. It addresses the questions of how many legitimate ways the risk could be dealt with and the best way to do so. It examines sensitivity, and risk interrelationships by analyzing impacts and sensitivity of related risks and performance variation. It further analyzes the impact of potential and accomplished, external and internal changes.

Risk analysis activities that help define the scope and sensitivity of the risk item include finding answers to the following questions:

- If something changes, will risk change faster, slower, or at the same pace?
- If a given risk item occurs, what collateral effects happen?
- How does it affect other risks?
- How does it affect the overall situation?
- Development of a watch list (prioritized list of risk items that demand constant attention by management) and a set of metrics to determine if risks are steady, increasing, or decreasing.
- Development of a feedback system to track metrics and other risk management data.
- Development of quantified risk assessment.

Quantified risk assessment is a formal quantification of probabilities of occurrence and consequences using a top-down structured process following the WBS. For each element, risks are assessed through analysis, simulation and test to determine statistical probability and specific conditions caused by the occurrence of the consequence.

Cautions in Risk Assessments

Reliance solely on numerical values from simulations and analysis should be avoided. Do not lose sight of the actual source and consequences of the risks. Testing does not eliminate risk. It only

provides data to assess and analyze risk. Most of all, beware of manipulating relative numbers, such as 'risk index" or "risk scales," even when based on expert opinion, as quantified data. They are important information, but they are largely subjective and relative; they do not necessarily define risk accurately. Numbers such as these should always be the subject of a sensitivity analysis.

Risk Handling

Once the risks have been categorized and analyzed, the process of handling those risks is initiated. The prime purpose of risk handling activities is to mitigate risk. Methods for doing this are numerous, but all fall into four basic categories:

- Risk Avoidance,
- Risk Control,
- Risk Assumption, and
- Risk Transfer.

Avoidance
To avoid risk, remove requirements that represent uncertainty and high risk (probability or consequence.) Avoidance includes trading off risk for performance or other capability, and it is a key activity during requirements analysis. Avoidance requires understanding of priorities in requirements and constraints. Are they mission critical, mission enhancing, nice to have, or "bells and whistles?"

Control
Control is the deliberate use of the design process to lower the risk to acceptable levels. It requires the disciplined application of the systems engineering process and detailed knowledge of the technical area associated with the design. Control techniques are plentiful and include:

- Multiple concurrent design to provide more than one design path to a solution,
- Alternative low-risk design to minimize the risk of a design solution by using the lowest-risk design option,
- Incremental development, such as preplanned product improvement, to dissociate the design from high-risk components that can be developed separately,
- Technology maturation that allows high-risk components to be developed separately while the basic development uses a less risky and lower-performance temporary substitute,
- Test, analyze and fix that allows understanding to lead to lower risk design changes. (Test can be replaced by demonstration, inspection, early prototyping, reviews, metric tracking, experimentation, models and mock-ups, simulation, or any other input or set of inputs that gives a better understanding of the risk),
- Robust design that produces a design with substantial margin such that risk is reduced, and
- The open system approach that emphasizes use of generally accepted interface standards that provide proven solutions to component design problems.

Acceptance
Acceptance is the deliberate acceptance of the risk because it is low enough in probability and/or consequence to be reasonably assumed without impacting the development effort. Key techniques for handling accepted risk are budget and schedule reserves for unplanned activities and continuous assessment (to assure accepted risks are maintained at acceptance level). The basic objective of risk management in systems engineering is to reduce all risk to an acceptable level.

The strong budgetary strain and tight schedules on DoD programs tends to reduce the program manager's and system engineer's capability to provide reserve. By identifying a risk as acceptable, the worst-case outcome is being declared acceptable. Accordingly, the level of risk considered acceptable should be chosen very carefully in a DoD acquisition program.

Transfer

Transfer can be used to reduce risk by moving the risk from one area of design to another where a design solution is less risky. Examples of this include:

- Assignment to hardware (versus software) or vice versa; and
- Use of functional partitioning to allocate performance based on risk factors.

Transfer is most associated with the act of assigning, delegating, or paying someone to assume the risk. To some extent transfer always occurs when contracting or tasking another activity. The contract or tasking document sets up agreements that can transfer risk from the government to contractor, program office to agency, and vice versa. Typical methods include insurance, warranties, and incentive clauses. Risk is never truly transferred. If the risk isn't mitigated by the delegated activity it still affects your project or program.

Key areas to review before using transfer are:

- How well can the delegated activity handle the risk? Transfer is effective only to the level the risk taker can handle it.
- How well will the delegated activity solution integrate into your project or program? Transfer is effective only if the method is integrated with the overall effort. For example, is the warranty action coordinated with operators and maintainers?
- Was the method of tasking the delegated activity proper? Transfer is effective only if the transfer mechanism is valid. For example, can incentives be "gamed?"
- Who has the most control over the risk? If the project or program has no or little control over the risk item, then transfer should be considered to delegate the risk to those most likely to be able to control it.

Monitoring and Reporting

Risk monitoring is the continuous process of tracking and evaluating the risk management process by metric reporting, enterprise feedback on watch list items, and regular enterprise input on potential developing risks. (The metrics, watch lists, and feedback system are developed and maintained as an assessment activity.) The output of this process is then distributed throughout the enterprise, so that all those involved with the program are aware of the risks that affect their efforts and the system development as a whole.

Special Case – Integration as Risk

Integration of technologies in a complex system is a technology in itself! Technology integration during design may be a high-risk item. It is not normally assessed or analyzed as a separately identified risk item. If integration risks are not properly identified during development of the functional baseline, they will demonstrate themselves as serious problems in the development of the product baseline.

Special Case – Software Risk

Based on past history, software development is often a high-risk area. Among the causes of performance, schedule, and cost deficiencies have been:

- Imperfect understanding of operational requirements and its translation into source instructions,
- Risk tracking and handling,
- Insufficient comprehension of interface constraints, and
- Lack of sufficient qualified personnel.

Risk Awareness

All members of the enterprise developing the system must understand the need to pay attention to the existence and changing nature of risk.

Consequences that are unanticipated can seriously disrupt a development effort. The uneasy feeling that something is wrong, despite assurances that all is fine may be valid. These kinds of intuitions have allowed humanity to survive the slings and arrows of outrageous fortune throughout history. Though generally viewed as non-analytical, these apprehensions should not be ignored. Experience indicates those non-specific warnings have validity, and should be quantified as soon as possible.

15.3 SUMMARY POINTS

- Risk is inherent in all activities.
- Risk is composed of knowledge of two characteristics of a possible negative future event: probability of occurrence and consequences of occurrence.
- Risk management is associated with a clear understanding of probability.
- Risk management is an essential and integral part of technical program management (systems engineering).
- Risks and uncertainties must be identified, analyzed, handled, and tracked.
- There are four basic ways of handling risk: avoidance, transfer, acceptance, and control.
- Program risks are classified as low, moderate, or high depending on consequences and probability of occurrence. Risk classification should be based on quantified data to the extent possible.

SUPPLEMENT 15-A

RISK MANAGEMENT IN DOD ACQUISITION

Policy

DoD policy is quite clear in regard to risk management: it must be done.

The PM shall identify the risk areas in the program and integrate risk management within overall program management. (DoD 5000.2-R.)

In addition, DoDD 5000.4 identifies risk and cost analysis as a responsibility of the program manager.

Risk Management View

A DSMC study indicates that major programs which declared moderate risk at Milestone B have been more successful in terms of meeting cost and schedule goals than those which declared low risk (DSMC TR 2-95). This strongly implies that program offices that understand and respect risk management will be more successful. For this reason, the program office needs to adopt a systems-level view of risk. The systems engineer provides this view. Systems Engineering is the cornerstone of program office risk management program because it is the connection to realistic assessment of product maturity and development, and the product is, in the final analysis, what system acquisition is really about.

However, the program office has external risks to deal with as well as the internal risks prevalent in the development process. The Systems Engineer has to provide the program manager internal risk data in a manner that aids the handling of the external risks. In short, the systems engineer must present bad news such that it is reasonable and compelling to higher levels of authority. See Chapter 20 for further discussion on this topic.

Factoring Risk Management into the Process

Risk management, as an integral part of the overall program planning and management process, is enhanced by applying a controlled, consistent, approach to systems engineering and using integrated teams for both product development and management control. Programs should be transitioned to the next phase only if risk is at the appropriate level. Know the risk drivers behind the estimates. By its nature there are always subjective aspects to assessing and analyzing risk at the system level, even though they tend to be represented as quantitative and/or analytically objective.

Risk and Phases

Risk management begins in the Concept and Technology Development phase. During Concept Exploration initial system level risk assessments are made. Unknown-unknowns, uncertainty, and some high-risk elements are normal and expected. When substantial technical risk exists, the Component Advanced Development stage is appropriate, and is included in the life-cycle process specifically as an opportunity to address and reduce risks to a level that are consistent with movement into systems acquisition.

The S&T community has a number of vehicles available that are appropriate for examining technology in application and for undertaking risk reduction activities. These include Advanced Technology Demonstrations, Advanced Concept Technology Demonstrations, as well as Joint Warfighting Experiments. The focus of the activities undertaken during these risk reduction stages include:

- Testing, analyzing, or mitigating system and subsystem uncertainty and high risk out of the program.

- Demonstrating technology sufficient to uncover system and subsystem unknown-unknowns (especially for integration).

- Planning for risk management during the transition to and continuation of systems acquisition during the System Development and Demonstration phase, especially handling and tracking of moderate risk.

System Development and Demonstration requires the application of product and manufacturing engineering, which can be disrupted if the technology development is not sufficient to support engineering development. Risk management in during this phase emphasizes:

- Reduction and control of moderate risks,

- All risks under management including emerging ones, and

- Maintenance of risk levels and reaction to problems.

Objective Assessment of Technology

The revised acquisition process has been deliberately structured to encourage and allow programs to progress through appropriate risk reduction stages and phases, based on an objective assessment of the maturity levels associated with the products and systems under development. It is therefore, particularly important that program managers and their staffs ensure that the decisions made regarding recommendations to proceed, and the paths to be taken, be based on as impartial and objective opinions as possible. The temptation is always to move ahead and not to delay to improve the robustness of a given product or system. When systems are hurried into engineering development and production, in spite of the fact that the underlying technologies require further development, history indicates that the results will eventually show the fallacy of speed over common sense. And to fix the problem in later stages of development—or even after deployment—can be hugely expensive in terms of both monetary cost and human lives.

The prevailing presumption at Milestone B is that the system is ready for engineering development. After this, the acquisition community generally assumes that risk is moderate to low, that the technology is "available." There is evidence to support the assertion that programs often progress into engineering development with risks that actually require substantial exploratory and applied research and development to bring them to the moderate levels of risk or lower. One approach that has proven successful in making objective risk assessments is the use of independent evaluation teams. Groups that have no pre-determined interest to protect or axe to grind are often capable of providing excellent advice regarding the extent to which a system is ready to proceed to the next level of development and subsequent phases.

Risk Classification on the System (Program) Level

Classification definitions should be established early and remain consistent throughout the program. The program office should assess the risks of achieving performance, schedule, and cost in clear and accurate terms of both probability and consequence. Where there is disagreement about the risk, assessment efforts should be immediately increased. Confusion over risk is the worst program risk, because it puts in doubt the validity of the risk management process, and therefore, whether program reality is truly understood.

The system level risk assessment requires integration and interpretation of the quantified risk assessment of the parts. This requires reasonable judgement. Because integration increases the potential for risk, it is reasonable to assume overall risk is not better than the sum of objective data for the parts.

Reality Versus Expectations

Program managers are burdened with the expectations of superiors and others that have control over the program office's environment. Pressure to accommodate these expectations is high. If the systems engineer cannot communicate the reality of risk in terms that are understandable, acceptable, or sufficiently verifiable to management, then these pressures may override vertical communication of actual risk.

Formal systems engineering with risk management incorporated can provide the verifiable information. However, the systems engineer also has the responsibility to adequately explain probability and consequences such that the program manager can accept the reality of the risk and override higher level expectations.

Uncertainty is a special case, and very dangerous in an atmosphere of high level expectations. Presentation of uncertainty issues should strongly emphasize consequences, show probability trends, and develop "most likely" alternatives for probability.

SUPPLEMENT 15-B

MODEL FOR SYSTEM LEVEL RISK ASSESSMENT

The following may be used to assist in making preliminary judgments regarding risk classifications:

	Low Risk	**Moderate Risk**	**High Risk**
Consequences	Insignificant cost, schedule, or technical impact	Affects program objectives, cost, or schedule; however cost, schedule, performance are achievable	Significant impact, requiring reserve or alternate courses of action to recover
Probability of Occurrence	Little or no estimated likelihood	Probability sufficiently high to be of concern to management	High likelihood of occurrence
Extent of Demonstration	Full-scale, integrated technology has been demonstrated previously	Has been demonstrated but design changes, tests in relevant environments required	Significant design changes required in order to achieve required/desired results
Existence of Capability	Capability exists in known products; requires integration into new system	Capability exists, but not at performance levels required for new system	Capability does not currently exist

Also see Technology Readiness Levels matrix in Chapter 2

PART 4

PLANNING, ORGANIZING, AND MANAGING

CHAPTER 16

SYSTEMS ENGINEERING PLANNING

16.1 WHY ENGINEERING PLANS?

Systems engineering planning is an activity that has direct impact on acquisition planning decisions and establishes the feasible methods to achieve the acquisition objectives. Management uses it to:

- Assure that all technical activities are identified and managed,
- Communicate the technical approach to the broad development team,
- Document decisions and technical implementation, and
- Establish the criteria to judge how well the system development effort is meeting customer and management needs.

Systems engineering planning addresses the scope of the technical effort required to develop the system. The basic questions of "who will do what" and "when" are addressed. As a minimum, a technical plan describes what must be accomplished, how systems engineering will be done, how the effort will be scheduled, what resources are needed, and how the systems engineering effort will be monitored and controlled. The planning effort results in a management-oriented document covering the implementation of program requirements for system engineering, including technical management approaches for subsequent phases of the life cycle. In DoD it is an exercise done on a systems level by the government, and on a more detailed level by contractors.

Technical/Systems Engineering Planning

Technical planning may be documented in a separate engineering management plan or incorporated into a broad, integrated program management plan. This plan is first drafted at project or program inception during the early requirements analysis effort. Requirements analysis and technical planning are inherently linked, because requirements analysis establishes an understanding of what must be provided. This understanding is fundamental to the development of detailed plans.

To be of utility, systems engineering plans must be regularly updated. To support management decision making, major updates will usually occur at least just before major management milestone decisions. However, updates must be performed as necessary between management milestones to keep the plan sufficiently current to achieve its purpose of information, communication, and documentation.

16.2 ELEMENTS OF TECHNICAL PLANS

Technical plans should include sufficient information to document the purpose and method of the systems engineering effort. Plans should include the following:

- An introduction that states the purpose of the engineering effort and a description of the system being developed,
- A technical strategy description that ties the engineering effort to the higher-level management planning,

- A description of how the systems engineering process will be tailored and structured to complete the objectives stated in the strategy,
- An organization plan that describes the organizational structure that will achieve the engineering objectives, and
- A resource plan that identifies the estimated funding and schedule necessary to achieve the strategy.

Introduction

The introduction should include:

Scope: The scope of the plan should provide information concerning what part of the big picture the plan covers. For example, if the plan were a DoD program office plan, it would emphasize control of the higher-level requirements, the system definition (functional baseline), and all activities necessary for system development. On the other hand, a contractor's plan would emphasize control of lower-level requirements, preliminary and detail designs (allocated and product baselines), and activities required and limited by the contractual agreement.

Description: The description of the system should:

- Be limited to an executive summary describing those features that make the system unique,
- Include a general discussion of the system's operational functions, and
- Answer the question "What is it and what will it do?"

Focus: A guiding focus for the effort should be provided to clarify the management vision for the development approach. For example, the focus may be *lowest cost to obtain threshold requirements, superior performance within budget, superior standardization for reduced logistics, maximum use of the open systems approach to reduce cost*, or the like. A focus statement should:

- Be a single objective to avoid confusion,
- Be stated simply to avoid misinterpretation, and
- Have high-level support.

Purpose: The purpose of the engineering effort should be described in general terms of the outputs, both end products and life-cycle enabling products that are required. The stated purpose should answer the question, "What does the engineering effort have to produce?"

Technical Strategy

The basic purpose of a technical strategy is to link the development process with the acquisition or contract management process. It should include:

- Development phasing and associated baselining,
- Key engineering milestones to support risk management and business management milestones,
- Associated parallel developments or product improvement considerations, and
- Other management generated constraints or high-visibility activities that could affect the engineering development.

Phasing and Milestones: The development phasing and baseline section should describe the approach to phasing the engineering effort, including tailoring of the basic process described in this book and a rationale for the tailoring. The key milestones should be in general keeping with the technical review process, but tailored as appropriate to support business management milestones and the project/program's development phasing. Strategy considerations should also include discussion of how design and verification will phase into production and fielding. This area should identify how production will be phased-in (including use of limited-rate initial production and long lead-time purchases), and that initial support considerations require significant coordination between the user and acquisition community.

Parallel Developments and Product Improvement: Parallel development programs necessary for the system to achieve its objectives should be identified and the relationship between the efforts explained. Any product improvement strategies should also be identified. Considerations such as evolutionary development and preplanned product improvement should be described in sufficient detail to show how they would phase into the overall effort.

Impacts on Strategy

All conditions or constraints that impact the strategy should be identified and the impact assessed. Key points to consider are:

- Critical technologies development,
- Cost As an Independent Variable (CAIV), and
- Any business management directed constraint or activity that will have a significant influence on the strategy.

Critical Technologies: Discussion of critical technology should include:

- Risk associated with critical technology development and its impact on the strategy,
- Relationship to baseline development, and
- Potential impact on the overall development effort.

Cost As an Independent Variable: Strategy considerations should include discussion of how CAIV will be implemented, and how it will impact the strategy. It should discuss how unit cost, development cost, life cycle cost, total ownership cost, and their interrelationships apply to the system development. This area should focus on how these costs will be balanced, how they will be controlled, and what impact they have on the strategy and design approach.

Management Issues: Management issues that pose special concerns for the development strategy could cover a wide range of possible issues. In general, management issues identified as engineering strategy issues are those that impact the ability to support the management strategy. Examples would include:

- Need to combine developmental phases to accommodate management driven schedule or resource limitations,
- Risk associated with a tight schedule or limited budget,
- Contractual approach that increases technical risk, and
- Others of a similar nature.

Management-dictated technical activities—such as use of M&S, open systems, IPPD, and others—should not be included as a strategy issue unless they impact the overall systems engineering strategy to meet management expectations. The strategy discussion should lay out the plan, how it dovetails with the management strategy, and how management directives impact it.

Systems Engineering Processes

This area of the planning should focus on how the system engineering processes will be designed to support the strategy. It should include:

- Specific methods and techniques used to perform the steps and loops of the systems engineering process,
- Specific system analysis and control tools and how they will be used to support step and loop activities, and
- Special design considerations that must be integrated into the engineering effort.

Steps and Loops: The discussion of how the systems engineering process will be done should show the specific procedures and products that will ensure:

- Requirements are understood prior to the flow-down and allocation of requirements,
- Functional descriptions are established before designs are formulated,
- Designs are formulated that are traceable to requirements,
- Methods exist to reconsider previous steps, and
- Verification processes are in place to ensure that design solutions meet needs and requirements.

This planning area should address each step and loop for each development phase, include identification of the step-specific tools (Functional Flow Block Diagrams, Timeline Analysis, etc.) that will be used, and establish the verification approach. The verification discussion should identify all verification activities, the relationship to formal developmental T&E activities, and independent testing activities (such as operational testing).

Norms of the particular technical area and the engineering processes of the command, agency, or company doing the tasks will greatly influence this area of planning. However, whatever procedures, techniques, and analysis products or models used, they should be compatible with the basic principles of systems engineering management as described earlier in this book.

An example of the type of issue this area would address is the requirements analysis during the system definition phase. Requirements analysis is more critical and a more central focus during system definition than in later phases. The establishment of the correct set of customer requirements at the beginning of the development effort is essential to proper development. Accordingly, the system definition phase requirements analysis demands tight control and an early review to verify the requirements are established well enough to begin the design effort. This process of control and verification necessary for the system definition phase should be specifically described as part of the overall requirements analysis process and procedures.

Analysis and Control: Planning should identify those analysis tools that will be used to evaluate alternative approaches, analyze or assess effectiveness, and provide a rigorous quantitative basis for selecting performance, functional, and design requirements. These processes can include trade studies, market surveys, M&S, effectiveness analyses, design analyses, QFD, design of experiments, and others.

Planning must identify the method by which control and feedback will be established and maintained. The key to control is performance-based measurement guided by an event-based schedule. Entrance and exit criteria for the event-driven milestones should be established sufficient to demonstrate proper development progress has been completed. Event-based schedules and exit criteria are further discussed later in this chapter. Methods to maintain feedback and control are developed to monitor progress toward meeting the exit criteria. Common methods were discussed earlier in this book in the chapters on metrics, risk management, configuration management, and technical reviews.

Design Considerations: In every system development there are usually technical activities that require special attention. These may come from management concerns, legal or regulatory directives, social issues, or organizational initiatives. For example, a DoD program office will have to conform to DoDD 5000.2-R, which lists several technical activities that must be incorporated into the development effort. DoD plans should specifically address each issue presented in the Program Design section of DoD 5000.2-R.

In the case of a contractor there may be issues delineated in the contract, promised in the proposal, or established by management that the technical effort must address. The system engineering planning must describe how each of these issues will be integrated into the development effort.

Organization

Systems engineering management planning should identify the basic structure that will develop the system. Organizational planning should address how the integration of the different technical disciplines, primary function managers, and other stakeholders will be achieved to develop the system. This planning area should describe how multidisciplinary teaming would be implemented, that is, how the teams will be organized, tasked, and trained. A systems-level team should be established early to support this effort. Roles, authority, and basic responsibilities of the system-level design team should be specifically described. Establishing the design organization should be one of the initial tasks of the system-level design team. Their basic approach to organizing the effort should be described in the plan. Further information on organizing is contained in a later chapter.

Resources

The plan should identify the budget for the technical development. The funds required should be matrixed against a calendar schedule based on the event-based schedule and the strategy. This should establish the basic development timeline with an associated high-level estimated spending profile. Shortfalls in funding or schedule should be addressed and resolved by increasing funds, extending schedule, or reducing requirements prior to the plan preparation. Remember that future analysis of development progress by management will tend to be based on this budget "promised" at plan inception.

16.3 INTEGRATION OF PLANS – PROGRAM PLAN INTERFACES

Systems engineering management planning must be coordinated with interfacing activities such as these:

- Acquisition Strategy assures that technical plans take into account decisions reflected in the Acquisition Strategy. Conflicts must be identified early and resolved.
- Financial plan assures resources match the needs in the tech plan. Conflicts should be identified early and resolved.
- Test and Evaluation Master Plan (TEMP) assures it complements the verification approach. It should provide an integrated approach to verify that the design configuration will meet customer requirements. This approach should be compatible with the verification approach delineated in the systems engineering plan.
- Configuration management plan assures that the development process will maintain the system baselines and control changes to them.
- Design plans (e.g., electrical, mechanical, structural, etc.) coordinates identification of IPT team composition.
- Integrated logistics support planning and support analysis coordinates total system support.
- Production/Manufacturing plan to coordinate activities concerning design producibility, and follow-on production,
- Quality management planning assures that quality engineering activities and quality management functions are included in system engineering planning,
- Risk management planning establishes and coordinates technical risk management to support total program risk management.
- Interoperability planning assures interoperability suitability issues are coordinated with system engineering planning. (Where interoperability is an especially critical requirement such as, communication or information systems, it should be addressed as a separate issue with separate integrated teams, monitoring, and controls).
- Others such as M&S plan, software development plan, human integration plan, environment, safety and health planning, also interface.

Things to Watch

A well developed technical management plan will include:

- The expected benefit to the user,
- How a total systems development will be achieved using a systems engineering approach,
- How the technical plan complements and supports the acquisition or management business plan,
- How incremental reviews will assure that the development stays on track,
- How costs will be reduced and controlled,
- What technical activities are required and who will perform them,
- How the technical activities relate to work accomplishment and calendar dates,
- How system configuration and risk will be controlled,
- How system integration will be achieved,
- How the concerns of the eight primary life cycle functions will be satisfied,
- How regulatory and contractual requirements will be achieved, and
- The feasibility of the plan, i.e., is the plan practical and executable from a technical, schedule, and cost perspective.

16.4 SUMMARY POINTS

- Systems engineering planning should establish the organizational structure that will achieve the engineering objectives.
- Planning must include event-based scheduling and establish feedback and control methods.
- It should result in important planning and control documents for carrying out the engineering effort.
- It should identify the estimated funding and detail schedule necessary to achieve the strategy.
- Systems engineering planning should establish the proper relationship between the acquisition and technical processes.

APPENDIX 16-A

SCHEDULES

The event-based schedule, sometimes referred to as the Systems Engineering Master Schedule (SEMS) or Integrated Master Schedule (IMS) is a technical event-driven (not time-driven) plan primarily concerned with product and process development. It forms the basis for schedule control and progress measurement, and relates engineering management events and accomplishments to the WBS. These events are identified either in the format of entry and exit events (e.g. initiate PDR, complete PDR) or by using entry and exit criteria for each event. Example exit criteria shown in Figures 16-1 and 16-2.

The program office develops an event-based schedule that represents the overall development effort. This schedule is usually high-level and focused on the completion of events that support the acquisition milestone decision process. An event-based schedule is developed by the contractor to include significant accomplishments that must be completed in order to meet the progress required prior to contract established events. The contractor also includes events, accomplishments, and associated success criteria specifically identified by the contract. DoD program offices can use the contractor's event-based schedule and the

System Requirements Review (SRR)	System Functional Review/Software Spec Review(SFR/SSR)	Preliminary Design Review (PDR)
• Mission Analysis completed • Support Strategy defined • System options decisions completed • Design usage defined • Operational performance requirement defined • Manpower sensitivities completed • Operational architecture available and reviewed	• Installed environments defined • Maintenance concept defined • Preliminary design criteria established • Preliminary design margins established • Interfaces defined/preliminary interface specs completed • Software and software support requirements completed • Baseline support/resources requirements defined • Support equipment capability defined • Technical architecture prepared • System defined and requirements shown to be achievable	• Design analyses/definition completed • Material/parts characterization completed • Design maintainability analysis completed/support requirements defined • Preliminary production plan completed • Make/buy decisions finalized • Breadboard investigations completed • Coupon testing completed • Design margins completed • Preliminary FMECA completed • Software functions and architecture and support defined • Maintenance tasks trade studies completed • Support equipment development specs completed

Figure 16-1. Sample Event-Based Schedule Exit Criteria

Critical Design Review Test Readiness Review (CDR/TRR)	System Verfication Review/ Functional Configuration Audit (SVR/FCA)	Physical Configuration Audit (PCA)
• Parts, materials, processes selected • Development tests completed • Inspection points/criteria completed • Component level FMECA completed • Repair level analysis completed • Facility requirements defined • Software test descriptions completed • Hardware and software hazard analysis completed • Firmware spt completed • Software programmers manual completed • Durability test completed • Maintinability analyses completed • Qualification test procedures approved • Producibility analyses completed	• All verification tasks completed • Durability tests completed • Long lead time items identified • PME and operational training completed • Tech manuals completed • Flight test plan approved • Support and training equipment developed • Fielding analysis completed • Provisioning data verified	• Qualification testing completed • All QA provisions finalized • All manufacturing process requirements and documentation finalized • Product fabrication specifications finalized • Support and training equipment qualification completed • All acceptance test requirements completed • Life management plan completed • System support capability demonstrated • Post production support analysis completed • Final software description document and all user manuals complete

Figure 16-2. Sample Event-Driven Schedule Exit Criteria (continued)

contractor's conformance to it for several purposes: source selection, monitoring contractor progress, technical and other reviews, readiness for option award, incentives/awards determination, progress payments decision, and similar activities.

The event-based schedule establishes the key parameters for determining the progress of a development program. To some extent it controls and interfaces with systems engineering management planning, integrated master schedules and integrated master plans, as well as risk management planning, system test planning, and other key plans which govern the details of program management.

The calendar or detail schedule is a time-based schedule that shows how work efforts will support tasks and events identified in the event-based schedule. It aligns the tasks and calendar dates to show when each significant accomplishment must be achieved. It is a key component for developing Earned Value metrics. The calendar schedule is commonly referred to as the detail schedule, systems engineering detail schedule, or SEDS. The contractor is usually required to maintain the relationship between the event and calendar schedules for contract required activities. Figure 16-3 shows the relationship between the system requirements, the WBS, the contractual requirements, the event-based schedule, and the detail schedule.

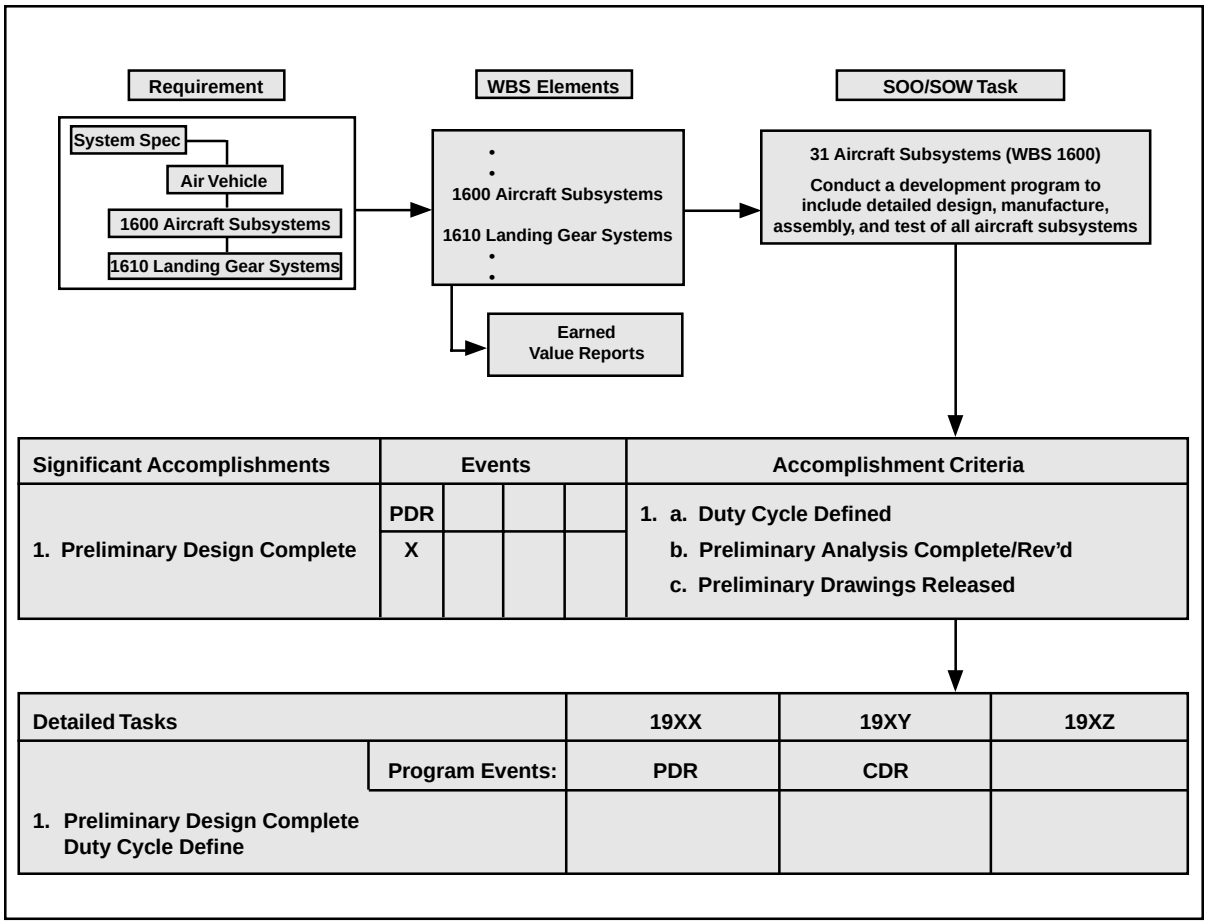


Figure 16-3. Event-Based—Detailed Schedule Interrelationships

Schedule Summary

The event-based schedule establishes the key tasks and results expected. The event-based schedule establishes the basis for a valid calendar-based (detail) schedule.

CHAPTER 17

PRODUCT IMPROVEMENT STRATEGIES

17.1 INTRODUCTION

Complex systems do not usually have stagnant configurations. A need for a change during a system's life cycle can come from many sources and effect the configuration in infinite ways. The problem with these changes is that, in most cases it is difficult, if not impossible, to predict the nature and timing of these changes at the beginning of system development. Accordingly, strategies or design approaches have been developed to reduce the risk associated with predicted and unknown changes.

Well thought-out improvement strategies can help control difficult engineering problems related to:

- Requirements that are not completely understood at program start,
- Technology development that will take longer than the majority of the system development,
- Customer needs (such as the need to combat a new military threat) that have increased, been upgraded, are different, or are in flux,
- Requirements change due to modified policy, operational philosophy, logistics support philosophy, or other planning or practices from the eight primary life cycle function groups,
- Technology availability that allows the system to perform better and/or less expensively,
- Potential reliability and maintainability upgrades that make it less expensive to use, maintain, or support, including development of new supply support sources,
- Safety issues requiring replacement of unsafe components, and
- Service life extension programs that refurbish and upgrade systems to increase their service life.

In DoD, the 21st century challenge will be improving existing products and designing new ones that can be easily improved. With the average service life of a weapons system in the area of 40 or more years, it is necessary that systems be developed with an appreciation for future requirements, foreseen and unforeseen. These future requirements will present themselves as needed upgrades to safety, performance, supportability, interface compatibility, or interoperability; changes to reduce cost of ownership; or major rebuild. Providing these needed improvements or corrections form the majority of the systems engineer's post-production activities.

17.2 PRODUCT IMPROVEMENT STRATEGIES

As shown by Figure 17-1, these strategies vary based on where in the life cycle they are applied. The strategies or design approaches that reflect these improvement needs can be categorized as planned improvements, changes in design or production, and deployed system upgrades.

Planned Improvements

Planned improvements strategies include evolutionary acquisition, preplanned product development, and open systems. These strategies are not exclusive and can be combined synergistically in a program development.

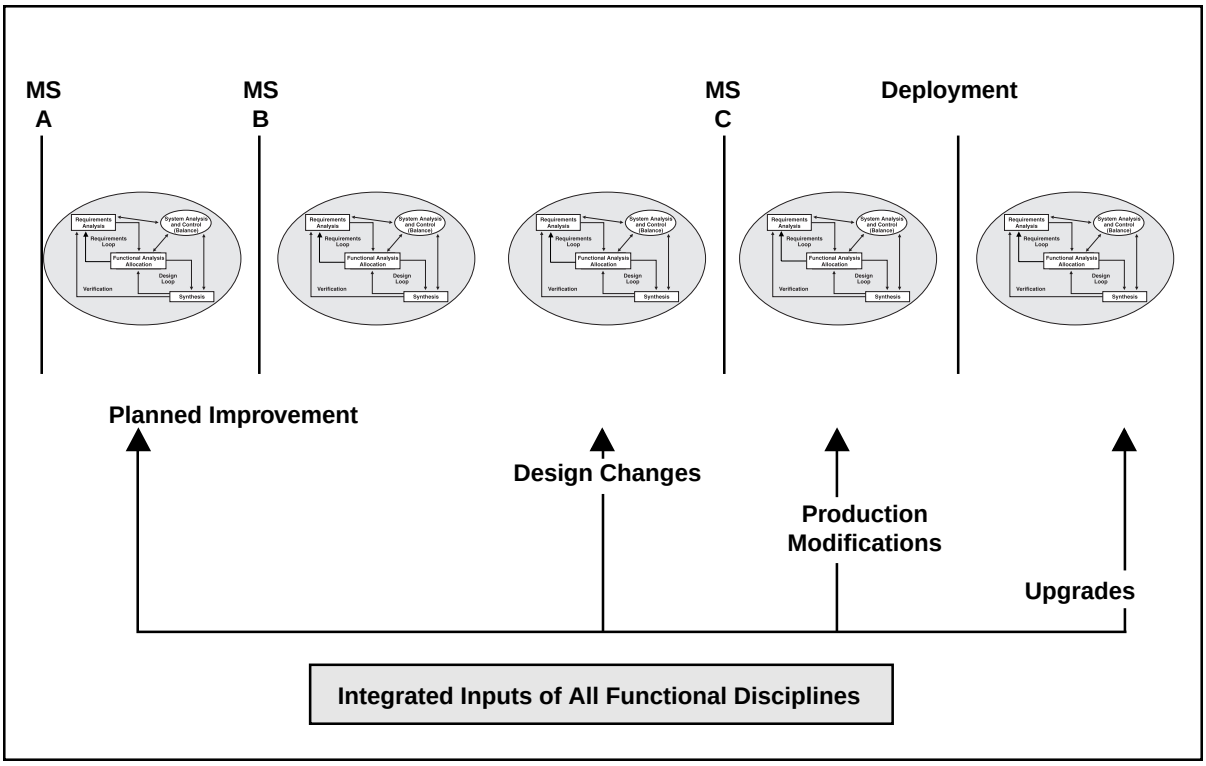


Figure 17-1. Types of Product Improvement Strategies

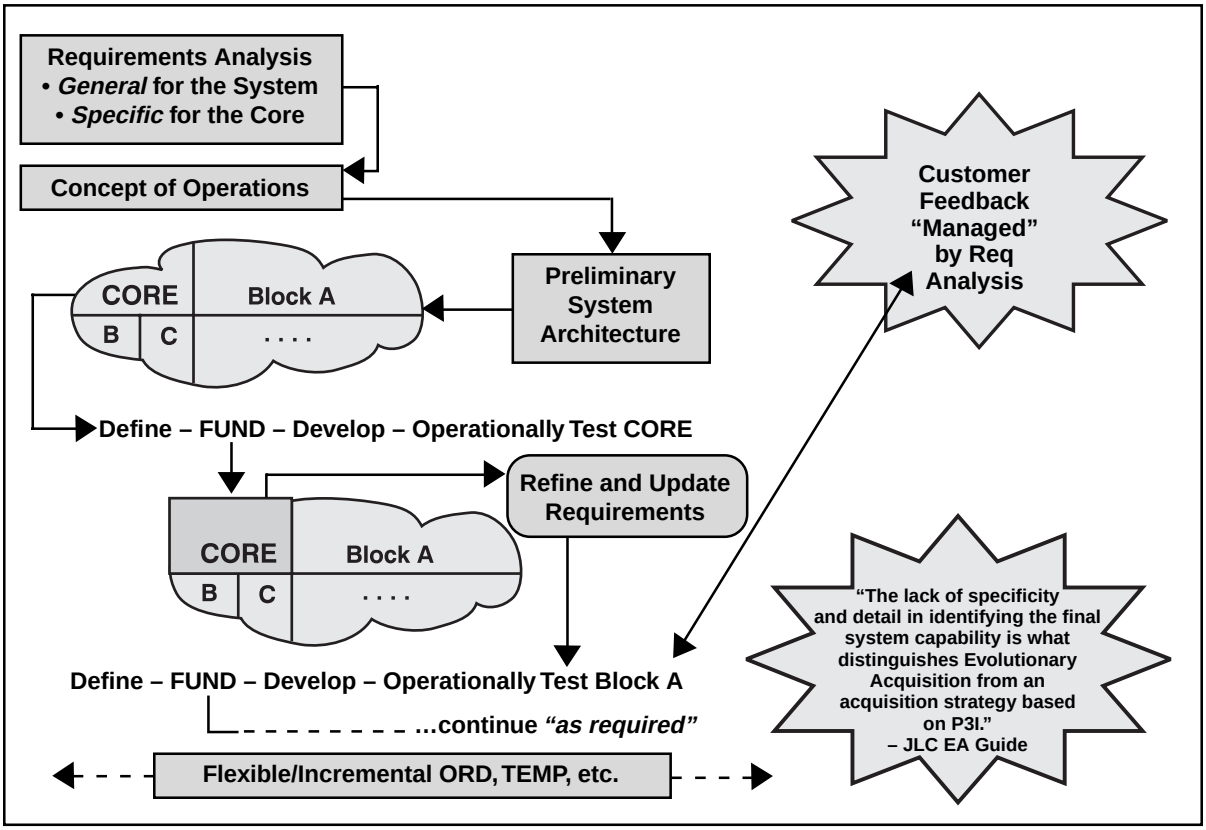


Figure 17-2. Evolutionary Acquisition

Evolutionary Acquisition: Evolutionary acquisition is the preferred approach to systems acquisition in DoD. In an environment where technology is a fast moving target and the key to military superiority is a technically superior force, the requirement is to transition useful capability from development to the user as quickly as possible, while laying the foundation for further changes to occur at later dates. Evolutionary acquisition is an approach that defines requirements for a core capability, with the understanding that the core is to be augmented and built upon (evolved) until the system meets the full spectrum of user requirements. The core capability is defined as a function of user need, technology maturity, threat, and budget. The core is then expanded as need evolves and the other factors mentioned permit.

A key to achieving evolutionary acquisition is the use of time-phased requirements and continuous communication with the eventual user, so that requirements are staged to be satisfied incrementally, rather than in the traditional single grand design approach. Planning for evolutionary acquisition also demands that engineering designs be based on open system, modular design concepts that permit additional increments to be added over time without having to completely re-design and re-develop those portions of the system already fielded. Open designs will facilitate access to recent changes in technologies and will also assist in controlling costs by taking advantage of commercial competition in the marketplace. This concept is not new; it has been employed for years in the C4ISR community, where system are often in evolution over the entire span of their lifecycles.

Preplanned Product Improvement (P3I): Often referred to as P3I, preplanned product improvement is an appropriate strategy when requirements are known and firm, but where constraints (typically either technology or budget) make some portion of the system unachievable within the schedule required. If it is concluded that a militarily

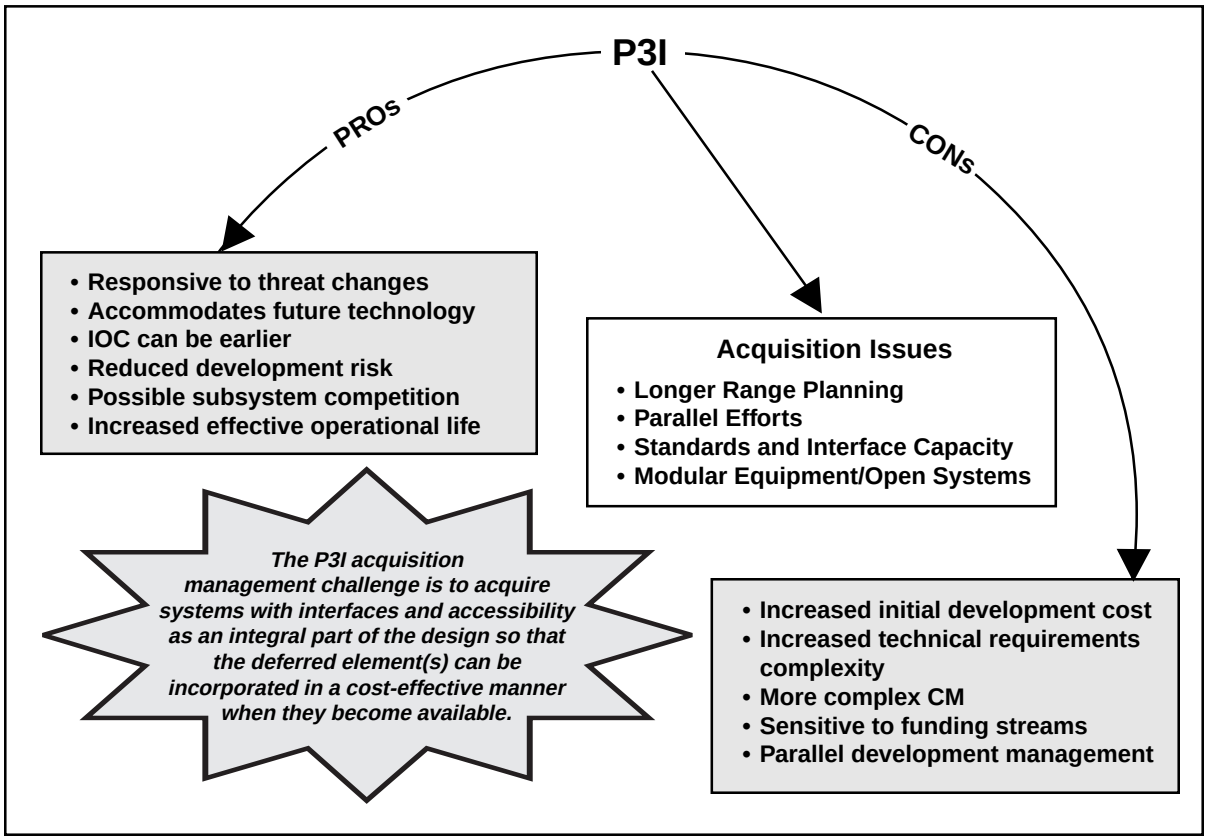


Figure 17-3. Pre-Planned Product Improvement

useful capability can be fielded as an interim solution while the portion yet to be proceeds through development, then P3I is appropriate. The approach generally is to handle the improvement as a separate, parallel development; initially test and deliver the system without the improvement; and prove and provide the enhanced capability as it becomes available. The key to a successful P3I is the establishment of well-defined interface requirements for the system and the improvement. Use of a P3I will tend to increase initial cost, configuration management activity, and technical complexity. Figure 17-3 shows some of the considerations in deciding when it is appropriate.

Open Systems Approach: The open system design approach uses interface management to build flexible design interfaces that accommodate use of competitive commercial products and provide enhanced capacity for future change. It can be used to prepare for future needs when technology is yet not available, whether the operational need is known or unknown. The open systems focus is to design the system such that it is easy to modify using standard interfaces, modularity, recognized interface standards, standard components with recognized common interfaces, commercial and nondevelopmental items, and compartmentalized design. Open system approaches to design are further discussed at the end of this chapter.

Changes in Design or Production

Engineering Change Proposals (ECPs): Changes that are to be implemented during the development and production of a given system are typically initiated through the use of ECPs. If the proposed change is approved (usually by a configuration control board) the changes to the documentation that describes the system are handled by formal configuration management, since, by definition, ECPs, when approved, change an approved baseline. ECPs govern the scope and details of these changes. ECPs may address a variety of needs, including correction of deficiencies, cost reduction, and safety. Furthermore, ECPs may been assigned differing levels of priority from routine to emergency. MIL-HDBK-61, Configuration Management Guidance, offers an excellent source of advice on issues related to configuration changes.

Block Change before Deployment: Block changes represent an attempt to improve configuration management by having a number of changes grouped and applied such that they will apply consistently to groups (or blocks) of production items. This improves the management and configuration control of similar items substantially in comparison to change that is implemented item by item and single change order by single change order. When block changes occur, the life cycle impact should be carefully addressed. Significant differences in block configurations can lead to different manuals, supply documentation, training, and restrictions as to locations or activities where the system can be assigned.

Deployed Systems Upgrades

Major Rebuild: A major rebuild results from the need for a system that satisfies requirements significantly different or increased from the existing system, or a need to extend the life of a system that is reaching the end of its usable life. In both cases the system will have upgraded requirements and should be treated as basically a new system development. A new development process should be started to establish and control configuration baselines for the rebuilt system based on the updated requirements.

Major rebuilds include remanufacturing, service-life extension programs, and system developments where significant parts of a previous system will be reused. Though rebuilding existing systems can dramatically reduce the cost of a new system in some cases, the economies of rebuild can be deceiving, and the choice of whether to pursue a rebuild should be done after careful use of trade studies. The key to engineering such systems is to remember that they are new systems and require the full developmental considerations of baselining, the systems engineering process, and life cycle integration.

Post-Production Improvement: In general, product improvements become necessary to improve the system or to maintain the system as its components

reach obsolescence. These projects generally result in a capability improvement, but for all practical purposes the system still the serves the same basic need. These improvements are usually characterized by an upgrade to a component or subsystem as opposed to a total system upgrade.

Block Upgrades: Post-production block upgrades are improvements to a specific group of the system population that provides a consistent configuration within that group. Block upgrades in post-production serve the same general purpose of controlling individual system configurations as production block upgrades, and they require the same level of life-cycle integration.

Modifying an Existing System

Upgrading an existing system is a matter of following the system engineering process, with an emphasis on configuration and interface management. The following activities should be included when upgrading a system:

- Benchmark the modified requirements both for the upgrade and the system as a whole,
- Perform functional analysis and allocation on the modified requirements,
- Assess the actual capability of the pre-upgrade system,
- Identify cost and risk factors and monitor them,
- Develop and evaluate modified system alternatives,
- Prototype the chosen improvement alternative, and
- Verify the improvement.

Product improvement requires special attention to configuration and interface management. It is not uncommon that the existing system's configuration will not be consistent with the existing configuration data. Form, fit, and especially function interfaces often represent design constraints that are not always readily apparent at the outset of a system upgrade. Upgrade planning should ensure that the revised components will be compatible at the interfaces. Where interfaces are impacted, broad coordination and agreement is normally required.

Traps in Upgrading Deployed Systems

When upgrading a deployed system pay attention to the following significant traps:

Scheduling to minimize operational impacts: The user's operational commitments will dictate the availability of the system for modification. If the schedule conflicts with an existing or emerging operational need, the system will probably not become available for modification at the time agreed to. Planning and contractual arrangements must be flexible enough to accept unforeseen schedule changes to accommodate user's unanticipated needs.

Configuration and interface management: Configuration management must address three configurations: the actual existing configuration, the modification configuration, and the final system configuration. The key to successful modification is the level of understanding and control associated with the interfaces.

Logistics compatibility problems: Modification will change the configuration, which in most cases will change the supply support and maintenance considerations. Coordination with the logistics community is essential to the long-term operational success of the modification.

Minimal resources available: Modifications tend to be viewed as simple changes. As this chapter has pointed out, they are not; and they should be carefully planned. That planning should include an estimate of needed resources. If the resources are not available, either the project should be abandoned, or a plan formulated to mitigate and control the risk of an initial, minimal budget combined with a plan for obtaining additional resources.

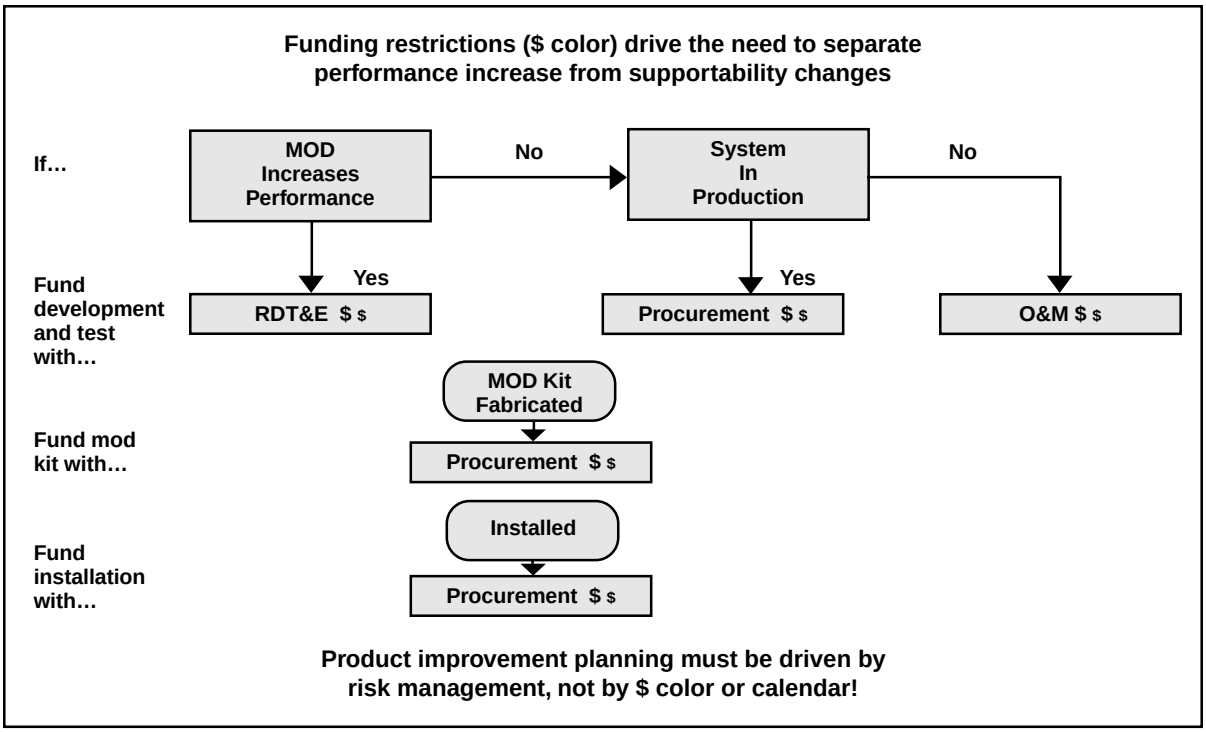


Figure 17-4. Funding Rule for DoD System Upgrades

Limited competitors: Older systems may have only a few suppliers that have a corporate knowledge of the particular system functions and design. This is especially problematic if the original system components were commercial or NDIs that the designer does not have product baseline data for. In cases such as these, there is a learning process that must take place before the designer or vendor can adequately support the modification effort. Depending on the specific system, this could be a major effort. This issue should be considered very early in the modification process because it has serious cost implications.

Government funding rules: As Figure 17-4 shows the use of government funding to perform system upgrades has restrictions. The purpose of the upgrade must be clear and justified in the planning efforts.

17.3 ROLES AND RESPONSIBILITIES

Modification management is normally a joint government and contractor responsibility. Though any specific system upgrade will have relationships established by the conditions surrounding the particular program, government responsibilities would usually include:

- Providing a clear statement of system requirements,
- Planning related to government functions,
- Managing external interfaces,
- Managing the functional baseline configuration, and
- Verifying that requirements are satisfied.

Contractor responsibilities are established by the contract, but would normally include:

- Technical planning related to execution,
- Defining the new performance envelope,
- Designing and developing modifications, and

- Providing evidence that changes made have modified the system as required.

System Engineering Role

The systems engineering role in product improvement includes:

- Planning for system change,
- Applying the systems engineering process,
- Managing interface changes,
- Identifying and using interface standards which facilitate continuing change,
- Ensuring life cycle management is implemented,
- Monitoring the need for system modifications, and
- Ensuring operations, support activities, and early field results are considered in planning.

17.4 SUMMARY POINTS

- Complex systems do not usually have stagnant configurations.
- Planned improvements strategies include evolutionary acquisition, preplanned product development, and open systems.
- A major rebuild should be treated as a new system development.
- Upgrading an existing system is a matter of following the system engineering process, with an emphasis on configuration and interface management.
- Pay attention to the traps. Upgrade projects have many.

SUPPLEMENT 17-A

OPEN SYSTEM APPROACH

The open system approach is a business and technical approach to system development that results in systems that are easier to change or upgrade by component replacement. It is a system development logic that emphasizes flexible interfaces and maximum interoperability, optimum use of commercial competitive products, and enhanced system capacity for future upgrade. The value of this approach is that open systems have flexibility, and that flexibility translates into benefits that can be recognized from business, management, and technical perspectives.

From a management and business view, the open system approach directs resources to a more intensive design effort with the expectation of a life cycle cost reduction. As a business approach it supports the DoD policy initiatives of CAIV, increased competition, and use of commercial products. It is a technical approach that emphasizes systems engineering, interface control, modular design, and design for upgrade. As a technical approach it supports the engineering goals of design flexibility, risk reduction, configuration control, long-term supportability, and enhanced utility.

Open Systems Initiative

In DoD the open system initiative was begun as a result of dramatic changes in the computer industry that afforded significant advantages to design of C4ISR and IT systems. The standardization achieved by the computer industry allows C4ISR and IT systems to be designed using interface standards to select off-the-shelf components to form the system. This is achieved by using commercially-supported specifications and standards for specifying system interfaces (external and internal, functional and physical), products, practices, and tools. An open system is one

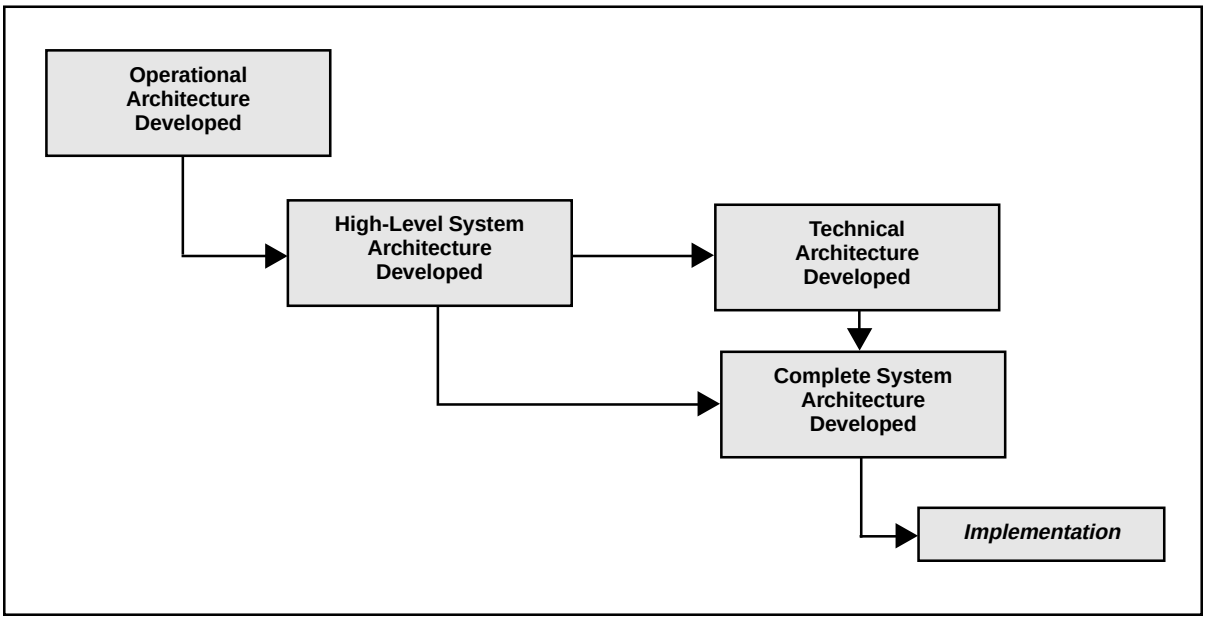


Figure 17-5. C4I and IT Development

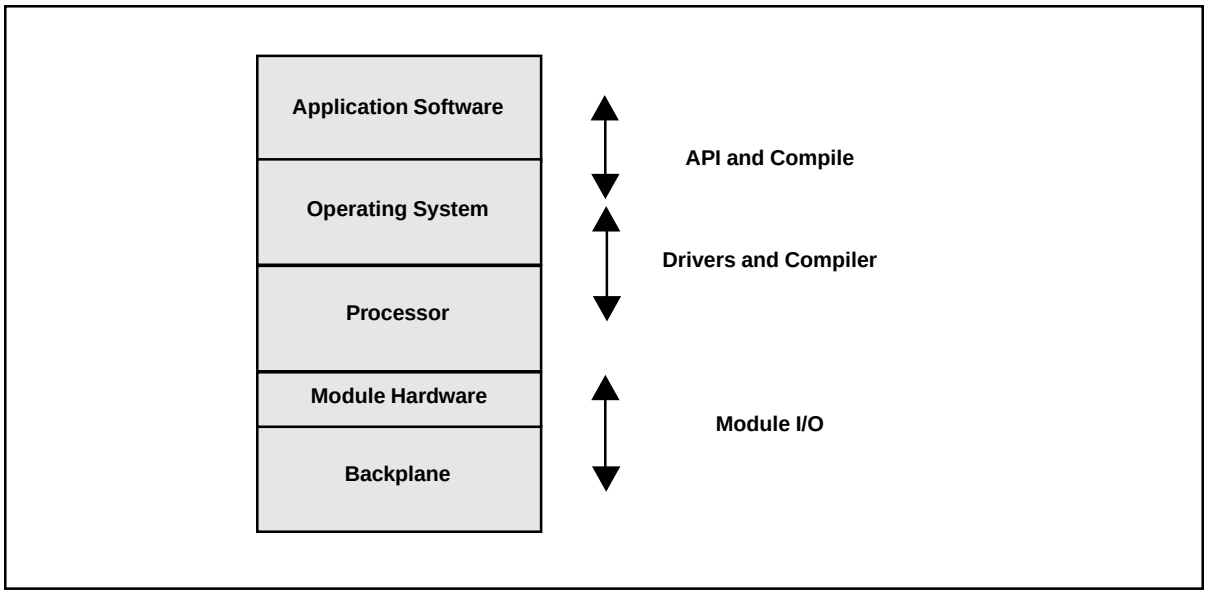


Figure 17-6. Simplified Computer Resource Reference Model

in which interfaces are fully described by open standards.[1] An open system approach extends this concept further by using modular design and interface design to enhance the availability of multiple design solutions, especially those reflecting use of open standards, competitive commercial components, NDIs, and future upgrade capability.

As developed in the C4ISR and IT communities, the open system approach requires the design of three architectures: operational, technical, and system.

As shown in Figure 17-5, the first one prepared is an operational architecture that defines the tasks, operational elements, and information flows required to accomplish or support an operational function. The user community generates the operational concepts that form an operational architecture. The operational architecture is allusive. It is not a specific document required to be developed by the user such as the ORD; but because of their operational nature, the user must provide the components of the operational architecture. It is usually left to the developer to assemble and structure the information as part of the system definition requirements analysis. Once the operational architecture has clearly defined the operational need, development of a system architecture[2] is begun.

The (open) system architecture is a set of descriptions, including graphics, of systems and interconnections supporting the operational functions described in the operational architecture. Early in the (open) system architecture development a technical architecture is prepared to establish a set of rules, derived from open consensus-based industry standards, to govern the arrangement, interaction, and interdependence of the elements of a reference model. Reference models are a common conceptual framework for the type of system being designed. (A simple version for computer resources is shown in Figure 17-6.)

[1] Open Standards are non-proprietary, consensus-based standards widely accepted by industry. Examples include SAE, IEEE, and ISO standards.

[2] This system architecture typically describes the end product but not the enabling products. It relies heavily on interface definitions to describe system components.

The technical architecture identifies the services, interfaces, standards, and their relationships; and provides the technical guidelines upon which engineering specifications are based, common building blocks are built, and product lines are developed. In short, the technical architecture becomes a design requirement for developing the system. (The purpose, form, and function of the technical architecture is similar to building codes.)

The system architecture is then further developed to eventually specify component performance and interface requirements. These are then used to select the specific commercial components that form the system under development. This process, called an *implementation*, envisions the production process as consisting primarily of selecting components, conformance (to the interface and performance requirements) management, and assembly, with little or no need for detailed design fabrications.

The process described above has allowed significant achievements in computer-related developments. Other technical fields have also used the open system design approach extensively. (Common examples are the electrical outlets in your home and the tire-to-wheel interface on your car). In most cases the process is not as well defined as it is in the current digital electronics area. A consistent successful use of the open design concept, in and outside the electronics field, requires an understanding of how this process relates to the activities associated with systems engineering management.

Systems Engineering Management

The open system approach impacts all three essential elements of systems engineering management: systems engineering phasing, the systems engineering process, and life cycle considerations. It requires enhanced interface management in the systems engineering process, and requires specific design products be developed prior to engineering-event milestones. The open systems approach is inherently life-cycle friendly. It favorably impacts production and support functions, but it also requires additional effort to assure life-cycle conformance to interface requirements.

Open Systems Products and SE Development Phasing

A system is developed with stepped phases that allow an understanding of the operational need to eventually evolve into a design solution. Though some tailoring of this concept is appropriate, the basic phasing (based on the operational concept preceding the system description, which precedes the preliminary design, which precedes the detailed design) is necessary to coordinate the overall design process and control the requirements flowdown. As shown by Figure 17-7 the open system approach blends well with these development phases.

Concept Studies Phase

The initial detailed operational concept, including operational architectures, should be a user-community output (with some acquisition engineering assistance) produced during the concept exploration phase that emphasizes operational concepts associated with various material solutions. The operational concept is then updated as necessary for each following phase. Analysis of the initial operational concept should be a key element of the operational view output of the system definition phase requirements analysis. An operational architecture developed for supporting the system description should be complete, comprehensive, and clear; and verified to be so at the Alternative Systems Review. If the operational architecture cannot be completed, then a core operational capability must be developed to establish the basis for further development. Where a core capability is used, core requirements should be complete and firm, and the process for adding expanded requirements should be clear and controlled.

System Definition Phase

System interface definitions, such as the technical architecture, and high-level (open) system architecture should be complete in initial form at the

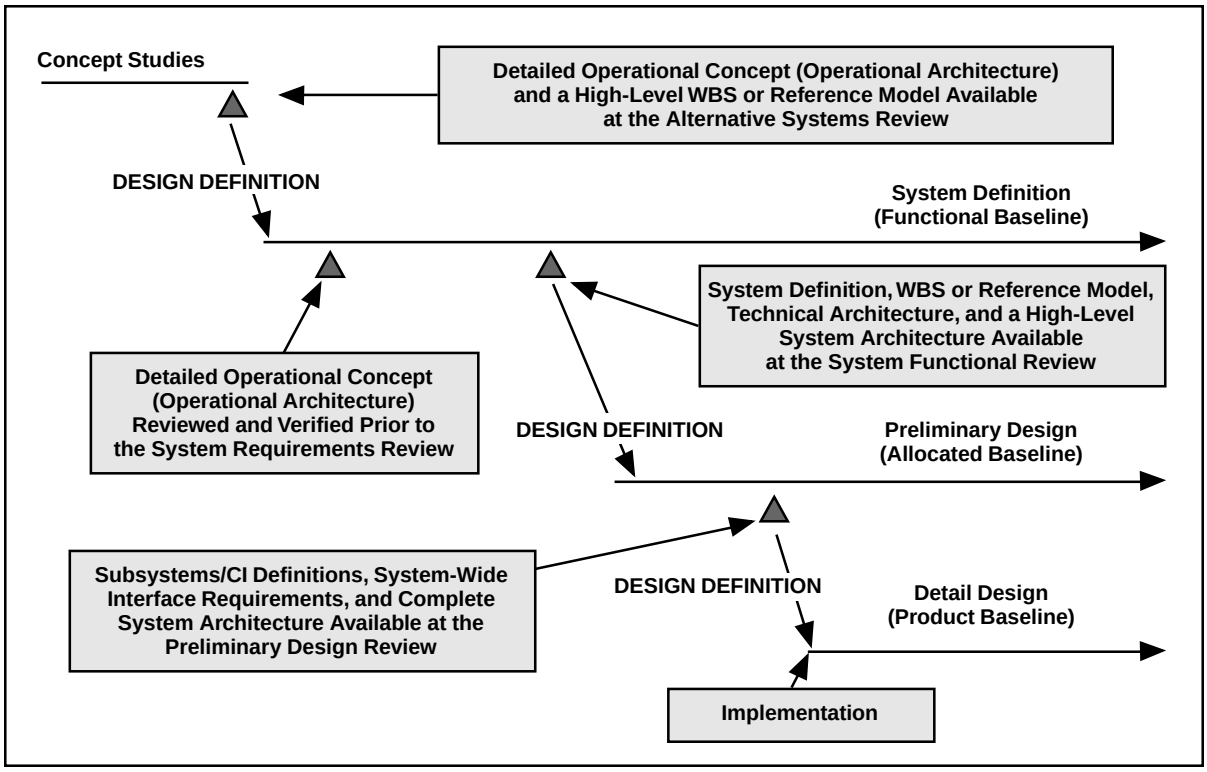


Figure 17-7. Phasing of Open System Development

end of the system definition phase (along with other functional baseline documentation). Successful completion of these items is required to perform the preliminary design, and they should be available for the System Functional Review, also referred to as the System Definition Review or System Design Review. The open system documentation can be separate or incorporated in other functional baseline documentation. The criteria for acceptance should be established in the systems engineering management plan as phase-exit criteria.

Preliminary Design Phase

Along with other allocated baseline documentation, the interface definitions should be updated and the open-system architecture completed by the end of the preliminary design effort. This documentation should also identify the proper level of openness (that is, the level of system decomposition at which the open interfaces are established) to obtain the maximum cost and logistic advantage available from industry practice.

The preliminary design establishes performance-based descriptions of the system components, as well as the interface and structure designs that integrate those components. It is in this phase that the open system approach has the most impact. Interface control should be enhanced and focused on developing modular designs that allow for maximum interchange of competitive commercial products. Review of the technical architecture (or interface definitions) becomes a key element of requirements analysis, open system focused functional partitioning becomes a key element of functional analysis and allocation, iterative analysis of modular designs becomes a key element of design synthesis, and conformance management becomes a key element of verification. Open system related products, such as the technical architecture, interface management documentation, and conformance management documentation, should be key data reviewed at the Preliminary Design Review. Again, the criteria for acceptance should be established in the systems engineering management plan as phase-exit criteria.

Detail Design Phase

The detail design phase becomes the implementation for those parts of the system that have achieved open system status. Conformance management becomes a significant activity as commercial components are chosen to meet performance and interface requirements. Conformance and interface design testing becomes a driving activity during verification to assure an open system or subsystem has been achieved and that components selected meet interface requirements and/or standards.

Systems Engineering Process

The systems engineering problem solving process consists of process steps and loops supported by system analysis and control tools. The focus of the open systems engineering process is compartmentalized design, flexible interfaces, recognized interface standards, standard components with recognized common interfaces, use of commercial and NDIs, and an increased emphasis on interface control. As shown by Figure 17-8, the open-system approach complements the systems engineering process to provide an upgradeable design.

Requirements analysis includes the review and update of interface standards and other interface definitions generated as output from previous systems engineering processes. Functional analysis and allocation focuses on functional partitioning to identify functions that can be performed independent of each other in order to minimize functional interfaces. Design synthesis focuses on modular design with open interfaces, use of open standards compliant commercial products, and the development of performance and interface specifications. The verification processes include conformance testing to validate the interface requirements are appropriate and to verify components chosen to implement the design meet the interface requirements. Engineering open designs, then, does not alter the fundamental practices within systems engineering, but, rather, provides a specific focus to the activities within that process.

System Engineering Control: Interface Management

The key to the open systems engineering process is interface management. Interface management should be done in a more formal and comprehensive manner to rigidly identify all interfaces and

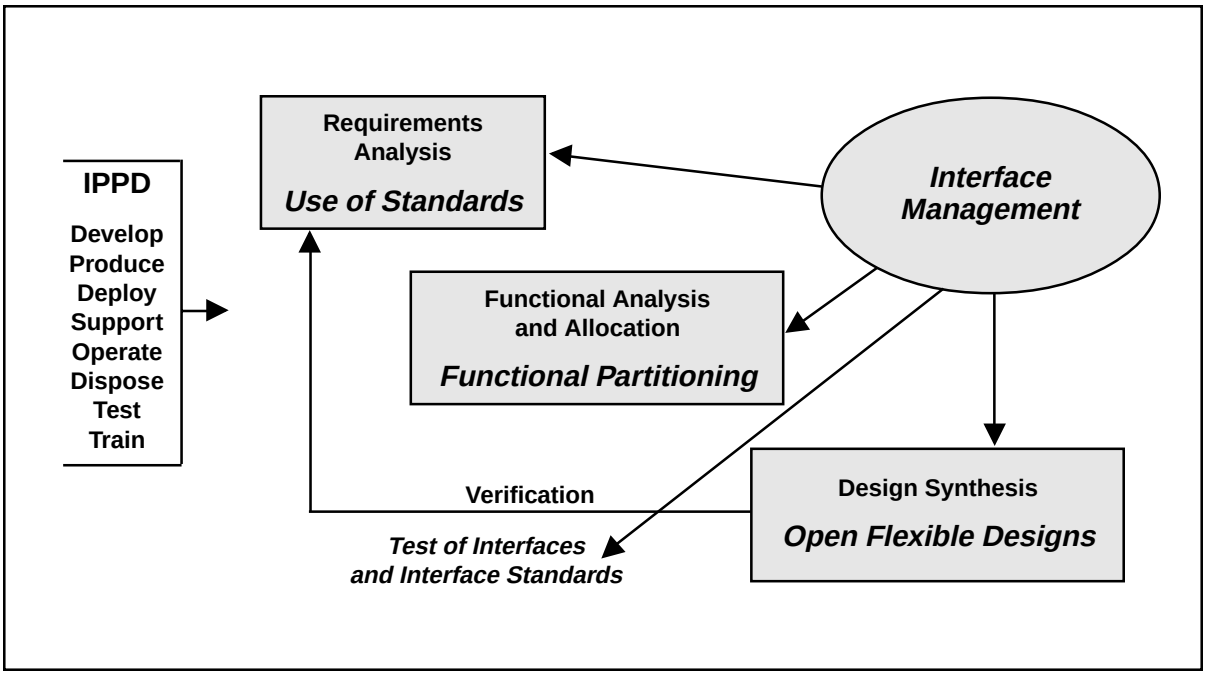


Figure 17-8. Open System Approach to the Systems Engineering Process

control the flowdown and integration of interface requirements. The interfaces become controlled elements of the baseline equal to (or considered part of) the configuration. Open system interface management emphasizes the correlation of interface requirements between interfacing systems. (Do those designing the interfacing systems understand the interface requirements in the same way?) Computer-Aided System Engineering (CASE) generated schematic block diagrams can be used to track interface design activity.

An open system is also characterized by multiple design solutions within the interfaces with emphasis on leveraging best commercial practice. The interface management effort must control interface design such that interfaces specifically chosen for an open system approach are designed based on the following priority:

- Open standards that allow competitive products,
- Open interface design that allows installation of competitive products with minimal change,
- Open interface design that allows minimal change installation of commercial or NDI products currently or planned to be in DoD use, and last,
- Unique design with interfaces designed with upgrade issues considered.

Note that these are clear priorities, not options.

Level of Openness

The level at which the interface design should focus on openness is also a consideration. Each system may have several levels of openness depending on the complexity of the system and the differences in the technology within the system. The level chosen to define the open interfaces should be supported by industry and be consistent with program objectives. For example, for most digital electronics that level is the line-replaceable (LRU) and shop-replaceable (SRU) level. On the other hand the Joint Strike Fighter intends to establish openness at a very high subsystem level to achieve a major program objective, development of different planes using common building blocks (which, in essence, serve as the reference model for the family of aircraft). The open system approach designed segments of a larger system could have additional openness at a lower level. For example, the Advanced Amphibious Assault Vehicle (AAAV) engine compartment is an open approach design allowing for different engine installation and future upgrade capability. On a lower level within the compartment the fuel filters, lines, and connectors are defined by open standard based interfaces. Other systems will define openness at other levels. Program objectives (such as interoperability, upgrade capability, cost-effective support, affordability, and risk reduction) and industry practice (based on market research) drive the choice of the level of openness that will best assure optimum utility and availability of the open system approach.

Life Cycle Considerations

Life cycle integration is established primarily through the use of integrated teaming that combines the design and life cycle planning. The major impacts on life-cycle activity include:

- ***Time and cost to upgrade a system is reduced.*** It is common in defense systems, which have average life spans in excess of 40 years, that they will require upgrade in their life due to obsolescence of original components, threat increase, and technology push that increases economy or performance. (Most commercial products are designed for a significantly shorter life than military systems, and designs that rely on these commercial products must expect that original commercial components will not necessarily be available throughout the system's life cycle.) By using an open system approach the ability to upgrade a system by changing a single or set of components is greatly enhanced. In addition, the open system approach eases the design problem of replacing the component, thereby reducing the cost and schedule of upgrade, which in turn reduces the operational impact.

- ***An open system approach enhances the use of competitive products to support the system.*** This flexibility tends to reduce the cost associated with supply support, but more importantly improves component and parts availability.

- ***Conformance management becomes a part of the life cycle configuration process.*** Replacement of components in an open system must be more controlled because the government has to control the system configuration without controlling the detail component configuration (which will come from multiple sources, all with different detail configurations). The government must expect that commercial suppliers will control the design of their components without regard to the government's systems. The government therefore must use performance- and interface-based specifications to assure the component will provide service equivalent to that approved through the acquisition process. Conformance management is the process that tracks the interface requirements through the life cycle, and assures that the new product meets those requirements.

Summary Comments

Open system design is not only compatible with systems engineering; it represents an approach that enhances the overall systems engineering effort. It controls interfaces comprehensively, provides interface visibility, reduces risk through multiple design solutions, and insists on life cycle interface control. This emphasis on interface identification and control improves systems engineers' capability to integrate the system, probably one of the hardest jobs they have. It also improves the tracking of interface requirements flow down, another key job of the systems engineer. Perhaps most importantly, this rigorous interface management improves systems engineers' ability to correctly determine where commercial items can be properly used.

CHAPTER 18

ORGANIZING AND INTEGRATING SYSTEM DEVELOPMENT

18.1 INTEGRATED DEVELOPMENT

DoD has, for years, required that system designs be integrated to balance the conflicting pressure of competing requirements such as performance, cost, supportability, producibility, and testability. The use of multi-disciplinary teams is the approach that both DoD and industry increasing have taken to achieve integrated designs. Teams have been found to facilitate meeting cost, performance, and other objectives from product concept through disposal.

The use of multi-disciplinary teams in design is known as Integrated Product and Process Development, simultaneous engineering, concurrent engineering, Integrated Product Development, Design-Build, and other proprietary and non-proprietary names expressing the same concept. (The DoD use of the term Integrated Product and Process Development (IPPD) is a wider concept that includes the systems engineering effort as an element. The DoD policy is explained later in this chapter.) Whatever name is used, the fundamental idea involves multi-functional, integrated teams (preferably co-located), that jointly derive requirements and schedules that place equal emphasis on product and process development. The integration requires:

- Inclusion of the eight primary functions in the team(s) involved in the design process,
- Technical process specialties such as quality, risk management, safety, etc., and
- Business processes (usually in an advisory capacity) such as, finance, legal, contracts, and other non-technical support.

Benefits

The expected benefits from team-based integration include:

- Reduced rework in design, manufacturing, planning, tooling, etc.,
- Improved first time quality and reduction of product variability,
- Reduced cost and cycle time,
- Reduced risk,
- Improved operation and support, and
- General improvement in customer satisfaction and product quality throughout its life cycle.

Characteristics

The key attributes that characterize a well integrated effort include:

- Customer focus,
- Concurrent development of products and processes,
- Early and continuous life cycle planning,
- Maximum flexibility for optimization,
- Robust design and improved process capability,
- Event-driven scheduling,
- Multi-disciplinary teamwork,

- Empowerment,
- Seamless management tools, and
- Proactive identification and management of risk.

Organizing for System Development

Most DoD program offices are part of a Program Executive Office (PEO) organization that is usually supported by a functional organization, such as a systems command. Contractors and other government activities provide additional necessary support. Establishing a system development organization requires a network of teams that draw from all these organizations. This network, sometimes referred to as the enterprise, represents the interests of all the stakeholders and provides vertical and horizontal communications.

These integrated teams are structured using the WBS and designed to provide the maximum vertical and horizontal communication during the development process. Figure 18-1 shows how team structuring is usually done. At the system level there is usually a management team and a design team. The management team would normally consist of the government and contractor program managers, the deputy program manager(s), possibly the contractor Chief Executive Officer, the contracting officer, major advisors picked by the program manager, the system design team leader, and other key members of the system design team. The design team usually consists of the first-level subsystem and life-cycle integrated team leaders.

The next level of teams is illustrated on Figure 18-1 as either product or process teams. These teams are responsible for designing system segments (product teams) or designing the supporting or enabling products (process teams). At this level the process teams are coordinating the system level process development. For example, the support team will integrate the supportability analysis from the parts being generated in lower-level design and

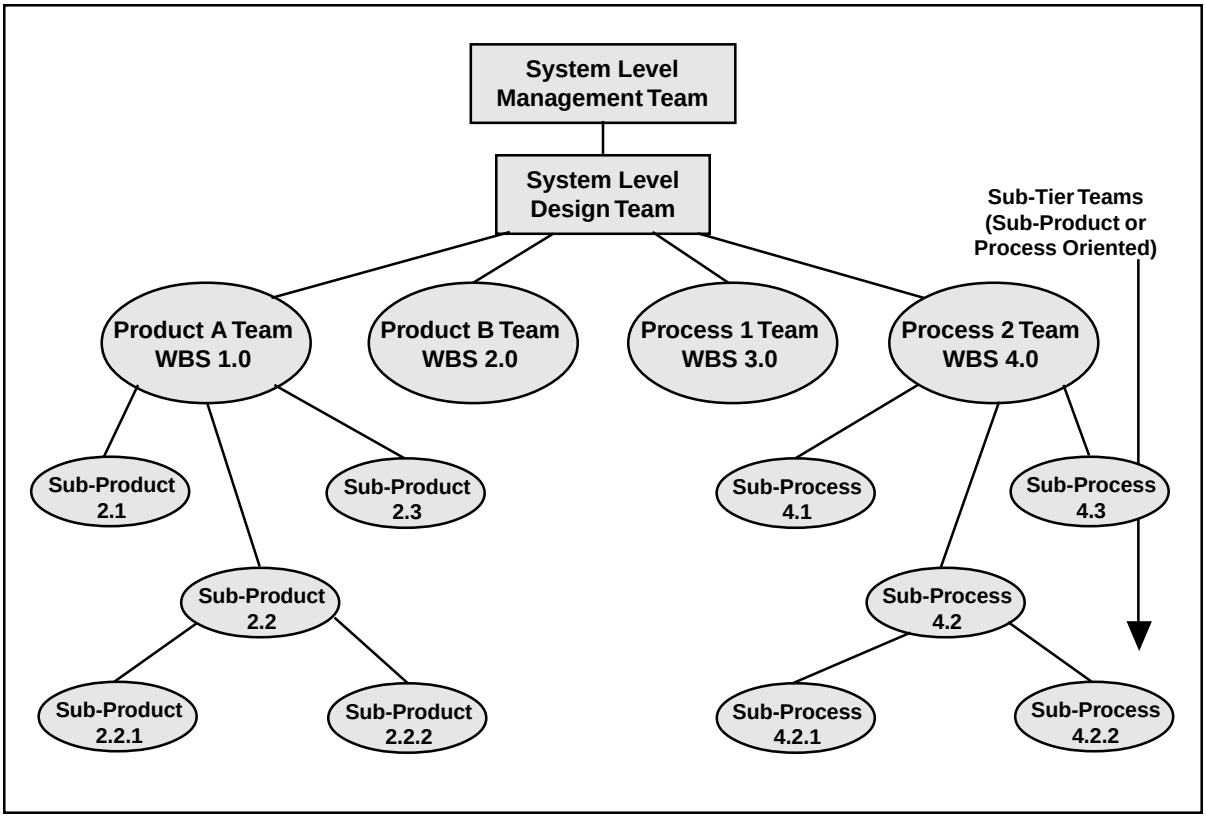


Figure 18-1. Integrated Team Structure

support process teams. Teams below this level continue the process at a lower level of decomposition. Teams are formed only to the lowest level necessary to control the integration. DoD team structures rarely extend lower than levels three or four on the WBS, while contractor teams may extend to lower levels, depending on the complexities of the project and the approach favored by management.

The team structure shown by Figure 18-1 is a hierarchy that allows continuous vertical communication. This is achieved primarily by having the team leaders, and, if appropriate, other key members of a team, be team members of the next highest team. In this manner the decisions of the higher team is immediately distributed and explained to the next team level, and the decisions of the lower teams are presented to the higher team on a regular basis. Through this method decisions of lower-level teams follow the decision making of higher teams, and the higher-level teams' decisions incorporate the concerns of lower-level teams.

The normal method to obtain horizontal communication is shown in Figure 18-2. At least one team member from the Product A Team is also a member of the Integration and Test Team. This member would have a good general knowledge of both testing and Product A. The member's job would be to assist the two teams in designing their end or enabling products, and in making each understand how their decisions would impact the other team. Similarly, the member that sits on both Product A and B teams would have to understand the both technology and the interface issues associated with both items.

The above is an idealized case. Each type of system, each type of contractor organization, and each level of available resources requires a tailoring of this structure. With each phase the focus and the tasks change and so should the structure. As phases

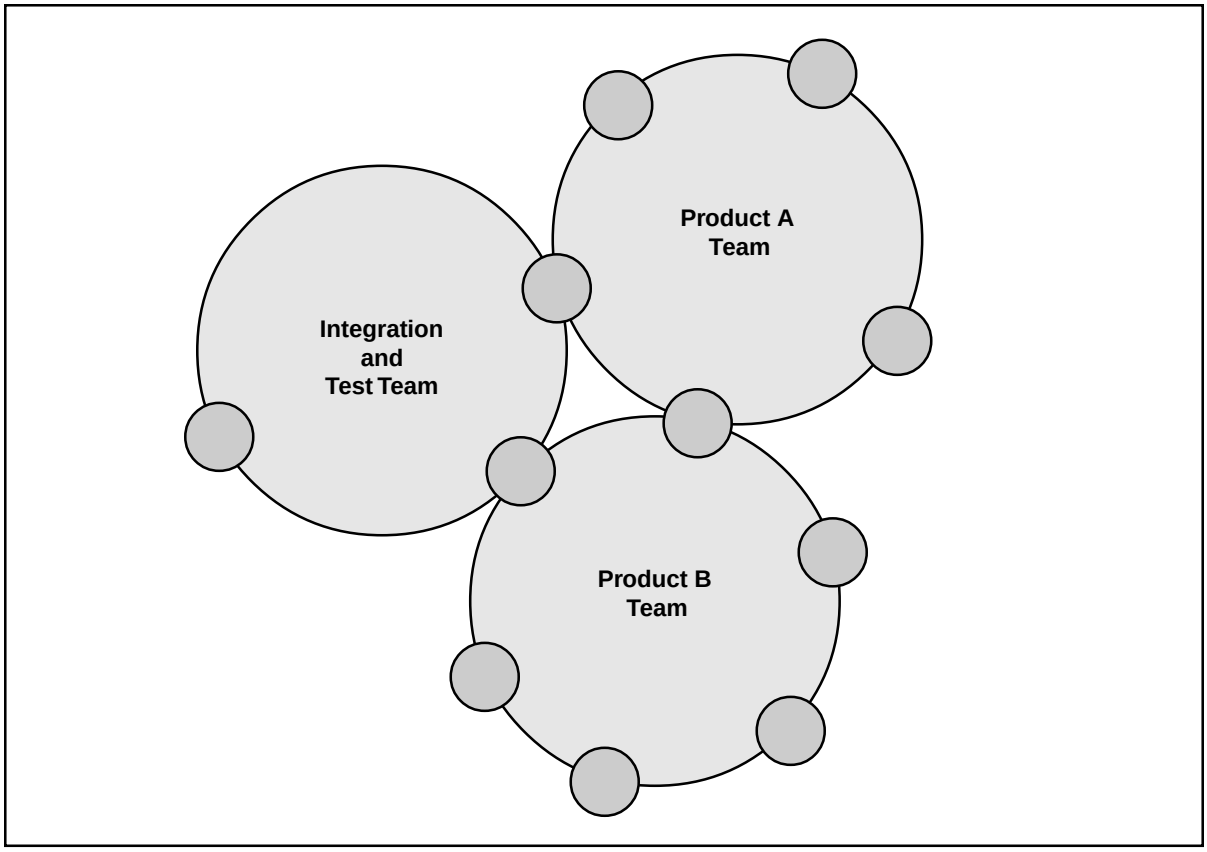


Figure 18-2. Cross Membership

are transited, the enterprise structure and team membership should be re-evaluated and updated.

18.2 INTEGRATED TEAMS

Integrated teams are composed of representatives from all appropriate primary functional disciplines working together with a team leader to:

- Design successful and balanced products,
- Develop the configuration for successful life-cycle control,
- Identify and resolve issues, and
- Make sound and timely decisions.

The teams follow the disciplined approach of the systems engineering process starting with requirements analysis through to the development of configuration baselines as explained earlier in this book. The system-level design team should be responsible for systems engineering management planning and execution. The system-level management team, the highest level program IPT, is responsible for acquisition planning, resource allocation, and management. Lower-level teams are responsible for planning and executing their own processes.

Team Organization

Good teams do not just happen; they are the result of calculated management decisions and actions. Concurrent with development of the enterprise organization discussed above, each team must also be developed. Basically the following are key considerations in planning for a team within an enterprise network:

- The team must have appropriate representation from the primary functions, technical specialties, and business support,
- There must be links to establish vertical and horizontal communication in the enterprise,
- You should limit over-uses of cross membership. Limit membership on three or four teams as a rough rule of thumb for the working level, and
- Ensure appropriate representation of government, contractor, and vendors to assure integration across key organizations.

Team Development

When teams are formed they go through a series of phases before a synergistic self-actuating team is evolved. These phases are commonly referred to as forming, storming, norming and performing. The timing and intensity of each phase will depend on the team size, membership personality, effectiveness of the team building methods employed, and team leadership. The team leaders and an enterprise-level facilitator provide leadership during the team development.

Forming is the phase where the members are introduced to their responsibilities and other members. During this period members will tend to need a structured situation with clarity of purpose and process. If members are directed during this initial phase, their uncertainty and therefore apprehension is reduced. Facilitators controlling the team building should give the members rules and tasks, but gradually reduce the level of direction as the team members begin to relate to each other. As members become more familiar with other members, the rules, and tasks, they become more comfortable in their environment and begin to interact at a higher level.

This starts the storming phase. *Storming* is the conflict brought about by interaction relating to the individuals' manner of dealing with the team tasks and personalities. Its outcome is members who understand the way they have to act with other members to accomplish team objectives. The dynamics of storming can be very complex and intense, making it the critical phase. Some teams will go through it quickly without a visible ripple, others will be loud and hot, and some will never emerge from this phase. The team building facilitators must be alert to dysfunctional activity.

Members may need to be removed or teams reorganized. Facilitators during this period must act as coaches, directing but in a personal collaborative way. They should also be alert for members that are avoiding storming, because the team will not mature if there are members who are not personally committed to participate in it.

Once the team has learned to interact effectively it begins to shape its own processes and become more effective in joint tasks. It is not unusual to see some reoccurrence of storming, but if the storming phase was properly transitioned these incidences should be minor and easily passed. In this phase, *norming*, the team building facilitators become a facilitator to the team—not directing, but asking penetrating questions to focus the members. They also monitor the teams and correct emerging problems.

As the team continues to work together on their focused tasks, their performance improves until they reach a level of self-actuation and quality decision making. This phase, *performing*, can take a while to reach, 18 months to two years for a system-level design team would not be uncommon. During the performing stage, the team building facilitator monitors the teams and corrects emerging problems.

At the start of a project or program effort, team building is commonly done on an enterprise basis with all teams brought together in a team-building exercise. There are two general approaches to the exercise:

- A team-learning process where individuals are given short but focused tasks that emphasize group decision, trust, and the advantages of diversity.

- A group work-related task that is important but achievable, such as a group determination of the enterprise processes, including identifying and removing non-value added traditional processes.

Usually these exercises allow the enterprise to pass through most of the storming phase if done correctly. Three weeks to a month is reasonable for this process, if the members are in the same location. Proximity does matter and the team building and later team performance are typically better if the teams are co-located.

18.3 TEAM MAINTENANCE

Teams can be extremely effective, but they can be fragile. The maintenance of the team structure is related to empowerment, team membership issues, and leadership.

Empowerment

The term empowerment relates to how responsibilities and authority is distributed throughout the enterprise. Maintenance of empowerment is important to promote member ownership of the development process. If members do not have personal ownership of the process, the effectiveness of the team approach is reduced or even neutralized. The quickest way to destroy participant ownership is to direct, or even worse, overturn solutions that are properly the responsibility of the team. The team begins to see that the responsibility for decisions is at a higher level rather than at their level, and their responsibility is to follow orders, not solve problems.

Empowerment requires:

- The flow of authority through the hierarchy of teams, not through personal direction (irrespective of organizational position). Teams should have clear tasking and boundaries established by the higher-level teams.

- Responsibility for decision making to be appropriate for the level of team activity. This requires management and higher-level teams to be specific, clear, complete, and comprehensive in establishing focus and tasking, and in specifying what decisions must be coordinated with higher levels. They should then avoid imposing or overturning decisions more properly in the realm of a lower level.

- Teams at each level be given a clear understanding of their duties and constraints. Within the bounds of those constraints and assigned duties members should have autonomy. Higher-level teams and management either accept their decisions, or renegotiate the understanding of the task.

Membership Issues

Another maintenance item of import is team member turnover. Rotation of members is a fact of life, and a necessary process to avoid teams becoming too closed. However, if the team has too fast a turnover, or new members are not fully assimilated, the team performance level will decline and possibly revert to storming. The induction process should be a team responsibility that includes the immediate use of the new team member in a jointly performed, short term, easily achievable, but important task.

Teams are responsible for their own performance, and therefore should have significant, say over the choice of new members. In addition teams should have the power to remove a member; however, this should be preceded by identification of the problem and active intervention by the facilitator. Removal should be a last resort.

Awards for performance should, where possible, be given to the team rather than individuals (or equally to all individuals on the team). This achieves several things: it establishes a team focus, shows recognition of the team as a cohesive force, recognizes that the quality of individual effort is at least in part due to team influence, reinforces the membership's dedication to team objectives, and avoids team member segregation due to uneven awards. Some variation on this theme is appropriate where different members belong to different organizations, and a common award system does not exist. The system-level management team should address this issue, and where possible assure equitable awards are given team members. A very real constraint on cash awards in DoD rises in the case of teams that include both civilian and military members. Military members cannot be given cash awards, while civilians can. Con-sequently, managers must actively seek ways to reward all team members appropriately, leaving no group out at the expense of others.

Leadership

Leadership is provided primarily by the organizational authority responsible for the program, the enterprise facilitator, and the team leaders. In a DoD program, the organizational leaders are usually the program manager and contractor senior manager. These leaders set the tone of the enterprise adherence to empowerment, the focus of the technical effort, and the team leadership of the system management team. These leaders are responsible to see that the team environment is maintained. They should coordinate their action closely with the facilitator.

Facilitators

Enterprises that have at least one facilitator find that team and enterprise performance is easier to maintain. The facilitator guides the enterprise through the team building process, monitors the team network through metrics and other feedback, and makes necessary corrections through facilitation. The facilitator position can be:

- A separate position in the contractor organization,
- Part of the responsibilities of the government systems engineer or contractor project manager, or
- Any responsible position in the first level below the above that is related to risk management.

Obviously the most effective position would be one that allows the facilitator to concentrate on the teams' performance. Enterprise level facilitators should have advanced facilitator training and (recommended) at least a year of mentored experience. Facilitators should also have significant broad experience in the technical area related to the development.

Team Leaders

The team leaders are essential for providing and guiding the team focus, providing vertical communication to the next level, and monitoring the team's performance. Team leaders must have a clear picture of what constitutes good performance for their team. They are not supervisors, though in some organizations they may have supervisory administrative duties. The leader's primary purpose is to assure that the environment is present that allows the team to perform at its optimum level—not to direct or supervise.

The team leader's role includes several difficult responsibilities:

- Taking on the role of coach as the team forms,
- Facilitating as the team becomes self-sustaining,
- Sometimes serving as director (only when a team has failed, needs refocus or correction, and is done with the facilitator),
- Providing education and training for members,
- Facilitating team learning,
- Representing the team to upper management and the next higher-level team, and
- Facilitating team disputes.

Team leaders should be trained in basic facilitator principles. This training can be done in about a week, and there are numerous training facilities or companies that can offer it.

18.4 TEAM PROCESSES

Teams develop their processes from the principles of system engineering management as presented earlier in the book. The output of the teams is the design documentation associated with products identified on the system architecture, including both end product components and enabling products.

Teams use several tools to enhance their productivity and improve communication among enterprise members. Some examples are:

- Constructive modeling (CAD/CAE/CAM/CASE) to enhance design understanding and control,
- Trade-off studies and prioritization,
- Event-driven schedules,
- Prototyping,
- Metrics, and most of all
- Integrated membership that represents the life cycle stakeholders.

Integrated Team Rules

The following is a set of general rules that should guide the activities and priorities of teams in a system design environment:

- Design results must be communicated clearly, effectively, and timely.
- Design results must be compatible with initially defined requirements.
- Continuous "up-the-line" communication must be institutionalized.
- Each member needs to be familiar with all system requirements.
- Everyone involved in the team must work from the same database.
- Only one member of the team has the authority to make changes to one set of master documentation.
- All members have the same level of authority (one person, one vote).
- Team participation is consistent, success-oriented, and proactive.

- Team discussions are open with no secrets.
- Team member disagreements must be reasoned disagreement (alternative plan of action versus unyielding opposition).
- Trade studies and other analysis techniques are used to resolve issues.
- Issues are raised and resolved early.
- Complaints about the team are not voiced outside the team. Conflicts must be resolved internally.

Guidelines for Meeting Management

Even if a team is co-located as a work unit, regular meetings will be necessary. These meetings and their proper running become even more important if the team is not co-located and the meeting is the primary means of one-on-one contact. A well-run technical meeting should incorporate the following considerations:

- Meetings should be held only for a specific purpose and a projected duration should be targeted.
- Advance notice of meetings should normally be at least two weeks to allow preparation and communication between members.
- Agendas, including time allocations for topics and supportive material should be distributed no less than three business days before the team meeting. The objective of the meeting should be clearly defined.
- Stick to the agenda during the meeting. Then cover new business. Then review action items.
- Meeting summaries should record attendance, document any decision or agreements reached, document action items and associated due-dates, provide a draft agenda for the next meeting, and frame issues for higher-level resolution.
- Draft meeting summaries should be provided to members within one working day of the meeting. A final summary should be issued within two working days after the draft comments deadline.

18.5 BARRIERS TO INTEGRATION

There are numerous barriers to building and maintaining a well functioning team organization, and they are difficult to overcome. Any one of these barriers can negate the effectiveness of an integrated development approach. Common barriers include:

- Lack of top management support,
- Team members not empowered,
- Lack of access to a common database,
- Lack of commitment to a cultural change,
- Functional organization not fully integrated into a team process,
- Lack of planning for team effort,
- Staffing requirements conflict with teams,
- Team members not collocated,
- Insufficient team education and training,
- Lessons learned and successful practices not shared across teams,
- Inequality of team members,
- Lack of commitment based on perceived uncertainty,
- Inadequate resources, and
- Lack of required expertise on either the part of the contractor or government.

Breaking Barriers

Common methods to combat barriers include:

- Education and training, and then more education and training: it breaks down the uncertainty of change, and provides a vision and method for success.
- Use a facilitator not only to build and maintain teams, but also to observe and advise management.
- Obtain management support up front. Management must show leadership by managing the teams' environment rather than trying to manage people.
- Use a common database open to all enterprise members.
- Establish a network of teams that integrates the design and provides horizontal and vertical communication.
- Establish a network that does not over-tax available resources. Where a competence is not available in the associated organizations, hire it through a support contractor.
- Where co-location is not possible have regular working sessions of several days duration. Telecommunications, video conferencing, and other technology based techniques can also go far to alleviate the problems of non-collocation.

Summary Comments

- Integrating system development is a systems engineering approach that integrates all essential primary function activities through the use of multi-disciplinary teams, to optimize the design, manufacturing and supportability processes.
- Team building goes through four phases: forming, storming, norming, and performing.
- Key leadership positions in a program network of teams are the program manager, facilitator, and team leaders.
- A team organization is difficult to build and maintain. It requires management attention and commitment over the duration of the teams involved.

SUPPLEMENT 18-A

IPPD – A DOD MANAGEMENT PROCESS

The DoD policy of Integrated Product and Process Development (IPPD) is a broad view of integrated system development which includes not only systems engineering, but other areas involved in formal decision making related to system development. DoD policy emphasizes integrated management at and above the Program Manager (PM) level. It requires IPPD at the systems engineering level, but does not direct specific organizational structures or procedures in recognition of the need to design a tailored IPPD process to every individual situation.

Integrated Product Teams

One of the key IPPD tenets is multi-disciplinary integration and teamwork achieved through the use of Integrated Product Teams (IPTs). While IPTs may not be the best solution for every management situation, the requirement to produce integrated designs that give consideration to a wide array of technical and business concerns leads most organizations to conclude that IPTs are the best organizational approach to systems management. PMs should remember that the participation of a contractor or a prospective contractor on a IPT should be in accordance with statutory requirements, such as procurement integrity rules. The service component's legal advisor must review prospective contractor involvement on IPTs. To illustrate issues the government-contractor team arrangement raises, the text box at the end of this section lists nine rules developed for government members of the Advanced Amphibious Assault Vehicle (AAAV) design IPTs.

The Secretary of Defense has directed that DoD perform oversight and review by using IPTs. These IPTs function in a spirit of teamwork with participants empowered and authorized, to the maximum extent possible, to make commitments for the organization or the functional area they represent. IPTs are composed of representatives from all appropriate functional disciplines working together to build successful programs and enabling decision makers to make the right decisions at the right time.

DoD IPT Structure

The DoD oversight function is accomplished through a hierarchy of teams that include levels of management from DoD to the program level. There are three basic levels of IPTs: the Overaching IPT (OIPT), the Working IPTs (WIPT), and Program IPTs with the focus and responsibilities as shown by Figure 18-3. For each ACAT I program, there will be an OIPT and at least one WIPT. WIPTs will be developed for particular functional topics, e.g., test, cost/performance, contracting, etc. An Integrating IPT (IIPT) will coordinate WIPT efforts and cover all topics not otherwise assigned to another IPT. These teams are structurally organized as shown on Figure 18-4.

Overarching IPT (OIPT)

The OIPT is a DoD level team whose primary responsibility is to advise the Defense Acquisition Executive on issues related to programs managed at that level. The OIPT membership is made up of the principals that are charged with responsibility for the many functional offices at the Office of the Secretary of Defense (OSD).

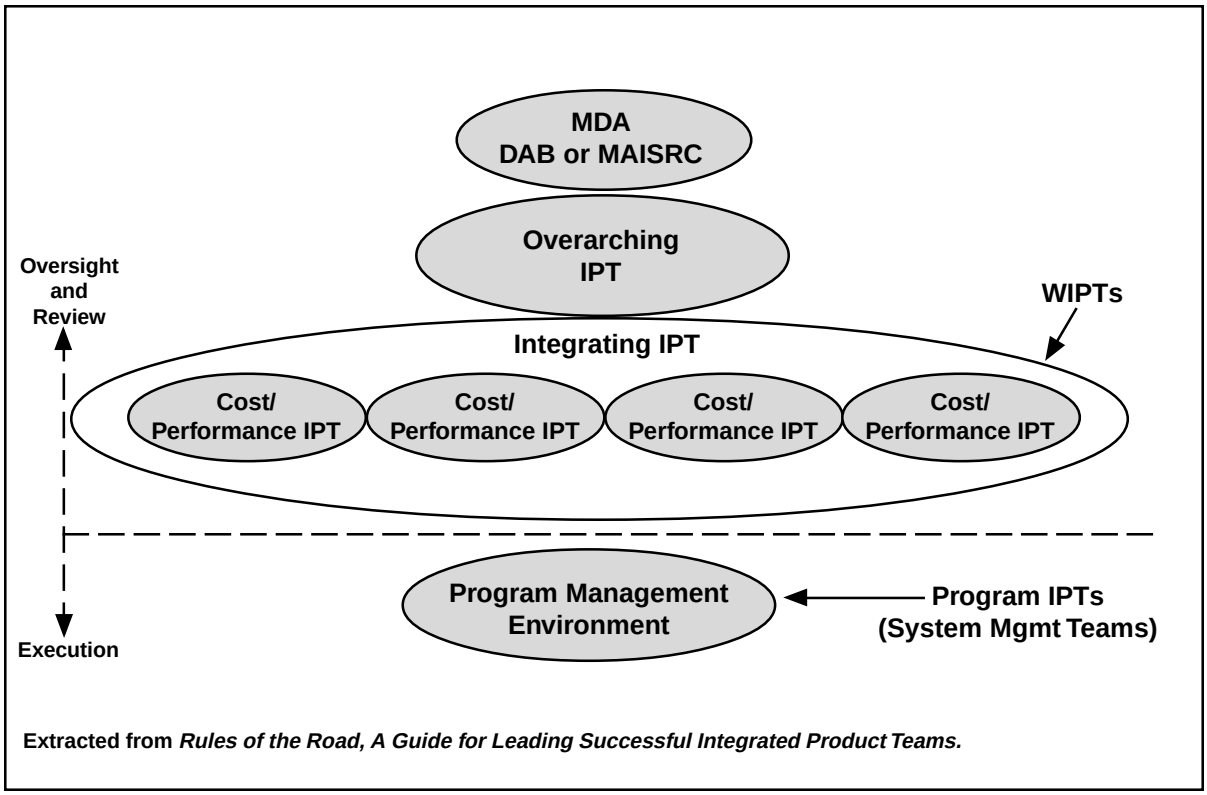
The OIPT provides:

- Top-level strategic guidance,

Organization	Teams	Focus	Participant Responsibilities
OSD and Components	OIPT*	• Strategic Guidance • Tailoring • Program Assessment • Resolve Issues Elevated by WIPTs	• Program Success • Functional Area Leadership • Independent Assessment • Issue Resolution
	WIPTs*	• Planning for Program Success • Opportunities for Acquisition Reform (e.g. innovation, streamlining) • Identify/Resolve Program Issues • Program Status	• Functional Knowledge and Experience • Empowered Contribution • Recom.'s for Program Success • Communicate Status and Unresolved Issues
Program Teams and System Contractors	Program IPTs**	• Program Execution • Identify and Implement Acquisition Reform	• Manage Complete Scope of Program Resources, and Risk • Integrate Government and Contractor Efforts for Report Program Status and Issues

* Covered in "Rules of the Road"
** Covered in "Guide to Implementation and Management of IPPD in DoD Acquisition"

Figure 18-3. Focus and Responsibilities of IPTs



Extracted from *Rules of the Road, A Guide for Leading Successful Integrated Product Teams.*

Figure 18-4. IPT Structure

- Functional area leadership,
- Forum for issue resolution,
- Independent assessment to the MDA,
- Determine decision information for next milestone review, and
- Provide approval of the WIPT structures and resources.

Working-Level IPT (WIPT)

The WIPTs may be thought of as teams that link the PM to the OIPT. WIPTs are typically functionally specialized teams (test, cost-performance, etc.). The PM is the designated head of the WIPT, and membership typically includes representation from various levels from the program to OSD staff. The principal functions of the WIPT are to advise the PM is the area of specialization and to advise the OIPT of program status.

The duties of the WIPT include:

- Assisting the PM in developing strategies and in program planning, as requested by the PM,
- Establishing IPT plan of action and milestones,
- Proposing tailored document and milestone requirements,
- Reviewing and providing early input to documents,
- Coordinating WIPT activities with the OIPT members,
- Resolving or evaluating issues in a timely manner, and
- Obtaining principals' concurrence with applicable documents or portions of documents.

Program IPTs

Program IPTs are teams that perform the program tasks. The integration of contractors with the government on issues relative to a given program truly occurs at the program IPT level. The development teams (product and process teams) described earlier in this chapter would be considered program IPTs. Program IPTs would also include teams formed for business reasons, for example teams established to prepare Planning, Programming, and Budgeting System (PPBS) documentation, to prepare for Milestone Approval, to develop the RFP, or the like.

SUPPLEMENT 18-B

GOVERNMENT ROLE ON IPTs

The following list was developed by the Advanced Amphibious Assault Vehicle (AAAV) program to inform its government personnel of their role on contractor/government integrated teams. It addresses government responsibilities and the realities imposed by contractual and legal constraints. Though it is specific to the AAAV case, it can be used as guidance in the development of team planning for other programs.

1. The IPTs are contractor-run entities. We do not lead or manage the IPTs.

2. We serve as "customer" representatives on the IPTs. We are there to REDUCE THE CYCLE TIME of contractor-Government (customer) communication. In other words, we facilitate contractor personnel getting Government input faster. Government IPT members also enable us to provide the contractor IPT Status and issue information up the Government chain on a daily basis (instead of monthly or quarterly).

3. WE DO NOT DO the contractor's IPT WORK, or any portion of their work or tasks. The contractor has been contracted to perform the tasks outlined in the contract SOW; their personnel and their subcontractors' personnel will perform those tasks, not us. But Government IPT members will be an active part of the deliberations during the development of, and participate in "on-the-fly" reviews of deliverables called out in CDRLs.

4. When asked by contractor personnel for the Government's position or interpretation, Government IPT members can offer their personal opinion, as an IPT member, or offer expert opinion; you can provide guidance as to our "customer" opinion and what might be acceptable to the Government but you can only offer the "Government" position for items that have been agreed to by you and your Supervisor. IT IS UP TO YOUR SUPERVISORS TO EMPOWER EACH OF YOU TO AN APPROPRIATE LEVEL OF AUTHORITY. It is expected that this will start at a minimal level of authority and be expanded as each individual's IPT experience and program knowledge grows. However… (see items 5 and 6).

5. Government IPT members CAN NOT authorize any changes or deviations to/from the contract SOW or Specifications. Government IPT members can participate in the deliberations and discussions that would result in the suggestion of such changes. If/When an IPT concludes that the best course of action is not in accordance with the contract, and a contract change is in order, then the contractor must submit a Contract Change Request (CCR) through normal channels.

6. Government IPT members CAN NOT authorize the contractor to perform work that is in addition to the SOW/contract requirements. The contractor IPTs can perform work that is not specifically required by the contract, at their discretion (provided they stay within the resources as identified in the Team Operating Contract (TOC).

7. Government IPT member participation in contractor IPT activities IS NOT Government consent that the work is approved by the Government or is chargeable to the contract. If an IPT is doing something questionable, identify it to your supervisor or Program Management Team (PMT) member.

8. Government members of IPTs do not approve or disapprove of IPT decisions, plans, or reports. You offer your opinion in their development, you vote as a member, and you coordinate issues with your Supervisor and bring the "Government" opinion (in the form of your opinion) back to the IPT, with the goal of improving the quality of the products; you don't have veto power.

9. Government IPT members are still subject to all the Government laws and regulations regarding "directed changes," ethics, and conduct. Your primary function is to perform those functions that are best done by Government employees, such as:

- Conveying to contractor personnel your knowledge/expertise on Marine Corps operations and maintenance techniques;
- Interfacing with all other Government organizations (e.g., T&E);
- Control/facilitization of government furnished equipment and materials (GFE and GFM);
- Ensuring timely payment of submitted vouchers; and
- Full participation in Risk Management.

CHAPTER 19

CONTRACTUAL CONSIDERATIONS

19.1 INTRODUCTION

This chapter describes how the systems engineer supports the development and maintenance of the agreement between the project office and the contractor that will perform or manage the detail work to achieve the program objectives. This agreement has to satisfy several stakeholders and requires coordination between responsible technical, managerial, financial, contractual, and legal personnel. It requires a document that conforms to the Federal Acquisition Regulations (and supplements), program PPBS documentation, and the System Architecture. As shown by Figure 19-1, it also has to result in a viable cooperative environment that allows necessary integrated teaming to take place.

The role of technical managers or systems engineers is crucial to satisfying these diverse concerns. Their primary responsibilities include:

- Supporting or initiating the planning effort. The technical risk drives the schedule and cost risks which in turn should drive the type of contractual approach chosen,
- Prepares or supports the preparation of the source selection plan and solicitation clauses concerning proposal requirements and selection criteria,
- Prepares task statements,

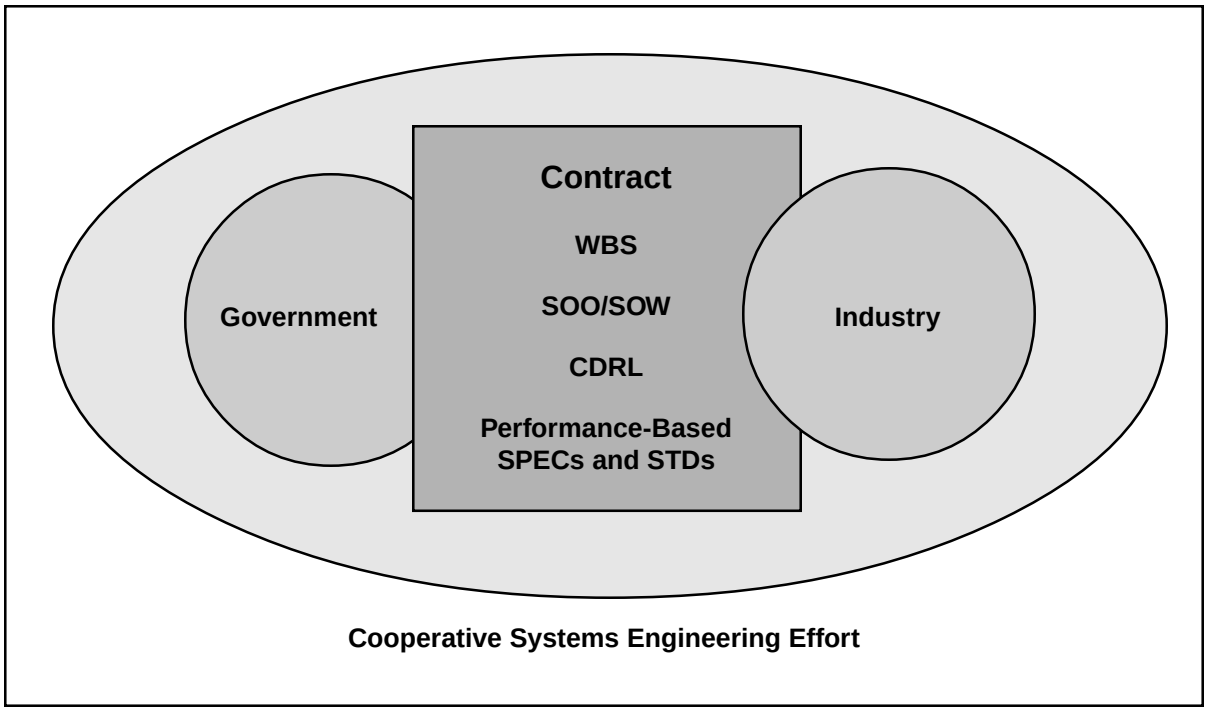


Figure 19-1. Contracting Process

- Prepares the Contract Data Requirements List (CDRL),
- Supports negotiation and participates in source selection evaluations,
- Forms Integrated Teams and coordinates the government side of combined government and industry integrated teams,
- Monitors the contractor's progress, and
- Coordinates government action in support of the contracting officer.

This chapter reflects the DoD approach to contracting for system development. It assumes that there is a government program or project office that is tasking a prime contractor in a competitive environment. However, in DoD there is variation to this theme. Some project activities are tasked directly to a government agency or facility, or are contracted sole source. The processes described in this chapter should be tailored as appropriate for these situations.

19.2 SOLICITATION DEVELOPMENT

As shown by Figure 19-2, the DoD contracting process begins with planning efforts. Planning includes development of a Request for Proposal (RFP), specifications, a Statement of Objective (SOO) or Statement of Work (SOW), a source selection plan, and the Contract Data Requirements List (CDRL).

Request for Proposal (RFP)

The RFP is the solicitation for proposals. The government distributes it to potential contractors. It describes the government's need and what the offeror must do to be considered for the contract. It establishes the basis for the contract to follow.

The key systems engineering documents included in a solicitation are:

- A statement of the work to be performed. In DoD this is a SOW. A SOO can be used to obtain a SOW or equivalent during the selection process.

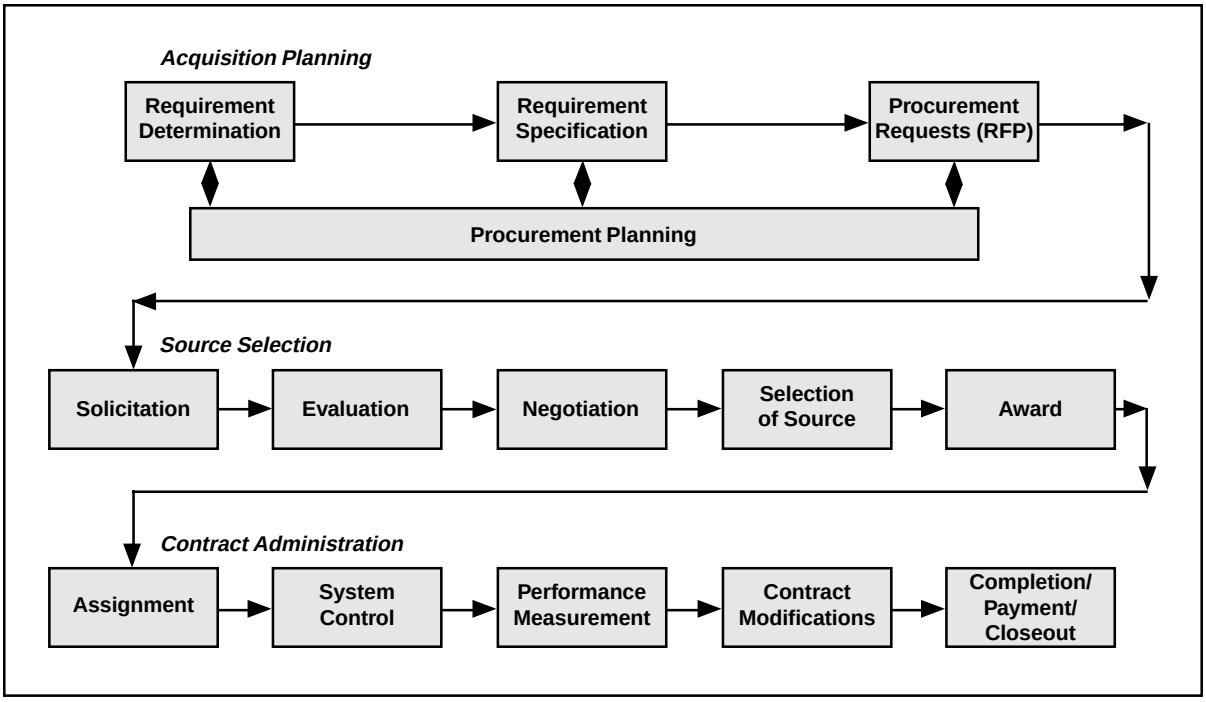


Figure 19-2. Contracting Process

- A definition of the system. Appropriate specifications and any additional baseline information necessary for clarification form this documentation. This is generated by the systems engineering process as explained earlier in this book.

- A definition of all data required by the customer. In DoD this accomplished through use of the Contract Data Requirements List (CDRL).

The information required to be in the proposals responding to the solicitation is also key for the systems engineer. An engineering team will decide the technical and technical management merits of the proposals. If the directions to the offerors are not clearly and correctly stated, the proposal will not contain the information needed to evaluate the offerors. In DoD Sections L and M of the RFP are those pivotal documents.

Task Statement

The task statement prepared for the solicitation will govern what is actually received by the government, and establish criteria for judging contractor performance. Task requirements are expressed in the SOW. During the solicitation phase the tasks can be defined in very general way by a SOO. Specific details concerning SOOs and SOWs are attached at the end of this chapter.

As shown by Figure 19-3, solicitation tasking approaches can be categorized into four basic options: use of a basic operational need, a SOO, a SOW, or a detail specification.

Option 1 maximizes contractor flexibility by submitting the Operational Requirements Document (ORD) to offerors as a requirements document (e.g. in place of SOO/SOW), and the offerors are requested to propose a method of developing a solution to the ORD. The government identifies its areas of concern in Section M (evaluation factors) of the RFP to provide guidance. Section L (instructions to the offerors) should require the bidders write a SOW based on the ORD as *part* of their proposal. The offeror proposes the type of system. The contractor develops the system specification and the Work Breakdown Structure (WBS). In general this option is appropriate for early efforts where contractor input is necessary to expand the understanding of physical solutions and alternative system approaches.

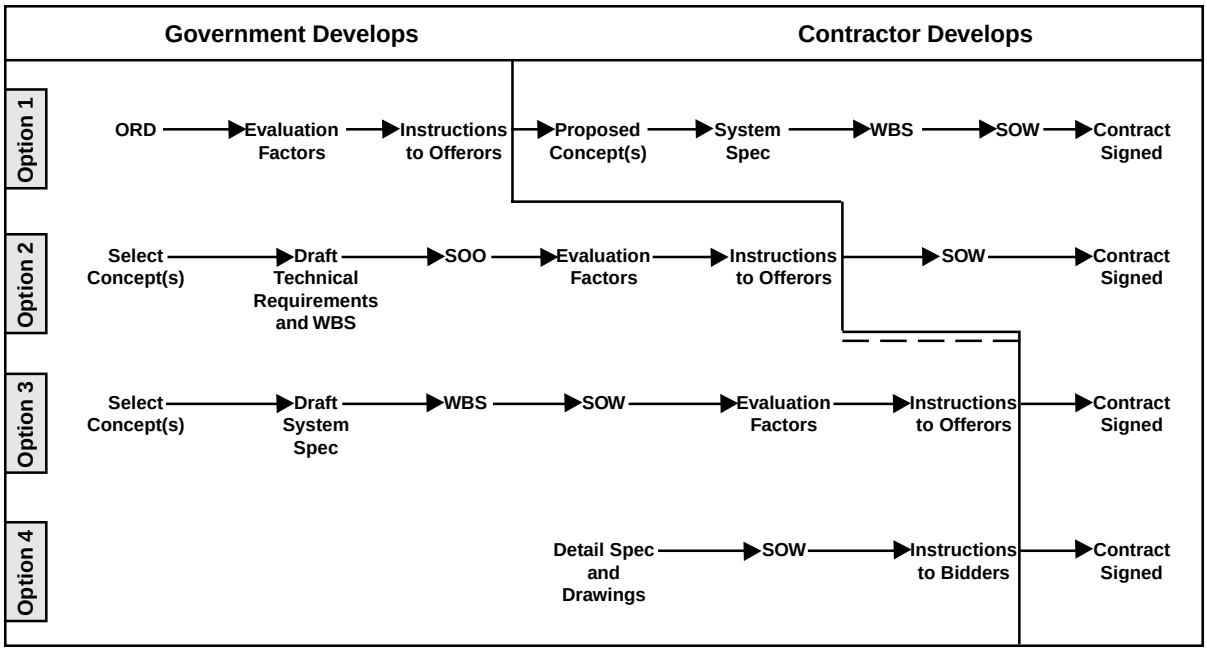


Figure 19-3. Optional Approaches

Option 2 provides moderate contractor flexibility by submitting a SOO to the offerors as the Section C task document (e.g., in place of SOW.) The government identifies its areas of concern in Section M (evaluation factors) to provide guidance. Section L (instructions to the offerors) should require as part of the proposal that offerors write a SOW based on the SOO. In this case the government usually selects the type of system, writes a draft technical-requirements document or system specification, and writes a draft WBS. This option is most appropriate when previous efforts have not defined the system tightly. The effort should not have any significant design input from the previous phase. This method allows for innovative thinking by the bidders in the proposal stage. It is a preferred method for design contracts.

Option 3 lowers contractor flexibility, and increases clarity of contract requirements. In this option the SOW is provided to the Contractor as the contractual task requirements document. The government provides instructions in Section L to the offerors to describe the information needed by the government to evaluate the contractor's ability to accomplish the SOW tasks. The government identifies evaluation factors in Section M to provide guidance for priority of the solicitation requirements. In most cases, the government selects the type of system, and provides the draft system spec, as well as the draft WBS. This option is most appropriate when previous efforts have defined the system to the lower WBS levels or where the product baseline defines the system. Specifically when there is substantial input from the previous design phase and there is a potential for a different contractor on the new task, the SOW method is appropriate.

Option 4 minimizes contractor flexibility, and requires maximum clarity and specificity of contract requirements. This option uses an Invitation for Bid (IFB) rather than an RFP. It provides bidders with specific detailed specifications or task statements describing the contract deliverables. They tell the contractor exactly what is required and how to do it. Because there is no flexibility in the contractual task, the contract is awarded based on the low bid. This option is appropriate when the government has detailed specifications or other product baseline documentation that defines the deliverable item sufficient for production. It is generally used for simple build-to-print reprocurement.

Data Requirements

As part of the development of an IFB or RFP, the program office typically issues a letter that describes the planned procurement and asks integrated team leaders and affected functional managers to identify and justify their data requirements for that contract. The data should be directly associated with a process or task the contractor is required to perform.

The affected teams or functional offices then develop a description of each data item needed. Data Item Descriptions (DIDs), located in the Acquisition Management Systems and Data Requirements Control List (AMSDL), can be used for guidance in developing these descriptions. Descriptions should be performance based, and format should be left to the contractor as long as all pertinent data is included. The descriptions are then assembled and submitted for inclusion in the solicitation. The listing of data requirements in the contract follows an explicit format and is referred to as the CDRL.

In some cases the government will relegate the data call to the contractor. In this case it is important that the data call be managed by a government/contractor team, and any disagreements be resolved prior to formal contract change incorporating data requirements. When a SOO approach is used, the contractor should be required by section L to propose data requirements that correspond to their proposed SOW.

There is current emphasis on electronic submission of contractually required data. Electronic Data Interchange (EDI) sets the standards for compatible data communication formats.

Additional information on data management, types of data, contractual considerations, and sources of data are presented in Chapters 10 and

13. Additional information on CDRLs is provided at the end of this chapter.

Technical Data Package Controversy

Maintenance of a detailed baseline such as the "as built" description of the system, usually referred to as a Technical Data Package (TDP), can be very expensive and labor intensive. Because of this, some acquisition programs may not elect to purchase this product description. If the Government will not own the TDP the following questions must be resolved prior to solicitation issue:

- What are the pros and cons associated with the TDP owned by the contractor?
- What are the support and reprocurement impacts?
- What are the product improvement impacts?
- What are the open system impacts?

In general the government should have sufficient data rights to address life cycle concerns, such as maintenance and product upgrade. The extent to which government control of configurations and data is necessary will depend on support and reprocurement strategies. This, in turn, demands that those strategic decisions be made as early as possible in the system development to avoid purchasing data rights as a hedge against the possibility that the data will be required later in the program life cycle.

Source Selection

Source Selection determines which offeror will be the contractor, so this choice can have profound impact on program risk. The systems engineer must approach the source selection with great care because, unlike many planning decisions made early in product life cycles, the decisions made relative to source selection can generally not be easily changed once the process begins. Laws and regulations governing the fairness of the process require that changes be made very carefully—and often at the expense of considerable time and effort on the part of program office and contractor personnel. In this environment, even minor mistakes can cause distortion of proper selection.

The process starts with the development of a Source Selection Plan (SSP), that relates the organizational and management structure, the evaluation factors, and the method of analyzing the offerors' responses. The evaluation factors and their priority are transformed into information provided to the offerors in sections L and M of the RFP. The offerors' proposals are then evaluated with the procedures delineated in the SSP. These evaluations establish which offerors are conforming, guide negotiations, and are the major factor in contractor selection. The SSP is further described at the end of this chapter.

The system engineering area of responsibility includes support of SSP development by:

- Preparing the technical and technical management parts of evaluation factors,
- Organizing technical evaluation team(s), and
- Developing methods to evaluate offerors' proposals (technical and technical management).

19.3 SUMMARY COMMENTS

- Solicitation process planning includes development of a Request for Proposal, specifications, a Statement of Objective or Statement of Work, a source selection plan, and the Contract Data Requirements List.
- There are various options available to program offices as far as the guidance and constraints imposed on contractor flexibility. The government, in general, prefers that solicitations be performance-based.
- Data the contractor is required to provide the government is listed on the CDRL List.
- Source Selection is based on the evaluation criteria outlined in the SSP and reflected in Sections L and M of the RFP.

SUPPLEMENT 19-A

STATEMENT OF OBJECTIVES (SOO)

The SOO is an alternative to a government prepared SOW. A SOO provides the Government's overall objectives and the offeror's required support to achieve the contractual objectives. Offerors use the SOO as a basis for preparing a SOW which is then included as an integral part of the proposal which the government evaluates during the source selection.

Purpose

SOO expresses the basic, top-level objectives of the acquisition and is provided in the RFP in lieu of a government-written SOW. This approach gives the offerors the flexibility to develop cost effective solutions and the opportunity to propose innovative alternatives.

Approach

The government includes a brief (1- to 2-page) SOO in the RFP and requests that offerors provide a SOW in their proposal. The SOO is typically appended to section J of the RFP and does not become part of the contract. Instructions for the contractor prepared SOW would normally be included in or referenced by Section L.

SOO Development

Step 1: The RFP team develops a set of objectives compatible with the overall program direction including the following:

- User(s) operational requirements,
- Programmatic direction,
- Draft technical requirements, and
- Draft WBS and dictionary.

Step 2: Once the program objectives are defined, the SOO is constructed so that it addresses product-oriented goals and performance-oriented requirements.

SOO and Proposal Evaluations

Section L (Instructions to Offerors) of the RFP must include instructions to the offeror that require using the SOO to construct and submit a SOW. In Section M (Evaluation Criteria) the program office should include the criteria by which the proposals, including the contractor's draft SOW, will be evaluated. Because of its importance, the government's intention to evaluate the proposed SOW should be stressed in Sections L and M.

Offeror Development of the Statement of Work

The offeror should establish and define in clear, understandable terms:

- Non-specification requirements (the tasks that the contractor must do),
- What has to be delivered or provided in order for him to get paid,
- What data is necessary to support the effort, and
- Information that would show how the offerors would perform the work that could differentiate between them in proposal evaluation and contractor selection.

SOO Example:
Joint Air-to-Surface Standoff Missile (JASSM)
Statement of Objectives

The Air Force and Navy warfighters need a standoff missile that will destroy the enemies' war-sustaining capabilities with a launch standoff range outside the range of enemy area defenses. Offerors shall use the following objectives for the pre-EMD and EMD acquisition phases of the JASSM program along with other applicable portions of the RFP when preparing proposals and program plans. IMP events shall be traceable to this statement of objectives:

Pre-EMD Objectives

a. Demonstrate, at the sub-system level as a minimum, end-to-end performance of the system concept. Performance will be at the contractor-developed System Performance Specification requirements level determined during this phase without violation of any key performance parameters.

b. Demonstrate the ability to deliver an affordable and producible system at or under the average unit procurement price (AUPP).

c. Provide a JASSM system review including final system design, technical accomplishments, remaining technical risks and major tasks to be accomplished in EMD.

EMD Objectives

a. Demonstrate through test and/or analysis that all requirements as stated in the contractor generated System Performance Specification, derived from Operational Requirements, are met, including military utility (operational effectiveness and suitability).

b. Demonstrate ability to deliver an affordable and producible system at or under the AUPP requirement.

c. Demonstrate all production processes.

d. Produce production representative systems for operational test and evaluation, including combined development/operational test and evaluation.

At contract award the SOW, as changed through negotiations, becomes part of the contract and the standard for measuring contractor's effectiveness.

SUPPLEMENT 19-B

STATEMENT OF WORK (SOW)

The SOW is a specific statement of the work to be performed by the contractor. It is derived from the Program WBS (System Architecture). It should contain, at a minimum, a statement of scope and intent, as well as a logical and clear definition of all tasks required. The SOW normally consists of three parts:

Section 1: Scope – Defines overall purpose of the program and to what the SOW applies.

Section 2: Applicable Documents – Lists the specifications and standards referenced in Section 3.

Section 3: Requirements – States the tasks the contractor has to perform to provide the deliverables. Tasks should track with the WBS. The SOW describes tasks the contractor has to do. The specifications describe the products.

Statement of Work Preparation and Evaluation Strategies

SOWs should be written by an integrated team of competent and experienced members. The team should:

- Review and use the appropriate WBS for the SOW framework,

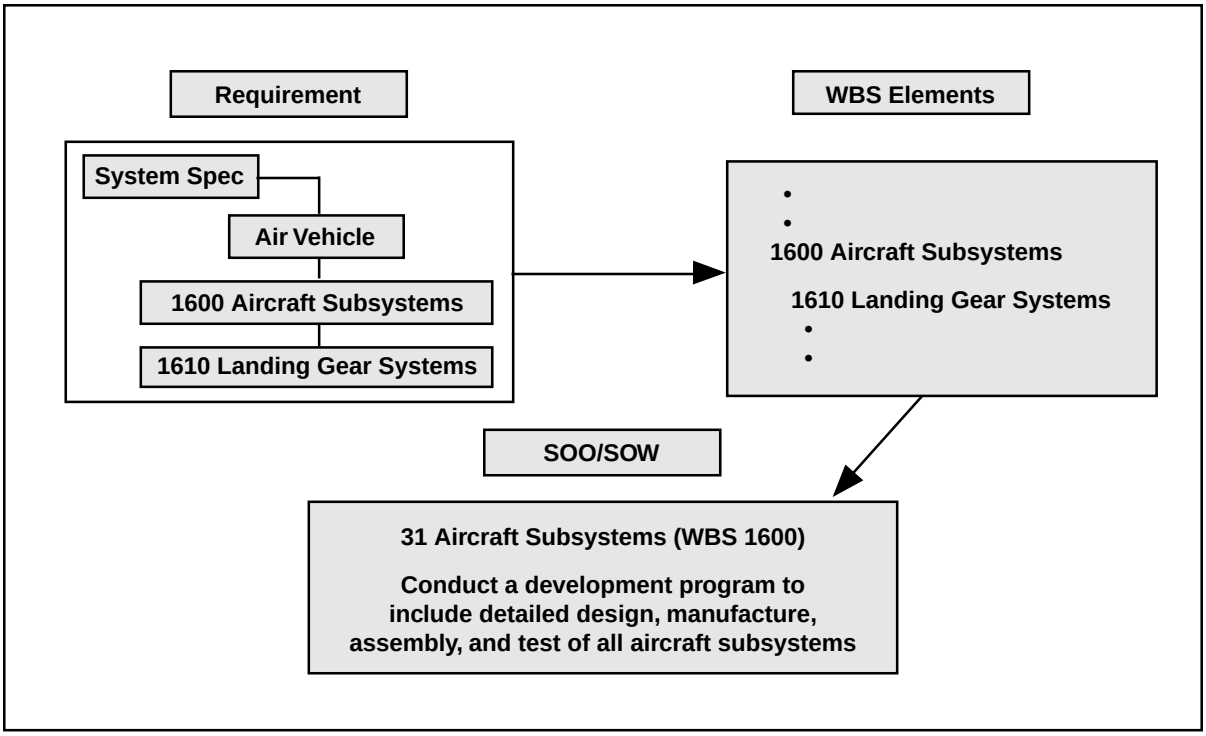


Figure 19-4. Requirement-WBS-SOW Flow

- Set SOW objectives in accordance with the Acquisition Plan and systems engineering planning,
- Develop a SOW tasking outline and check list,
- Establish schedule and deadlines, and
- Develop a comprehensive SOW from the above.

Performance-based SOW

The term *performance-based SOW* has become a common expression that relates to a SOW that tasks the contractor to perform the duties necessary to provide the required deliverables, but is not specific as to the process details. Basically, all SOWs should be performance based, however, past DoD generated SOWs have had the reputation of being overly directive. A properly developed SOW tasks the contractor without telling him how to accomplish the task.

Evaluating the SOW

The WBS facilitates a logical arrangement of the elements of the SOW and a tracing of work effort expended under each of the WBS elements. It helps integrated teams to ensure all requirements have been included, and provides a foundation for tracking program evolution and controlling the change process. As shown by Figure 19-4, the WBS serves as a link between the requirements and the SOW.

In the past, DoD usually wrote the SOW and, over time, an informal set of rules had been developed to assist in drafting them. While the government today generally does not write the SOW, but, rather, more often evaluates the contractor's proposed SOW, those same rules can assist in the government role of evaluator.

Statement of Work Rules

In section 1. ***Scope:***

DO NOT:

- Include directed work statements.
- Include data requirements or deliverable products.

In section 2. ***Applicable Documents:***

DO NOT:

- Include guidance documents that apply only to Government PMOs (e.g., DoD 5000 series and service regulations).

In section 3. ***Requirements:***

DO NOT:

- Define work tasks in terms of data to be delivered.
- Order, describe, or discuss CDRL data (OK to reference).
- Express work tasks in data terms.
- Invoke, cite, or discuss a DID.
- Invoke handbooks, service regulations, technical orders, or any other document not specifically written in accordance with MIL-STD-961/962.
- Specify how task is to be accomplished.
- Use the SOW to amend contract specifications.
- Specify technical proposal or performance criteria or evaluation factors.
- Establish delivery schedules.
- Over specify.

In section 3. ***Requirements:***

DO:

- Specify work requirements to be performed under contract.

- Set SOW objectives to reflect the acquisition plan and systems engineering planning.
- Provide a priceable set of tasks.
- Express work to be accomplished in work words.
- Use “shall” whenever a task is mandatory.
- Use “will” only to express a declaration of purpose or simple futurity.
- Use WBS as an outline.
- List tasks in chronological order.
- Limit paragraph numbering to 3rd sub-level (3.3.1.1.) – Protect Government interests.
- Allow for contractor’s creative effort.

SUPPLEMENT 19-C

CONTRACT DATA REQUIREMENTS LIST

The Contract Data Requirements List (CDRL) is a list of authorized data requirements for a specific procurement that forms a part of the contract. It is comprised of a series of DD Forms 1423 (Individual CDRL forms) containing data requirements and delivery instructions. CDRLs should be linked directly to SOW tasks and managed by the program office data manager. A sample CDRL data requirement is shown in Figure 19-5.

Data requirements can also be identified in the contract via Special Contract Clauses (Federal Acquisition Clauses.) Data required by the FAR clauses are usually required and managed by the Contracting Officer.

CONTRACT DATA REQUIREMENTS LIST

ATCH NR: 3 TO EXHIBIT: SYSTEM/ITEM: ATF DEM/VAL PHASE

TO CONTRACT/PR: F33657-86-C-2085 CATEGORY: X CONTRACTOR: LOCKHEED

1) 3100	2) SOW 3.1 3)	6) ASD/TASE	10) ONE/R	12) 60DAC		14) ASD/TASE 2/0
4) OT E62011	5) SOW 3.1	7) IT	8) D	9)	11)	13) SEE 16

ASD/TASM 2/0
ASD/TASL 2/0
ACO 1/0

16)
BLK 4: SEE APPENDIXES TO CDRL FOR DID.
THIS DID IS TAILORED AS FOLLOWS:
(1) CONTRACTOR FORMAT IS ACCEPTABLE.
(2) CHANGE PARAGRAPH 2a OF DID TO READ: "PROGRAM RISK ANALYSIS. THIS SECTION SHALL DESCRIBE THE PLAN AND METHODOLOGY FOR A CONTINUING ASSESSMENT OF TECHNICAL, SUPPORTABILITY, COST, AND SCHEDULE RISKS OF THE SYSTEM PROGRAM. THIS SECTION SHOULD BE CONSISTENT WITH AND NOT DUPLICATE THE SYSTEM INTEGRATION PLAN (REFERENCE DI-S-3563/T); i.e., ONE PLAN MAY REFERENCE THE OTHER."
BLK 13: REVISIONS SHALL BE SUBMITTED AS REQUIRED BY CHANGE RESULTING FROM THE SYSTEMS ENGINEERING PROCESS.
NOTE: SCHEDULES ASSOCIATED WITH THIS PLAN SHALL BE INTEGRATED WITH THE MASTER PROGRAM PLANNING SCHEDULE SUBMITTED ON MAGNETIC MEDIA IN ACCORDANCE WITH DI-A-3007/T.

15) 7/0

PREPARED BY:	DATE: 86 JUN 11	APPROVED BY:	DATE: 86 JUNE 11

DD FORM 1423 ADPE ADAPTATION SEP 81 (ASD/YYD)

Figure 19-5. CDRL Single Data Item Requirement Example

Data Requirement Sources

Standard Data Item Descriptions (DID) define data content, preparation instructions, format, intended use, and recommended distribution of data required of the contractor for delivery. The Acquisition Management Systems and Data Requirements Control List (AMSDL) identifies acquisition management systems, source documents, and standard DIDs. With acquisition reform the use of DIDs has declined, and data item requirements now are either tailored DIDs or a set of requirements specifically written for the particular RFP in formats agreeable to the contractor and the government.

DD Form 1423 Road Map

Block 1: Data Item Number – represents the CDRL sequence number.

Block 2: Title of Data Item – same as the title entered in item 1 of the DID (DD Form 1664).

Block 4: Authority (Data Acquisition Document Number) – same as item 2 of the DID form and will include a "/t" to indicate DID has been tailored.

Block 5: Contract Reference – identifies the DID authorized in block 4 and the applicable document and paragraph numbers in the SOW from which the data flows.

Block 6: Requiring Office – activity responsible for advising the technical adequacy of the data.

Block 7: Specific Requirements – may be needed for inspection/acceptance of data.

Block 8: Approval Code – if "A," it is a critical data item requiring specific, advanced, written approval prior to distribution of the final data item.

Block 9: Distribution Statement Required:

Category A is unlimited-release to the public.

Category B is limited-release to government agencies.

Category C limits release to government agencies and their contractors.

Category D is limited-release to DoD offices and their contractors.

Category E is for release to DoD components only.

Category F is released only as directed and normally classified.

Block 12: Date of First Submission – indicates year/month/day of first submission and identifies specific event or milestone data is required.

Block 13: Date of Subsequent Submission – if data is submitted more than once, subsequent dates will be identified.

Block 14: Distribution – identify each addressee and identify the number of copies to be received by each. Use office symbols, format of data to be delivered, command initials, etc.

Block 16: Remarks – explain only tailored features of the DID, any additional information for blocks 1-15, and any resubmittal schedule or special conditions for updating data submitted for government approval.

SUPPLEMENT 19-D

THE SOURCE SELECTION PLAN

Prior to solicitation issuance, a source selection plan should be prepared by the Program Manager (PM), reviewed by the Contracting Officer, and approved by the Source Selection Authority (SSA). A Source Selection Plan (SSP) generally consists of three parts:

- The first part describes the organization, membership, and responsibilities of the source selection team,
- The second part identifies the evaluation factors, and
- The last part establishes detailed procedures for the evaluation of proposals.

Source Selection Organization

The SSA is responsible for selecting the source whose proposal is most advantageous to the government. The Source Selection Advisory Council (SSAC) provides advice to the SSA based on the Source Selection Evaluation Board's (SSEB's) findings and the collective experience of SSAC members. The SSEB generates the information the SSA needs by performing a comprehensive evaluation of each offeror's proposal. A Technical Evaluation Review Team(s) evaluates the technical portion of the proposals to support the SSEB. The process flow is shown in Figure 19-6.

The PM is responsible for developing and implementing the acquisition strategy, preparing the SSP, and obtaining SSA approval of the plan before the formal solicitation is issued to industry. The System Engineer or technical manager supports the PM's efforts. The Contracting Officer is responsible for preparation of solicitations and contracts, any communications with potential offerors or offerors, consistency of the SSP with requirements of the Federal Acquisition Regulation (FAR) and DoD FAR Supplement (DFARS), and award of the contract.

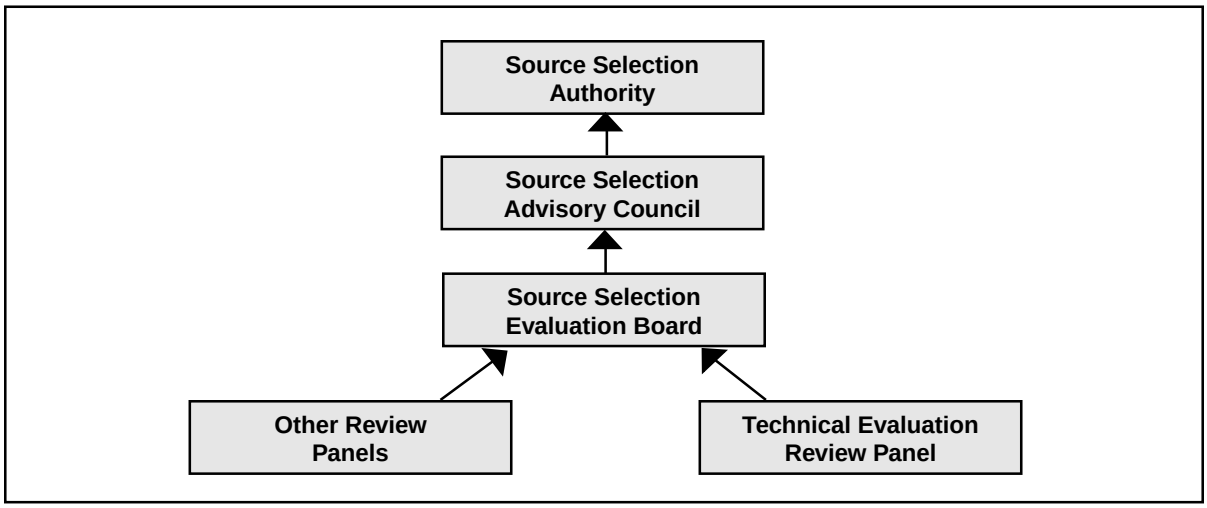


Figure 19-6. Source Selection Process

SSP Evaluation Factors

The evaluation factors are a list, in order of relative importance, of those aspects of a proposal that will be evaluated quantitatively and qualitatively to arrive at an integrated assessment as to which proposal can best meet the Government's need as described in the solicitation. Figure 19-7 shows an example of one evaluation category, life cycle cost. The purpose of the SSP evaluation is to inform offerors of the importance the Government attaches to various aspects of a proposal and to allow the government to make fair and reasoned differentiation between proposals.

In general the following guidance should be used in preparing evaluation factors:

- Limit the number of evaluation factors,
- Tailor the evaluation factors to the Government requirement (e.g., combined message of the SOO/SOW, specification, CDRL, etc.), and
- Cost is always an evaluation factor. The identification of the cost that is to be used and its relative importance in rating the proposal should be clearly identified.

Factors to Consider

There is not sufficient space here to attempt to exhaustively list all the factors that might influence the decision made in a source selection. The following are indicative of some of the key consideration, however:

- Is the supplier's proposal responsive to the government's needs as specified in the RFP?
- Is the supplier's proposal directly supportive of the system requirements specified in the system specification and SOO/SOW?
- Have the performance characteristics been adequately specified for the items proposed? Are they meaningful, *measurable*, and traceable from the system-level requirements?
- Have effectiveness factors been specified (e.g., reliability, maintainability, supportability, and availability?) Are they meaningful, *measurable*, and traceable, from the system-level requirements?
- Has the supplier addressed the requirement for test and evaluation of the proposed system element?

Rating (Points)	Evaluation Criteria – Life Cycle Cost
9-10	Offeror has included a complete Life Cycle Cost analysis that supports their proposal.
7-8	Offeror did not include a complete Life Cycle Cost analysis but has supported their design approach on the basis of Life Cycle Cost.
5-6	Offeror plans to complete a Life Cycle Cost analysis as part of the contract effort and has described the process that will be used.
3-4	Offeror plans to complete a Life Cycle Cost analysis as part of the contract effort but did not describe the process that will be used.
0-2	Life Cycle Cost was not addressed in the Offeror's proposal.

Figure 19-7. Evaluation Factors Example

- Have life cycle support requirements been identified (e.g., maintenance resource requirements, spare/repair parts, test and support equipment, personnel quantities and skills, etc?) Have these requirements been minimized to the extent possible through design?

- Does the proposed design configuration reflect growth potential or change flexibility?

- Has the supplier developed a comprehensive manufacturing and construction plan? Are key manufacturing processes identified along with their characteristics?

- Does the supplier have an adequate quality assurance and statistical process control programs?

- Does the supplier have a comprehensive planning effort (e.g., addresses program tasks, organizational structure and responsibilities, a WBS, task schedules, program monitoring and control procedures, etc.)?

- Does the supplier's proposal address all aspects of total life cycle cost?

- Does the supplier have previous experience in the design, development, and production of system elements/components which are similar in nature to the item proposed?

Proposal Evaluation

Proposal evaluation factors can be analyzed with any reasonable trade study approach. Figure 19-8 shows a common approach. In this approach each factor is rated based on the evaluation factor matrix established for each criteria, such as that shown in Figure 19-7. It is then multiplied by a weighting factor based on the perceived priority of each criteria. All the weighted evaluations are added together and the highest score wins.

Like trade studies the process should be examined for sensitivity problems; however, in the case of source selection, the check must be done with anticipated values prior to release of the RFP.

Evaluation Criteria	WT. Factor (%)	Proposal A		Proposal B		Proposal C	
		Rating	Score	Rating	Score	Rating	Score
A. Technical Requirements:	25						
1. Performance Characteristics	6	4	24	5	30	5	30
2. Effectiveness Factors	4	3	12	4	16	3	12
3. Design Approach	3	2	6	3	9	1	3
4. Design Documentation	4	3	12	4	16	2	8
5. Test and Evaluation Approach	2	2	4	1	2	2	4
6. Product Support Requirements	4	2	8	3	12	2	8
B. Production Capability	20						
1. Production Layout	8	5	40	6	48	6	48
2. Manufacturing Process	5	2	10	3	15	4	20
3. Quality Control Assurance	7	5	35	6	42	4	28
C. Management	20						
1. Planning (Plans/Schedules)	6	4	24	5	30	4	24
2. Organization Structure	4	4	16	4	12	4	16
3. Available Personnel Resources	5	3	15	3	20	3	15
4. Management Controls	5	3	15	3	20	4	20
D. Total Cost	25						
1. Acquisition Price	10	7	70	5	50	6	60
2. Life Cycle Cost	15	9	135	10	150	8	120
E. Additional Factors	10						
1. Prior Experience	4	4	16	3	12	3	12
2. Past Performance	6	5	30	5	30	3	18
Grand Total	100		476		516*		450

* Select Proposal B

Figure 19-8. Source Evaluation

CHAPTER 20

MANAGEMENT CONSIDERATIONS AND SUMMARY

20.1 MANAGEMENT CONSIDERATIONS

The Acquisition Reform Environment

No one involved in systems acquisition, either within the department or as a supplier, can avoid considering how to manage acquisition in the current reform environment. In many ways, rethinking the way we manage the systems engineering process is *implicit* in reforming acquisition management. Using performance specifications (instead of detailed design specifications), leaving design decisions in the hands of contractors, delaying government control of configuration baselines—all are reform measures related directly to systems engineering management. This text has already addressed and acknowledged managing the technical effort in a reform environment.

To a significant extent, the systems engineering processes—and systems engineers in general—are victims of their own successes in this environment. The systems engineering process was created and evolved to bring discipline to the business of producing very complex systems. It is intended to ensure that requirements are carefully analyzed, and that they flow down to detailed designs. The process demands that details are understood and managed. And the process has been successful. Since the 1960s manufacturers, in concert with government program offices, have produced a series of ever-increasingly capable and reliable systems using the processes described in this text. The problem is, in too many cases, we have overlaid the process with ever-increasing levels of controls, reports, and reviews. The result is that the cycle time required to produce systems has increased to unacceptable levels, even as technology life cycles have decreased precipitously. The fact is that, in too many cases, we are producing excellent systems, but systems that take too long to produce, cost too much, and are often outdated when they are finally produced. The demand for change has been sounded, and systems engineering management must respond if change is to take place. The question then becomes how should one manage to be successful in this environment? We have a process that produces good systems; how should we change the process that has served us well so that it serves us better?

At the heart of acquisition reform is this idea: we can improve our ability to provide our users with highly capable systems at reasonable cost and schedule. We can if we manage design and development in a way that takes full advantage of the expertise resident both with the government and the contractor. This translates into the government stating its needs in terms of performance outcomes desired, rather than in terms of specific design solutions required; and, likewise, in having contractors select detailed design approaches that deliver the performance demanded, and then taking responsibility for the performance actually achieved.

This approach has been implemented in DoD, and in other government agencies as well. In its earlier implementations, several cases occurred where the government managers, in an attempt to ensure that the government did not impose design solutions on contractors, chose to deliberately distance the government technical staff from contractors. This presumed that the contractor would step forward to ensure that necessary engineering disciplines and functions were covered. In more than one case, the evidence after the fact was that, as the government stepped back to a less directive role

in design and development, the contractor did not take a corresponding step forward to ensure that normal engineering management disciplines were included. In several cases where problems arose, after-the-fact investigation showed important elements of the systems engineering process were either deliberately ignored or overlooked.

The problem in each case seems to have been failure to communicate expectations between the government and the contractor, compounded by a failure on the part of the government to ensure that normal engineering management disciplines were exercised. One of the more important lessons learned has been that while the systems engineering process can—and should be—tailored to the specific needs of the program, there is substantial risk ignoring elements of the process. Before one decides to skip phases, eliminate reviews, or take other actions that appear to deliver shortened schedules and less cost, one must ensure that those decisions are appropriate for the risks that characterize the program.

Arbitrary engineering management decisions yield poor technical results. One of the primary requirements inherent in systems engineering is to assess the engineering management program for its consistency with the technical realities and risks confronted, and to communicate his/her findings and recommendations to management. DoD policy is quite clear on this issue. The government is not, in most cases, expected to take the lead in the development of design solutions. That, however, does not relieve the government of its responsibilities to the taxpayers to ensure that sound technical and management processes are in place. The systems engineer must take the lead role in establishing the technical management requirements for the program and seeing that those requirements are communicated clearly to program managers and to the contractor.

Communication – Trust and Integrity

Clearly, one of the fundamental requirements for an effective systems engineer is the ability to communicate. Key to effective communication is the rudimentary understanding that communication involves two elements—a transmitter and a receiver. Even if we have a valid message and the capacity for expressing our positions in terms that enable others to understand what we are saying, true communication may not take place if the intended receiver chooses not to receive our message. What can we do, as engineering managers to help our own cause as far as ensuring that our communications are received and understood?

Much can be done to condition others to listen and give serious consideration to what one says, and, of course, the opposite is equally true—one can condition others to ignore what he/she says. It is primarily a matter of establishing credibility based on integrity and trust.

First, however, it is appropriate to discuss the systems engineer's role as a member of the management team. Systems engineering, as practiced in DoD, is fundamentally the practice of engineering management. The systems engineer is expected to integrate not only the technical disciplines in reaching recommendations, but also to integrate traditional management concerns such as cost, schedule, and policy into the technical management equation. In this role, senior levels of management expect the systems engineer to understand the policies that govern the program, and to appreciate the imperatives of cost and schedule. Furthermore, in the absence of compelling reasons to the contrary, they expect support of the policies enunciated and they expect the senior engineer to balance technical performance objectives with cost and schedule constraints.

Does this mean that the engineer should place his obligation to be a supportive team member above his ethical obligation to provide honest engineering judgment? Absolutely not! But it does mean that, if one is to gain a fair hearing for expression of reservations based on engineering judgment, one must be viewed as a member of the team. The individual who always fights the system, always objects to established policy, and, in general, refuses to try to see other points of view will eventually become isolated. When others cease listening, the

communication stops and even valid points of view are lost because the intended audience is no longer receiving the message—valid or not.

In addition to being team players, engineering managers can further condition others to be receptive to their views by establishing a reputation for making reasoned judgments. A primary requirement for establishing such a reputation is that managers must have technical expertise. They must be able to make technical judgments grounded in a sound understanding of the principles that govern science and technology. Systems engineers must have the education and the experience that justifies confidence in their technical judgments. In the absence of that kind of expertise, it is unlikely that engineering managers will be able to gain the respect of those with whom they must work. And yet, systems engineers cannot be expert in all the areas that must be integrated in order to create a successful system. Consequently, systems engineers must recognize the limits of their expertise and seek advice when those limits are reached. And, of course, systems engineers must have built a reputation for integrity. They must have demonstrated a willingness to make the principled stand when that is required and to make the tough call, even when there are substantial pressures to do otherwise.

Another, perhaps small way, that engineers can improve communication with other members of their teams (especially those without an engineering background) is to have confidence in the position being articulated and to articulate the position concisely. The natural tendency of many engineers is to put forward their position on a subject along with all the facts, figures, data and required proofs that resulted in the position being taken. This sometimes results in explaining how a watch works when all that was asked was "What time is it?" Unless demonstrated otherwise, team members will generally trust the engineer's judgment and will assume that all the required rationale is in place, without having to see it. There are some times when it is appropriate to describe how the watch works, but many times communication is enhanced and time saved by providing a confident and concise answer.

When systems engineers show themselves to be strong and knowledgeable, able to operate effectively in a team environment, then communication problems are unlikely to stand in the way of effective engineering management.

20.2 ETHICAL CONSIDERATIONS

The practice of engineering exists in an environment of many competing interests. Cost and schedule pressures; changes in operational threats, requirements, technology, laws, and policies; and changes in the emphasis on tailoring policies in a common-sense way are a few examples. These competing interests are exposed on a daily basis as organizations embrace the integrated product and process development approach. The communication techniques described earlier in this chapter, and the systems engineering tools described in earlier chapters of this book, provide guidance for engineers in effectively advocating the importance of the technical aspects of the product in this environment of competing interests.

But, what do engineers do when, in their opinion, the integrated team or its leadership are not putting adequate emphasis on the technical issues? This question becomes especially difficult in the cases of product safety or when human life is at stake. There is no explicit set of rules that directs the individual in handling issues of ethical integrity. Ethics is the responsibility of everyone on the integrated team. Engineers, while clearly the advocate for the technical aspects of the intgrated solution, do not have a special role as ethical watchdogs because of their technical knowledge.

Richard T. De George in his article entitled *Ethical Responsibilities of Engineers in Large Organizations: The Pinto Case*[1] makes the following case: "The myth that ethics has no place in engineering

[1] *Ethical Issues in Engineering*, Johnson, Ch 15.

has been attacked, and at least in some corners of the engineering profession been put to rest. Another myth, however, is emerging to take its place—the myth of the engineer as moral hero."

This emphasis, De George believes, is misplaced. "The zeal of some preachers, however, has gone too far, piling moral responsibility upon moral responsibility on the shoulders of the engineer. Though engineers are members of a profession that holds public safety paramount, we cannot reasonably expect engineers to be willing to sacrifice their jobs each day for principle and to have a whistle ever by their sides ready to blow if their firm strays from what they perceive to be the morally right course of action."

What then is the responsibility of engineers to speak out? De George suggests as a rule of thumb that engineers and others in a large organization are morally permitted to go public with information about the safety of a product if the following conditions are met:

1. If the harm that will be done by the product to the public is serious and considerable.

2. If they make their concerns known to their superiors.

3. If, getting no satisfaction from their immediate supervisors, they exhaust the channels available within the operation, including going to the board of directors (or equivalent).

De George believes if they still get no action at this point, engineers or others are morally permitted to make their concerns public but not morally obligated to do so. To have a moral obligation to go public he adds two additional conditions to those above:

4. The person must have documented evidence that would convince a reasonable, impartial observer that his/her view of the situation is correct and the company policy wrong.

5. There must be strong evidence that making the information public will in fact prevent the threatened serious harm.

Most ethical dilemmas in engineering management can be traced to different objectives and expectations in the vertical chain of command. Higher authority knows the external pressures that impact programs and tends to focus on them. System engineers know the realities of the on-going development process and tend to focus on the internal technical process. Unless there is communication between the two, misunderstandings and late information can generate reactive decisions and potential ethical dilemmas. The challenge for system engineers is to improve communication to help unify objectives and expectations. Divisive ethical issues can be avoided where communication is respected and maintained.

20.3 SUMMARY

The material presented in this book is focused on the details of the classic systems engineering process and the role of the systems engineer as the primary practitioner where the activities included in that process are concerned. The systems engineering process described has been used successfully in both DoD and commercial product development for decades. In that sense, little new or revolutionary material has been introduced in this text. Rather, we have tried to describe this time-proven process at a level of detail that makes it logical and understandable as a tool to use to plan, design, and develop products that must meet a defined set of requirements.

In DoD, systems engineers must assume roles of engineering managers on the program or project assigned. They must understand that the role of the systems engineer is necessarily different from that normal to the narrowly specialized functional engineer, yet it is also different from the role played by the program manager. In a sense, the role of the systems engineer is a delicate one, striving to balance technical concerns with the real management

pressures deriving from cost, schedule, and policy. The systems engineer is often the person in the middle; it is seldom a comfortable position. This text has been aimed at that individual.

The first two parts of the text were intended to first give the reader a comprehensive overview of systems engineering as a practice and to demonstrate the role that systems engineering plays within the DoD acquisition management process. Part 2, in particular, was intended to provide relatively detailed insights into the specific activities that make up the process. The government systems engineer may find him/herself deeply involved in some of the detailed activities that are included in the process, while less involved in others. For example, government systems engineers may find themselves very involved in requirements definition and analysis, but less directly involved in design synthesis. However, the fact that government engineers do not directly synthesize designs does not relieve them from a responsibility to understand the process and to ensure that sound practices are pursued in reaching design decisions. It is for this reason that understanding details of the process are critical.

Part 3 of the book is perhaps the heart of the text from an engineering management perspective. In Part 3, we have presented discussions on a series of topics under the general heading of Systems Analysis and Control. The engine that translates requirements into designs is defined by the requirements analysis, functional analysis and allocation, and design synthesis sequence of activities. Much of the role of the systems engineer is to evaluate progress, consider alternatives, and ensure the product remains consistent and true to the requirements upon which the design is based. The tools and techniques presented in Part 3 are the primary means by which a good engineering management effort accomplishes these tasks.

Finally, in Part 4, we presented some of the considerations beyond the implementation of a disciplined systems engineering process that the engineering manager must consider in order to be successful. Particularly in today's environment where new starts are few and resources often limited, the planning function and the issues associated with product improvement and integrated team management must move to the forefront of the systems engineer's thinking from the very early stages of work on any system.

This book has attempted to summarize the primary activities and issues associated with the conduct and management of technical activities on DoD programs and projects. It was written to supplement the material presented courses at the Defense Systems Management College. The disciplined application of the principles associated with systems engineering has been recognized as one indicator of likely success in complex programs. As always, however, the key is for the practitioner to be able to absorb these fundamental principles and then to tailor them to the specific circumstances confronted. We hope that the book will prove useful in the future challenges that readers will face as engineering managers.

GLOSSARY

GLOSSARY

SYSTEMS ENGINEERING FUNDAMENTALS

AAAV Advanced Amphibious Assault Vehicle

ACAT Acquisition Category

ACR Alternative Concept Review

AMSDL Acquisition Management Systems Data List

ASR Alternative Systems Review

AUPP Average Unit Procurement Price

AWP Awaiting Parts

BL Baseline

BLRIP Beyond Low Rate Initial Production

C4ISR Command, ontrol, Communications, Computers, Intelligence, and Reconnaissance

CAD Computer-Aided Design

CAE Computer-Aided Engineering

CAIV Cost As an Independent Variable

CALS Continuous Acquisition and Life Cycle Support

CAM Computer-Aided Manufacturing

CASE Computer-Aided Systems Engineering

CATIA Computer-Aided Three-Dimensional Interactive Application

CCB Configuration Control Board

CCR Contract Change Request

CDR Critical Design Review

CDRL Contract Data Requirement List

CDS Concept Design Sheet

CE Concept Exploration

CEO Chief Executive Officer

CI Configuration Item

Circular A-109 Major Systems Acquisitions

CM Configuration Management

CM Control Manager

COTS Commercial Off-The-Shelf

CSCI Computer Software Configuration Item

CWI Continuous Wave Illumination

DAU Defense Acquisition University

DCMC Defense Contract Management Command

DDR Detail Design Review

DFARS Defense Supplement to the Federal Acquisition Regulation

DID Data Item Description

DoD Department of Defense

DoD 5000.2-R Mandatory Procedures for Major Defense Acquisition Programs (MDAPs), and Major Automated Information System Acquisition Programs (MAIS)

DoDISS DoD Index of Specifications and Standards

DSMC Defense Systems Management College

DT Developmental Testing

DTC Design To Cost

DT&E Developmental Test and Evaluation

EC Engineering Change

ECP Engineering Change Proposal

EDI Electronic Data Interchange

EIA Electronic Industries Alliance

EIA IS 632 Electronic Industries Association Interim Standard 632, on Systems Engineering

EIA IS-649 Electronic Industries Association Interim Standard 649, on Configuration Management

EOA Early Operational Assessments

FAR Federal Acquisition Regulation

FCA Functional Configuration Audit

FEO Field Engineering Order

FFBD Functional Flow Block Diagram

FIPS Federal Information Processing Standard

FMECA Failure Modes, Effects, and Criticality Analysis

FOT&E Follow-On Operational Test and Evaluation

FQR Formal Qualification Review

GFE Government Furnished Equipment

GFM Government Furnished Material

ICD Interface Control Documentation

ICWG Interface Control Working Group

IDE Integrated Digital Environment

IDEF Integration Definition Function

IDEF0 Integrated Definition for Function Modeling

IDEF1x Integration Definition for Information Modeling

IEEE Institute of Electrical and Electronics Engineers

IEEE/EIA 12207 IEEE/EIA Standard 12207, Software Life Cycle Processes

IEEE P1220 IEEE Draft Standard 1220, Application and Management of the Systems Engineering Process

IFB Invitation for Bid

IIPT Integrating Integrated Product Teams

IMS Integrated Master Schedule

IOC Initial Operational Capability

IOT&E Initial Operational Test and Evaluation

IPPD Integrated Product and Process Development

IPR In-Progress/Process Review

IPT Integrated Product Teams

JASSM Joint Air-to-Surface Standoff Missile

JROC Joint Requirements Oversight Council

JTA Joint Technical Architecture

KPPs Key Performance Parameters

LFT&E Live Fire Test and Evaluation

LRU Line-Replaceable Unit

LRIP Low Rate Initial Production

M&S Modeling and Stimulation

MAIS Major Automated Information System

MAISRC Major Automated Information Systems Review Council

MBTF Mean Time Between Failure

MDA Milestone Decision Authority

MDAP Major Defense Acquisition Program

MIL-HDBK-61 Military Handbook 61, on Configuration Management

MIL-HDBK-881 Military Handbook 881, on Work Breakdown Structure

MIL-STD 499A Military Standard 499A, on Engineering Management

MIL-STD-961D Military Standard 961D, on Standard Practice for Defense Specifications

MIL-STD 962 Military Standard 962, on Format and Content of Defense Standards

MIL-STD-973 Military Standard 973, on Configuration Management

MNS Mission Need Statement

MOE Measure of Effectiveness

MOP Measure of Performance

MOS Measure of Suitability

MRP II Manufacturing Resource Planning II

MS Milestone

MTTR Mean Time To Repair

NDI Non-Developmental Item

NIST National Institute of Standards and Technology

NRTS Not Repairable This Station

OA Operational Assessment
OIPT Overarching Integrated Product Teams
OMB Office of Management and Budget
OPS Operations
ORD Operational Requirements Document
OSD Office of the Secretary of Defense
OT&E Operational Test and Evaluation

P3I Preplanned Product Improvement
PAR Production Approval Reviews
PCA Physical Configuration Audit
PDR Preliminary Design Review
PDRR Program Definition and Risk Reduction
PEO Program Executive Office
PM Program Manager
PME Program/Project Manager – Electronics
PMO Program Management Office
PMT Program Management Team
PPBS Planning, Programming and Budgeting System
PRR Production Readiness Review

QA Quality Assurance
QFD Quality Function Deployment

R&D Research and Development
RAS Requirements Allocation Sheets
RCS Radar Cross Section
RDT&E Research, Development, Test and Evaluation
RFP Request for Proposal

S&T Science and Technology

SBA Simulation Based Acquisition

SBD Schematic Block Diagram

SD&E System Development and Demonstration

SDefR System Definition Review (as referred to in IEEE P1220)

SDR System Design Review

SE Systems Engineering

Section L Instructions to Offerors (Portion of Uniform Contract Format)

Section M Evaluation Criteria (Portion of Uniform Contract Format)

SEDS Systems Engineering Detail Schedule

SEMS Systems Engineering Master Schedule

SEP Systems Engineering Process

SFR System Functional Review

SI Software Item

SI&T System Integration and Test

SOO Statement of Objectives

SOW Statement of Work

SPEC Specification

SSA Source Selection Authority

SSAC Source Selection Advisory Council

SSEB Source Selection Evaluation Board

SSP Source Selection Plan

SSR Software Specification Review

SRR System Requirements Review

SRU Shop-Replaceable Unit

STD Standard

SVR System Verification Review

S/W Software

T&E Test and Evaluation

TDP Technical Data Package

TEMP Test and Evaluation Master Plan

TLS Timeline Analysis Sheet

TOC Team Operating Contract

TPM Technical Performance Measurement

TPWG Test Planning Work Group

TRR Test Readiness Review

VV&A Verfication, Validation, and Accreditation

WIPT Working-Level Integrated Product Team

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[13] Systems Engineering Handbook, A “How To” Guide for Engineers, Version 2.0, International Council on Systems Engineering, July 2000

[14] IBID

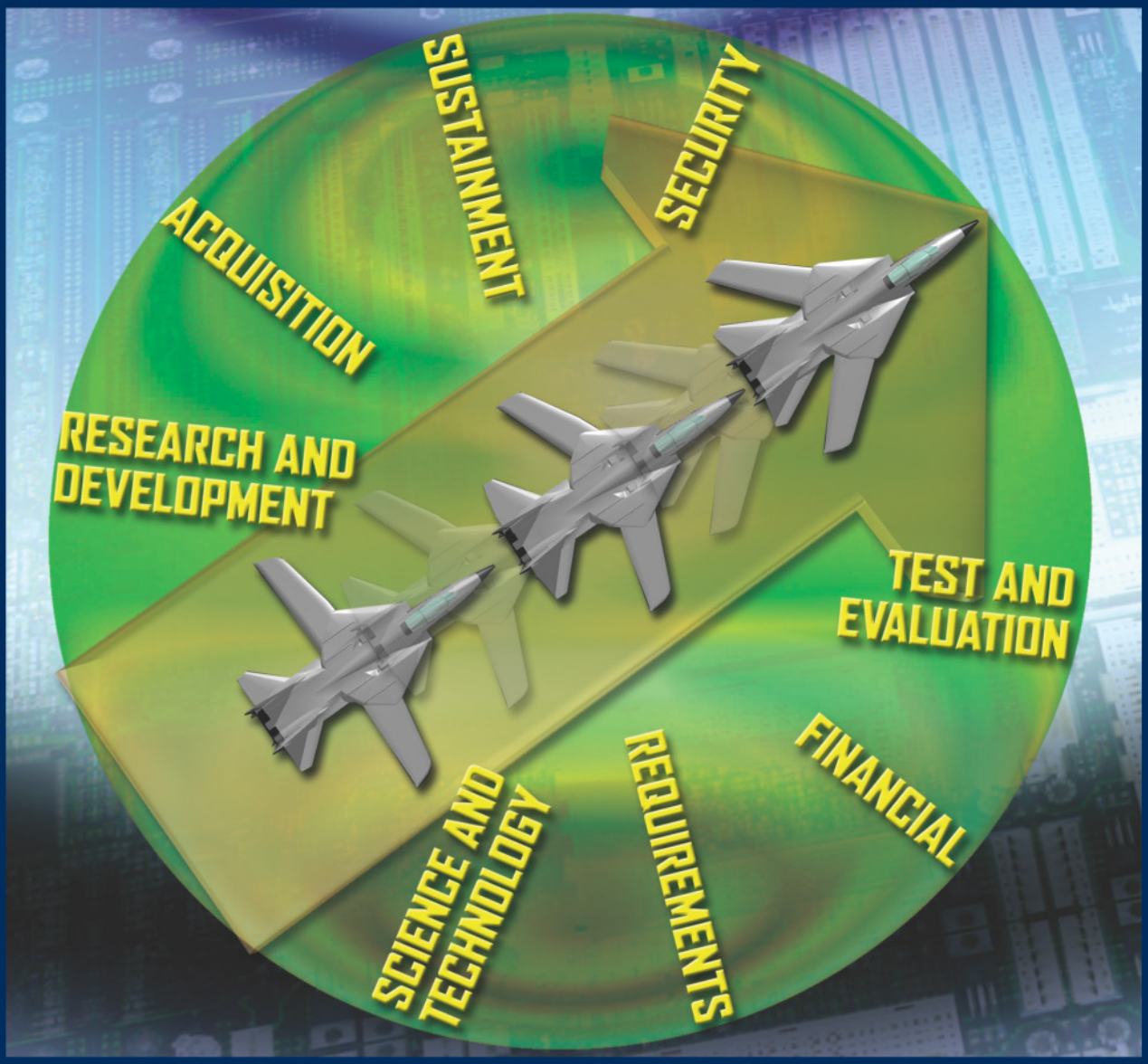
INCOSE members can download the softcopy of this handbook from www.incose.org in the Members' Area.

[15] A Manager's Guide to Technology Transition in an Evolutionary Acquisition Environment

Manager's Guide to Technology Transition in an Evolutionary Acquisition Environment

Version 1.0

January 31, 2003



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Office of the Under Secretary of Defense
(Acquisition, Technology and Logistics)

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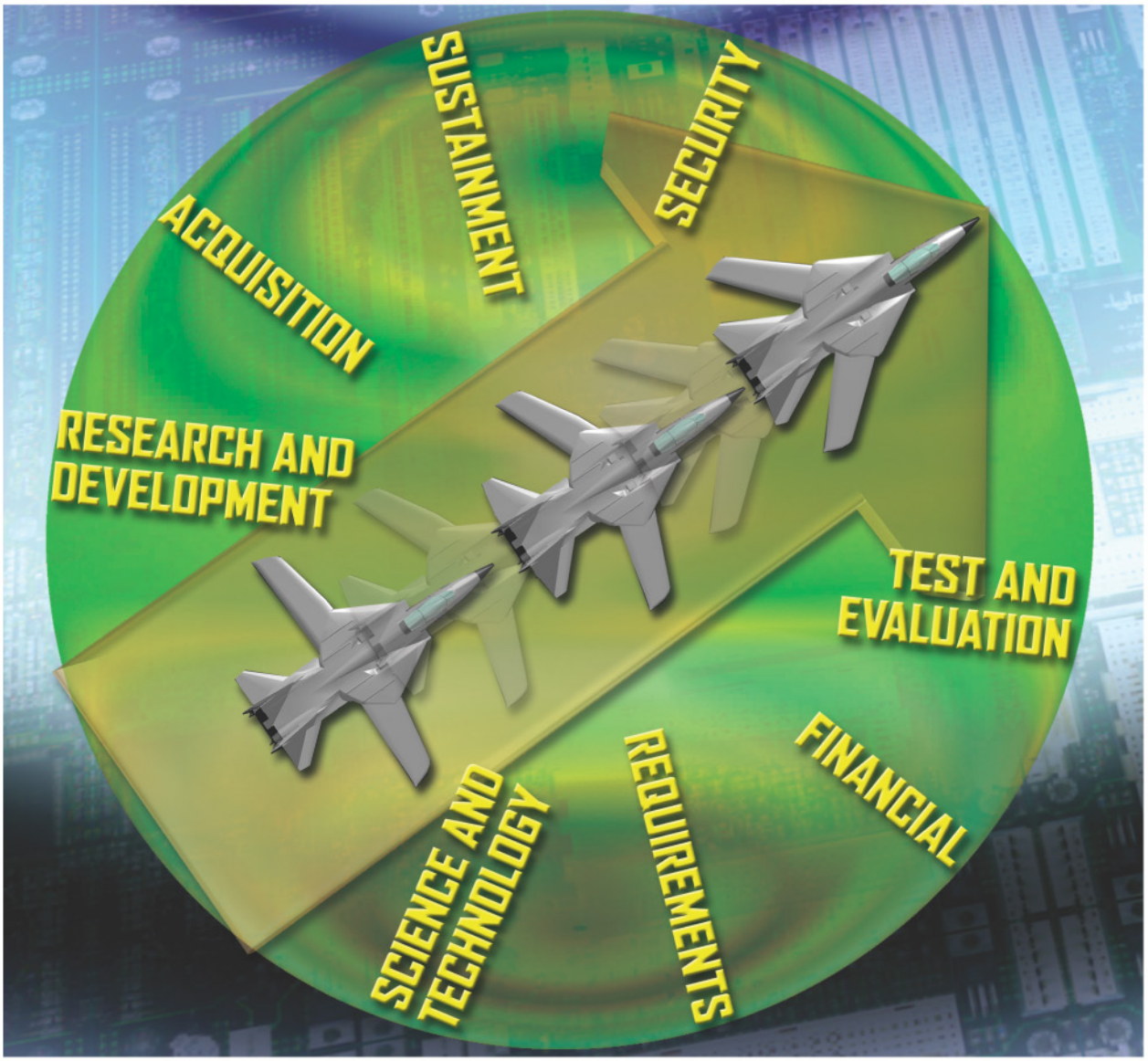

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Foreword

> Before the war in Afghanistan, that area was low on the list of major planning contingencies. Yet, in a very short time, we had to operate across the length and breadth of that remote nation, using every branch of the armed forces. We must prepare for more such deployments by developing assets such as advanced remote sensing, long-range precision strike capabilities, and transformed maneuver and expeditionary forces. This broad portfolio of military capabilities must also include the ability to defend the homeland, conduct information operations, ensure access to distant theaters, and protect critical U.S. infrastructure and assets in outer space.
>
> Innovation within the armed forces will rest on experimentation with new approaches to warfare, strengthening joint operations, exploiting U.S. intelligence advantages, and taking full advantage of science and technology…
>
> *—The National Security Strategy of the United States, September 2002*

The National Security Strategy highlights the dramatic changes in the security needs of our nation. The Department of Defense (DoD) is transforming to meet the challenges that it will face in the 21st century. "Taking full advantage of science and technology" is a critical aspect of the transformation. To take full advantage of science and technology, DoD must place the best possible technology in the hands of the soldiers, sailors, airmen, Marines, and civilians who will conduct and support future military operations.

Accelerating the flow of technology to the warfighter is one of the top priorities of the Under Secretary of Defense (Acquisition, Technology and Logistics),[1] as well as the services, defense agencies, and other key defense organizations that help transition technology. DoD is joined in transitioning technology by U.S. industry—large and small businesses, defense contractors and companies who have not traditionally dealt with DoD.

This document, the *Manager's Guide to Technology Transition In an Evolutionary Acquisition Environment* (the guide) is intended to be a source of information to promote collaboration among team members. It provides an overview of the processes, communities, programs, and challenges associated with technology transition. The guide shows the reader possible ways ahead for their programs and areas of pursuit and, where possible, lists sources that can provide information about strategies or approaches.[2]

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[1] Memorandum from the Under Secretary of Defense (Acquisition, Technology, and Logistics) to the Secretary of Defense, Subject: Top 5 Priorities for AT&L, August 6, 2002.

[2] This document is for information only. It is not authoritative or directive in nature. Users should refer to the appropriate authoritative sources when using these processes for specific programs.

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THE CHALLENGES

Keeping pace with technology and maintaining a technological advantage over our adversaries will be challenging in the 21st century because of the following three factors:

- *Technology is changing rapidly in many key areas.* The advance of technology has accelerated. Yesterday's technology may not be good enough on tomorrow's battlefield. Critical enabling technologies may become obsolescent quickly, or countermeasures may be developed.

- *Critical commercial technology will be widely available.* The lead for developing many critical technologies has shifted from the defense industry to commercial industry.

- *Our adversaries may have access to our defense technology.* Adversarial activity has extended from the battlefield into the international marketplace. Evidence shows that foreign entities are exploiting U.S. defense contractors and military research, development, testing, and evaluation facilities to obtain leading-edge research and technology. In addition, U.S. industry no longer is the leader in many areas of technology. Therefore, our adversaries may have access to many key defense-related technologies.

To respond to these 21st century challenges, DoD must not only field new technology rapidly, but also must maintain the technological edge in systems that will remain in service for decades. DoD must be able to

- leverage the best technology available from both government and commercial sources;

- rapidly transition the technology into new materiel systems;

- refresh the technology, as needed, to maintain the advantages that our warfighters need throughout the life of a system; and

- protect sensitive leading-edge research and technology against unauthorized or inadvertent loss or disclosure.

THE DECISION SUPPORT SYSTEMS

Technology transition requires DoD's active involvement. Transitioning technology is a "contact sport" that requires teamwork and communication between government, industry, and eight interrelated functional communities. All must

operate within the three decision support systems of DoD. The decision support systems are the following:

- The Requirements Generation System (RGS). The system that produces information for decision makers who must determine the projected mission needs of the warfighter.
- The Defense Acquisition System (DAS). The system that secures and sustains the nation's investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support the United States Armed Forces.
- The Financial Management System (FMS). The system that provides the resources for programs and initiatives for developing, procuring, and operating military weapons and systems.

THE PLAYERS—GOVERNMENT AND INDUSTRY

Meeting the warfighting needs of the nation is a team effort, in which industry assists the government throughout the system life cycle. As the pace of technology has increased, industry has become an even more important partner in the process. The guide discusses the roles of both government and industry and how they contribute to transitioning technology.

The Government Team

The government technology transition team comprises many functional components. The interrelated communities on the team discussed in this guide are the following:

- Requirements community—the warfighters or their representatives who develop new warfighting concepts and outline the capabilities needed to support them.
- Science and technology (S&T) community—the scientists and managers of S&T programs who develop knowledge about the key technologies that will be needed for future equipment.
- Research and development (R&D) community—the scientists, engineers, and other professionals who have the expertise necessary to field the technologies in military systems.
- Acquisition community—the program managers, product managers, staffs, and organizations that manage the development, procurement, production, and fielding of systems.

- Sustainment community—the operators, program and product managers, item managers, and logisticians who operate, maintain, and improve the equipment through the decades of service that are expected of major systems.

- Test and evaluation (T&E) community—the government organizations and personnel who ensure that the systems work as intended, and are safe to operate in the challenging military operational environment.

- Financial community—the government organizations and personnel who manage the resources needed by the other communities, and secure funding for the programs and systems needed to transition technology.

- Security community—The intelligence, counterintelligence, security, and foreign disclosure organizations, staffs, and personnel who advise the communities about technologies wanted by adversaries, capabilities for obtaining such technologies, countermeasures for protecting the technologies, and authorizations for transferring the technology to other countries.

The Industry Team

Like the government, "industry" is not a monolithic organization. It is a diverse group of players categorized by functional areas just like the government, with very different capabilities and points of view to contribute to technology transition. We will discuss the industry players throughout the guide, but separate them into four overlapping categories when necessary to increase the clarity and focus of the discussion. The industry categories are: large businesses, small businesses, defense contractors who have a traditional relationship with DoD, and nontraditional defense contractors. All of the players are valuable sources of new technology and innovative approaches to meeting the challenges of the 21st century.

HOW THE GUIDE IS ORGANIZED

The application of technology influences the entire life cycle of an acquisition program—from identifying and using commercial and government S&T, to enabling technology tradeoffs with the requirements community, to continually integrating the technology into development programs, and finally to continually upgrading the technology for legacy systems. As an evolving document, the guide's objectives are to help the eight government communities (1) plan for integrating evolutionary technology; and (2) continually enhance technology by identifying the appropriate tools, business arrangements, programs, and incentives. To these ends, we organized the guide as follows:

- Chapter 1, "The Environment for Technology Transition," discusses a working definition for technology transition, and outlines the decision support processes that govern DoD's technology transition. The chapter

identifies the communities that must interact in transitioning technology and their interests in this complex process.

- Chapter 2, "Technology Transition Planning and Tools," presents a host of tools, business arrangements, solicitation methods, and incentives for transitioning technology and implementing evolutionary acquisition. The chapter emphasizes the importance of planning for continual insertion of technology in fielded systems.

- Chapter 3, "Programs That Facilitate Technology Transition," describes a multitude of programs that are available to assist with technology transitions.

- Chapter 4, "Challenges and Considerations," builds on the previous chapters with a discussion of challenges and important considerations to help the communities at different stages in the process to transition technology and implement evolutionary acquisition.

In addition, the Guide presents reference materials in the following appendices:

- Appendix A, "Resources," describes publications that address topics related to this guide.

- Appendix B, "Websites," offers links to online resources for more in-depth information about the topics covered in this guide.

- Appendix C, "Success Stories," presents information about successes in dual-use science and technology, technology insertion, and technology transition. We gleaned many of the stories from interviews with participants in the S&T and acquisition communities.

- Appendix D, "Technology Transition Planning and Pathways," contains information about the planning for transitioning technology.

- Appendix E, "Research and Technology Protection Planning," contains information about protecting defense technology.

- Appendix F, "Glossary," defines the terms used throughout the guide.

- Appendix G, "Bibliography," lists publications used for developing this guide.

- Appendix H, "Abbreviations" contains abbreviations and acronyms used throughout the guide.

Chapter 1
The Environment for Technology Transition

This chapter defines key terms associated with technology transition. It then provides a guide to the management systems that enable the transition process. Finally, the chapter describes the key government players involved in technology transition and highlights the increasing role played by industry.

DEFINING TECHNOLOGY TRANSITION

Technology transition is the use of technology in military systems to create effective weapons and support systems—in the quantity and quality needed by the warfighter to carry out assigned missions at the "best value" as measured by the warfighter. *Best value* refers to increased performance as well as reduced cost for developing, producing, acquiring, and operating systems throughout their life cycle.[1]

Timeliness also is important. Our warfighters must maintain a technological advantage over their adversaries. This requires compressed development and acquisition cycles for rapidly advancing technologies.

Technology transitions can occur during the development of systems, or even after a system has been in the field for a number of years. The ability to transition technology smoothly and efficiently is a critical enabler for evolutionary acquisition.

Technology transitions can occur between government organizations, such as when a government laboratory transitions a technology to a government research and development (R&D) organization for use in a specific system. Also, industry can transition technology to government, and vice versa.

[1] Definitions in this paragraph are adapted from Deputy Under Secretary of Defense (Science and Technology), *Technology Transition for Affordability: A Guide for S&T Program Managers.* April 2001.

THE GOALS OF TECHNOLOGY TRANSITION

The objective of technology transition is to meet the warfighter's requirements at the lowest possible total ownership cost (TOC). To this end, the goals of technology transition are to use available resources to:

- leverage the best technology available from both government and commercial sources;
- rapidly transition the technology into new weapons and other military systems;
- refresh the technology, as needed, to maintain the advantages that our warfighters need throughout the life of a system; and
- protect sensitive leading-edge research and technology against unauthorized or inadvertent loss or disclosure.

The three major decision support systems in the Department of Defense (DoD) (the defense acquisition system, requirements generation system, and financial management system) guide and enable the technology transition process.

THE DECISION SUPPORT SYSTEMS

The defense acquisition system, requirements generation system, and financial management system are DoD's three principal decision support systems. These interrelated systems ensure that warfighters have the high-quality systems needed for modern warfare.

DoD develops its vision of future warfare and specific needs in the requirements generation system; DoD justifies, obtains, and allocates its funding in the financial management system; and DoD develops and procures new systems using the defense acquisition system. These three decision support systems provide the funding and management structure needed for new programs.

Currently, DoD is making major changes to all three systems to better support its future needs. DoD is reviewing and revising these processes to create the maximum flexibility and agility possible to support defense transformation, while meeting its legal requirements and maintaining the necessary management controls. Much work must be done, both within the Office of the Secretary of Defense (OSD) and the Services, to develop the necessary Department-level guidance and to promulgate the new policies. Accordingly, this document reflects the current directives and instructions. To the extent possible, we also discuss the implications of the changes that were known at the time of publication.

REQUIREMENTS GENERATION SYSTEM

The requirements generation system contains information about the future mission needs of warfighters. DoD has multiple requirements generation systems, which work together to develop the requirements for future warfighting systems. The joint requirements generation system, which the Chairman of the Joint Chiefs of Staff (CJCS) oversees, provides guidance to staffs responsible for reviewing requirements that support major defense acquisition programs and other programs of special interest to the joint community. Similar programs in each Service support the joint requirements generation system.

Contemplated Changes to the Requirements Generation System

In October 2002, the Joint Staff, as the proponent of the requirements generation system, announced upcoming changes to their processes to better support developing an integrated and effective joint force.[2] The Joint Staff is coordinating its changes with the acquisition community's improvements to the defense acquisition system. The changes will

- increase integration with the defense acquisition system,
- use integrated architectures for planning and decision making,
- create initial capability documents for guiding systems development, and
- support evolutionary acquisition.

To transition to the new processes, the Joint Staff cancelled the parts of CJCS Instruction (CJCSI) 3170.01B, "Requirements Generation System," that described Mission Needs Statements (MNSs), and Capstone Requirements Documents (CRDs). The MNS will be replaced by a document that focuses on mission area capabilities in the next revision to the CJCSI, expected in early 2003. The essential elements of the CRDs will be incorporated into architectures, which will be used to integrate capabilities in and between mission areas. In general, the "front end" of the requirements process will become more structured and disciplined to eliminate the perception of "unfunded mandates" that existed with MNSs and CRDs. The section about Operational Requirements Documents (ORDs) remains in effect. Future requirements documents, called initial capability documents, will focus more on capabilities and provide better support for evolutionary acquisition. Because of the upcoming changes, our discussion of the Requirements Generation System is general, and does not address MNSs and CRDs.[3]

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[2] Director of the Joint Staff memorandum, Subject: "Changes to the Requirements Generation System," DJSM-0921-02, October 7, 2002.

[3] For reference, the Chairman of the Joint Chiefs of Staff Instruction 3170.01B, "Requirements Generation System," April 15, 2001, is available at http://www.dtic.mil/doctrine/jel/cjcsd/cjcsi/3170_01b.pdf.

How the System Works

Each service, the U.S. Special Operations Command (USSOCOM), and under certain conditions the defense agencies, analyze their missions and capabilities and develop requirements for their areas of responsibility. These organizations develop a vision of their future, considering strategy, policies, threats, capabilities, doctrine, technology, and budgets. The analyses of their capabilities build on their analyses of the mission and determine the mission needs, usually expressed as opportunities and deficiencies. The analyses of mission and capabilities identify needs for future doctrine, organization, training, leadership, materiel, personnel, and facilities.

These early analyses give the other functional communities their first opportunity to influence the requirements generation system. The analyses of mission and capability may identify opportunities for exploiting technology breakthroughs that provide new capabilities for fulfilling warfighter needs, reducing total ownership costs, or improving the effectiveness of current equipment and systems. The key at this stage is to engage all communities and industry as early as possible. Requirements developers should search for different ways of fulfilling the mission and not limit their analysis to the technologies that are being developed in the DoD system. They should look at systems or programs that are deployed or are being developed or produced by other services, agencies, or allied nations. In addition, their analyses should identify potential new concepts, including the use of existing U.S. or allied military or commercial systems. The analysts should consider cost-reduction measures in each stage of the system's life cycle and look for ways of reducing costs by using innovative technology, engineering, manufacturing, support, or training.

In the future, requirements personnel will assess the needs for new systems based on the potential contribution to, and interoperability with, an integrated mission-area architecture. These architectures will be used to synchronize and manage the development of joint warfighting capabilities. If the need for a new system is justified, the organization will develop a requirements document.

The ORD is the current requirements document for new systems. Most new systems must have ORDs, although exceptions exist (the Missile Defense Agency, for example, has been allowed to develop certain systems without an ORD). An ORD is a formatted document that contains requirements for operational performance for a proposed system or concept. These operational performance requirements are tailored for the specific system (e.g., ship, missile, aircraft, vehicle, or communications system) and describe the system-level performance capabilities such as range, speed, survivability, and interoperability. An approved ORD constitutes a "requirement" for a new system. The requirement, when funded, will be the basis for a new acquisition program. The ORD is also used to develop the requirements for testing and evaluating the performance of the system. The

requirements community must coordinate closely with the test and evaluation community throughout the requirements generation process, especially with programs using the blocked, or phased requirements structure that supports evolutionary acquisition.

The requirements generation process requires a team of functional experts to support the capability development process. The technology, producibility, sustainment, interoperability, affordability and test and evaluation issues must be understood early in the requirements generation process. Close and continual communication with these functional experts will ensure that the required capabilities are achievable, the performance parameters are realistic, and that the system is affordable in terms of both initial procurement and total ownership costs.

DEFENSE ACQUISITION SYSTEM

The general policies for the defense acquisition system are outlined in the DoD 5000 series documents, which are being revised. These documents describe a flexible, yet disciplined, approach for meeting technology challenges.

There have already been significant changes to the Defense Acquisition System in recent years. The concept of evolutionary acquisition was introduced in the 2000 version of DoD Directive 5000.1 and DoD Instruction 5000.2, and will continue to be the central concept in the Defense Acquisition System.

Evolutionary acquisition is an acquisition strategy that defines, develops, produces or acquires, and fields an initial hardware or software increment (called a phase or block) of operational capability.[4] Evolutionary acquisition is based on technologies demonstrated in relevant environments, time-phased requirements, and demonstrated capabilities for deploying manufacturing or software. Evolutionary acquisition provides capabilities to the warfighter in increments. The capability is improved over time as technology matures and the warfighters gain experience with the systems. The first increment can be provided in less time than the "final" capability. Each increment will meet a useful capability specified by the user (i.e., at least the thresholds set by the user for that increment); however, the first increment may represent only 60 to 80 percent (or less) of the desired final capability. Each increment must be tested and evaluated to ensure that the warfighter receives the needed capability.

Two basic approaches are used for evolutionary acquisition. In one approach, the final functionality can be defined at the beginning of the program, with the content of each increment determined by the maturation of key technologies. In the

[4] Under Secretary of Defense (Acquisition, Technology, and Logistics), "Evolutionary Acquisition and Spiral Development," memorandum. Washington, D.C.: April 12, 2002.

second approach, the final functionality cannot be defined at the beginning of the program, and each increment of capability is defined by the maturation of the technologies matched with the evolving needs of the user.[5]

Contemplated Changes to the Defense Acquisition System

New versions of DoD Directive 5000.1 and DoD Instruction 5000.2 will promote flexibility along with common sense, business-based decision making. These documents will emphasize decentralized responsibility, tailoring, innovation, continuous improvement, technology development, transition planning, reduced cycle time, and collaboration during the acquisition process. The documents will include the following key changes:

- Closer integration with the requirements generation system, and increased "front end" planning and roadmapping;
- Continued emphasis on evolutionary acquisition, the preferred strategy for rapid acquisition of mature technology; and
- Simplified and flexible management that decentralizes the responsibility for deciding about acquisitions where possible, and increases the emphasis on innovation and tailoring of programs.

The emphasis on evolutionary acquisition will continue. Changes will be made to the "front end" of the process (currently called concept and technology development) to improve the alignment with the requirements and resourcing processes and provide technology development strategies. This increased planning and the additional flexibility in the system should resolve issues earlier and provide a more stable path for programs as they proceed through the process.

How the System Works

We discuss the defense acquisition system, as currently outlined in the DoD 5000 series documents, in detail in Chapter 2.

FINANCIAL MANAGEMENT SYSTEM

The third decision support system is the financial management system, which is designed to give DoD's warfighters the resources they need. The laws and guidance from the U.S. Congress, circulars issued by the Office of Management and Budget (OMB), and the financial management regulations promulgated by DoD establish the framework for the financial management system.

[5] Ibid.

Contemplated Changes to the Financial Management System

At this writing, DoD is considering significant changes to its part of this financial system but has not formalized most of them. The discussion below is current at the time of publication, but there may be changes in the near future.

How the System Works

DoD relies on its Planning, Programming, and Budgeting System (PPBS) to formulate defense budgets. The budgets are formulated beginning with a planning phase that establishes guidelines for budgets. The Secretary of Defense promulgates the guidelines in the Defense Planning Guidance (DPG) document and also imposes fiscal limits. Next, the programming phase translates the planning guidance into specific programs, resulting in the Program Objectives Memorandum (POM). POM programs must fit within prescribed fiscal limits. Final decisions are made, and detailed pricing issues addressed, in the budget portion of this process. Until recently, OSD reviewed the POM and budget of each service and defense agency separately, but in 2002, OSD reviewed the POMs and budgets together. The OSD review leads to a DoD-wide budget that the President includes in his annual budget submission to Congress in February of each year.

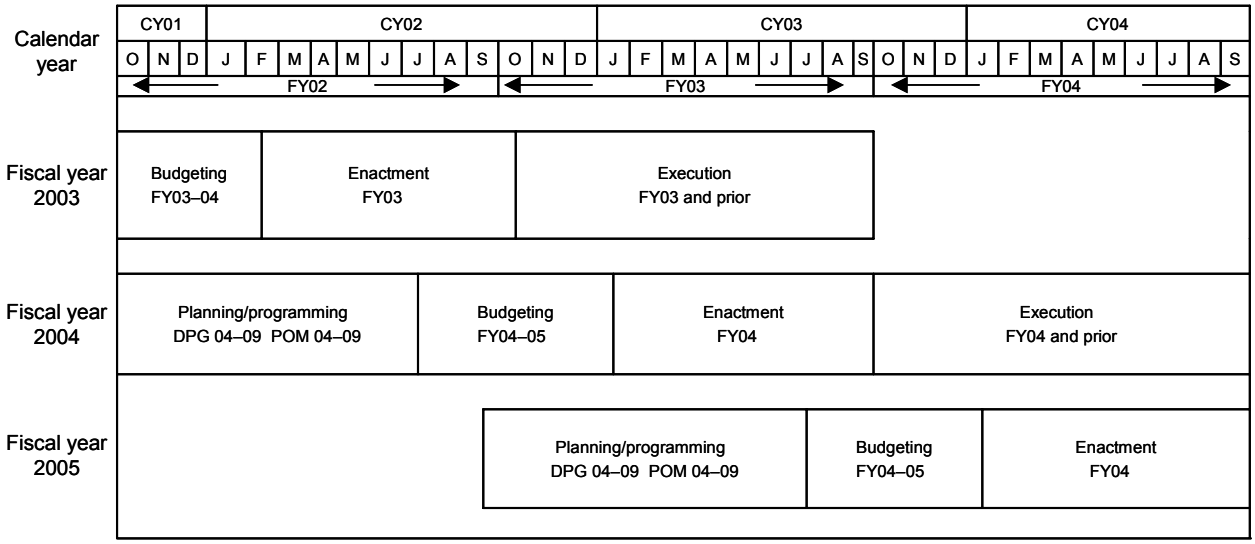
The congressional review consists of three steps: formulation of a budget plan for the entire federal government, authorization of defense programs, and appropriation legislation that makes funds available. Each step can include hearings, deliberations by congressional committees, legislation that is debated by committees and on the floor of the House and Senate, and votes by the House and Senate. The authorization and appropriations phases result in legislation that must be signed by the President. Once legislation has been enacted, funds are available for spending. The funds must be spent or "executed" in accordance with an extensive set of laws and regulations.

The financial management process is lengthy and, for that reason, budgets for many different years are being considered at the same time (see Figure 1-1). For one particular budget, the set of steps—from budget formulation through execution—can take many years. Just guiding a major routine proposal through planning, programming, and budgeting and getting it enacted by Congress can require 18 to 24 months. Execution can take several more years. Changes can be made during execution through what are termed "reprogramming" actions, but such changes are supposed to be limited to emergencies and are the exception, rather than the rule.

The financial process also has many constraints. The DoD financial management regulations, which document the constraints, consist of thousands of pages and impose many limits on the types and uses of funds. For example, science and technology (S&T) projects must be financed with certain types of research and

development funds while more mature development must use other types of research funds. A weapon or system must be purchased using yet another type of funding. DoD managers have only very limited ability to shift among different funds, or "colors of money" as they are sometimes called.

Figure 1-1. The PPBS as of 2002



This lengthy, constrained financial process poses a significant challenge for technology managers and generates some of the "transition" issues that we discuss in this guide. Planning inventions 2 years in advance to comply with the financial process can be difficult or impossible, especially for innovations that rely on rapidly changing technologies. Shifting funds as a program matures can make budgeting a challenge. If managers are not careful, shifting from one type of fund to another can result in a gap in funding (sometimes known as the "valley of death") that can threaten the program.

DoD is seeking increased flexibility for its acquisition managers, but many of the basic constraints in the financial management system will not go away. The key players from all communities, and especially those in the S&T and acquisition and financial communities, must work together to make the PPBS process work. Only if the players understand each other's challenges and communicate will we be able to encourage technology transition within the constraints of the federal financial management system.

THE GOVERNMENT PLAYERS

Transitioning technology successfully requires innovative players who understand their roles, and the roles of others in the process. Technology transition has many players. To focus our discussion, we have chosen eight communities that have important roles and high levels of interaction in transitioning technology.

REQUIREMENTS COMMUNITY

The requirements community represents the ultimate user—the warfighters—in the services and USSOCOM, that will deploy, operate, and maintain the weapons and support the systems needed for military operations. The term *warfighter,* as used in this guide, includes both organizations and personnel that conduct combat operations and the many other organizations and personnel that support the warfighting capabilities.

The requirements community develops warfighting concepts for as many as 20 years into the future. Concepts are captured in documents such as *Joint Vision 2020*.[6] These documents and other "long-range" warfighting concepts provide input into the Joint Warfighting Capability Objectives (JWCOs) contained in the *Joint Warfighting Science and Technology Plan.*[7] The JWCOs guide the planning for applied research and advanced technology development. They describe the specific performance parameters for new systems. The requirements community validates the military requirements for new capabilities. Before a new system is fielded, users participate in testing and evaluating the operation of the system to ensure that the new system is safe to use under realistic conditions and will meet the required operational need.

In the past, many ORDs established extremely challenging performance requirements that often resulted in long, high-risk, and expensive development and acquisition programs. Evolutionary acquisition uses more realistic requirements that will enable the rapid fielding of an initial capability to the warfighter, followed by new versions with incremental improvements in capability.

While the equipment is being developed and fielded, the government communities for requirements, acquisition, R&D, and sustainment work together as a team, along with industry, to refine the details of the system and agree on tradeoffs needed to make the system affordable. While a system is being developed, the requirements community should identify the essential capabilities needed but allow the developers the flexibility to determine how the need is met. Giving the S&T, R&D, and acquisition communities the largest possible "solution space" will enable innovation and the balancing of performance, operational and support characteristics.

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[6] *Joint Vision 2020* is the Chairman of the Joint Chiefs of Staff's long-range vision document outlining the capabilities that are needed to produce a highly effective, interoperable Joint Force in the year 2020. This document is available at http://www.dtic.mil/jv2020/jvpub2.htm. Services, USSOCOM, and other organizations with input to the requirements have equivalent "vision documents" that align with *Joint Vision 2020*. For an example, see the *Air Force Vision 2020* at http://www.af.mil/vision/vision.pdf. This website has links to the 2020 vision documents of other services and the Coast Guard.

[7] Deputy Under Secretary of Defense (Science and Technology), *Joint Warfighting Science and Technology Plan*. Washington, D.C.: February 2000.

The requirements documents specify interoperability requirements and establish affordability objectives. Interoperability refers to the ability of systems to function in forces that include multiple U.S. services as well as allied and coalition forces. Affordability objectives take into account the relative economic value of the capability compared with alternatives that compete for funding. One reason for establishing an affordability objective is to guide tradeoffs of "cost as an independent variable" (CAIV) early in the conceptual design. CAIV also can be greatly enhanced by setting goals and thresholds for most requirements and identifying critical capabilities that must be provided.

SCIENCE AND TECHNOLOGY COMMUNITY

The S&T community consists of the government academicians, scientists, and managers of S&T who understand the technologies that will be needed for future systems.

The S&T community includes technology development sources, such as government labs and agencies (e.g., the Defense Advanced Research Projects Agency [DARPA]) and industry labs. The S&T community focuses on developing and understanding technologies. The S&T community should also focus on rapidly transitioning technology to affordable products and teaming with acquisition and sustainment program managers (PMs) to address user needs. To accomplish their goals the S&T community uses programs and processes, such as:

- Advanced technology demonstrations (ATDs),
- Advanced-concept technology demonstrations (ACTDs),
- Joint and service/USSOCOM experimentation,
- Small Business Innovation Research (SBIR) program, and
- Independent research and development (IR&D).

S&T planning balances the need to support future warfighting concepts with the need to support research in other areas that may produce breakthroughs that the warfighters have not envisioned. In general, S&T programs that align with specific future warfighting needs will receive the highest priority for funding.

Academia and industry are sources of IR&D as well as contracted R&D supporting DoD's S&T objectives. Increasingly, commercial R&D is of major interest to the DoD, particularly R&D in computers, software, electronics, cryptography, telecommunications, robotics, and the medical and biological sciences. To take advantage of these resources, DoD's requirements, R&D, acquisition, sustainment, and S&T communities need to stay abreast of domestic and international

R&D as a market research function. They must also provide "seed money" (contracts, grants, cooperative agreements, or other transactions) to harvest and assess emerging commercial technology that may be of use to the military.

ACQUISITION COMMUNITY

The acquisition community includes acquisition executives, program executive officers, PMs, and their staffs. In response to a validated operational or business need, they build or acquire new or improved weapons systems or the capabilities or services inherent in information systems.

By policy, a PM is designated for each acquisition program. The PM directs the development, production, and initial deployment of a new system. The new system is created within limits of cost, schedule, and performance, as approved by the PM's acquisition executive. The PM's role is to ensure the warfighter's modernization requirements are met efficiently and effectively in the shortest possible time.

The acquisition community does not operate with a set plan for all systems. They interact with requirements personnel and technology providers, and develop tailored acquisition strategies that fit the needs of particular programs, consistent with the time-sensitive needs of the user's requirement, applicable laws and regulations, sound business management practices, and common sense. The current acquisition policies allow and encourage PMs to enter the acquisition process at different decision points, depending on the maturity of the concept, requirements definition, and technology. While the system is being developed, PMs work with the requirements community to maintain a balance of cost, schedule, and performance. They can trade performance and schedule objectives to achieve the cost and affordability goals for the programs. Sometimes, new or improved technologies that will reduce costs or improve performance become available while the system is being developed. PMs should be alert to these opportunities and keep their programs flexible enough to adopt these advantageous technologies.

RESEARCH AND DEVELOPMENT COMMUNITY

The focus of the R&D community is developing and supporting technologically superior and affordable systems for warfighters. The R&D community evaluates technologies and conducts applied research. They also engineer and design candidate systems and components. The community is responsible for getting the technology to the field. Its responsibility does not end when an item is fielded. The community continues to work with the warfighters and the sustainment community as they operate and maintain the capability in the field.

The R&D community supports the acquisition community by developing systems; reducing integration and manufacturing risks; ensuring operational supportability (with emphasis on reducing logistics support during use); integrating human systems; ensuring that systems are interoperable and can interface, as needed, with

other systems; ensuring that the systems are safe to use during demanding military operations; and last, but not least, giving the warfighters systems they need.

SUSTAINMENT COMMUNITY

Major systems may remain in the hands of the military for 20 years or more. Maintaining these systems and ensuring that they continue to operate at the highest possible levels is the responsibility of the sustainment (logistics) community. The term "sustainment community" includes the entire range of operations and support functions. The sustainment community includes PMs; item managers; and the supply, maintenance, and procurement personnel that support fielded equipment. This community improves the reliability, maintainability, and supportability of weapons systems by updating technology and other means. The challenge is to give this community the information and resources that it needs to exploit technology throughout a system's life.

The sustainment community operates at the end of the cycle of introducing new technology, but should be highly integrated with other communities. The requirements community emphasizes logistics supportability when it develops the ORDs for new systems. Reducing the logistics burden enables the warfighters to reduce their logistics footprint and to focus their resources on capabilities that can defeat an enemy. The acquisition community supports the logistics community by including supportability as a design factor and emphasizing logistics during the systems engineering process.

Because weapons systems are being retained longer, PMs and the logistics community are increasingly having to deal with obsolescence. If systems are designed with open architectures, their lives can be extended using replacement parts or upgrades that don't require redesigning the system.

TEST AND EVALUATION COMMUNITY

The test and evaluation (T&E) community independently assesses how well systems perform technically; how well the system fulfills documented requirements; and whether systems are safe, operationally effective, and suitable and survivable for their intended use in military operations. Two general types of testing are used: developmental and operational.

Developmental tests answer the question: does the system do what it was intended and designed to do? Developmental tests are any engineering-type tests used to verify the status of technical progress, verify that design risks are minimized, substantiate that contractually-required technical performance has been achieved, and certify readiness for initial operational testing.

Operational tests answer the question: will the system give the warfighter the needed capability, under demanding military operational conditions and when operated and maintained by warfighters? Operational tests are the field tests, under

realistic conditions, of an item (or component) of weapons, equipment, or munitions. Operational tests determine the effectiveness and suitability of the weapons, equipment, or munitions for use in military operations by typical military users.

The test and evaluation community does not develop the requirements for their tests. The community gets them from requirements documents and other sources. Ensuring that the test and evaluation community is part of the collaborative process used in developing systems is important. The community must have input into the process and clear and well-defined guidance about how the system is expected to perform. The evolutionary acquisition concept challenges the requirements, acquisition, sustainment, and test and evaluation communities to coordinate closely and continually when developing and testing "phased" or "blocked" programs to ensure that the T&E community is aware of what will constitute a "useful increment" of capability. Only with this knowledge can the T&E community design appropriate tests.

The test and evaluation community supports evolutionary acquisition by being continuously involved in the acquisition process, beginning with integrating T&E issues in the concept and technology development phase. PMs can form a working-level integrated product team (WIPT) to assist with T&E issues. The WIPT should include contractor and government developmental T&E personnel; operational T&E personnel; live fire test and evaluation (LFT&E) personnel (if applicable); and intelligence personnel. A T&E WIPT can assist a pre-systems acquisition activity (e.g., ACTD, ATD, or joint warfighting experiment) that is likely to develop into an acquisition program.

FINANCIAL COMMUNITY

The financial community includes personnel in charge of overall financial activities, budget officers who prepare and defend defense budgets, and personnel who manage the spending or execution of those budgets. Employees of the Defense Finance and Accounting Service also provide financial support by paying defense contractors and supplying accounting information and services. Every major headquarters and most bases and installations have financial personnel.

Financial personnel are responsible for providing warfighters with the resources they need to carry out defense missions. In the process, the financial personnel support and interact with all functional communities. The interactions with the acquisition community are particularly extensive because the DoD buys so many products and because of the complexity of some of the purchases. In addition to providing needed resources, financial personnel must comply with strict timelines for preparing budgets, timelines that are often dictated by outside organizations, such as the OMB and the U.S. Congress. Financial personnel also must ensure compliance with all relevant laws and financial regulations. Although everyone must comply with laws and regulations, the financial community is the focal point for many compliance efforts.

Sometimes the responsibilities of financial managers—such as providing resources and ensuring compliance—conflict with those of other communities. An acquisition manager may want to engage in a transaction designed to speed up an important project or integrate new technology into a weapon system. The financial manager may object because the transaction cannot be done in the time allotted, or because it may violate regulations. Some conflicts are inevitable in an environment that demands rapid decisions about complicated topics, and the deliberations that result from a conflict often lead to better decisions. Conflicts can be minimized, and those that occur can be resolved more productively, if the acquisition and financial communities understand each other's roles and responsibilities.

SECURITY COMMUNITY

The security community consists of the intelligence, counterintelligence, security, and foreign disclosure organizations, staffs, and personnel. The security community advises the other functional communities about technologies sought by adversaries, capabilities for obtaining such technologies, countermeasures for protecting the technologies, and authorizations for transferring the technology to other countries.

Planning for protecting research and technology is an increasingly important aspect of technology programs. Appendix E, Research and Technology Protection Planning, outlines the considerations for ensuring that our critical technology is not disclosed to potential adversaries.

INDUSTRY'S NEW ROLE

As the previous section indicated, many government players are involved in technology transition. But industry also plays an important role, a role that is expanding as commercial R&D grows in importance.

Investment Trends

Although commercial spending for R&D has increased substantially in recent years, federal government spending has remained constant. Thus, the commercial sector may create a larger share of the new technologies that will support DoD's future requirements.

This shift toward commercial R&D is illustrated by the trends in total R&D funding in the United States and the amount of funding coming from the federal government. As shown in Figure 1-2, in 1993, total U.S. R&D investment was

$166 billion. The federal government's contribution to this investment was $64 billion—or 38 percent of the total.[8] By the year 2000, total R&D investment in the United States had grown to $245 billion while the federal government's contribution held nearly constant at $65 billion,[9] representing just over one-quarter of U.S. investment (All dollar figures are in constant 1996 dollars). Thus, the federal government's share of total spending dropped from 38 percent in 1993 to 26 percent in 2000. DoD accounts for almost half of the total federal funding for R&D and is the largest single federal sponsor of R&D.

Figure 1-2. 1993 and 2000 R&D Funding

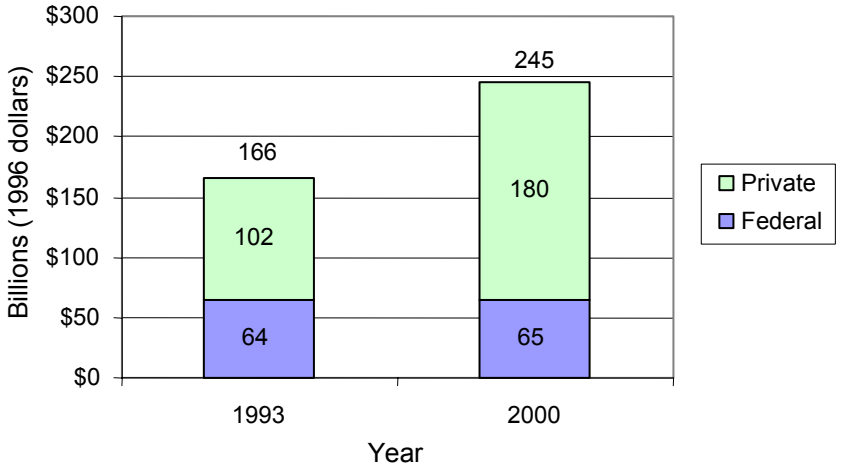


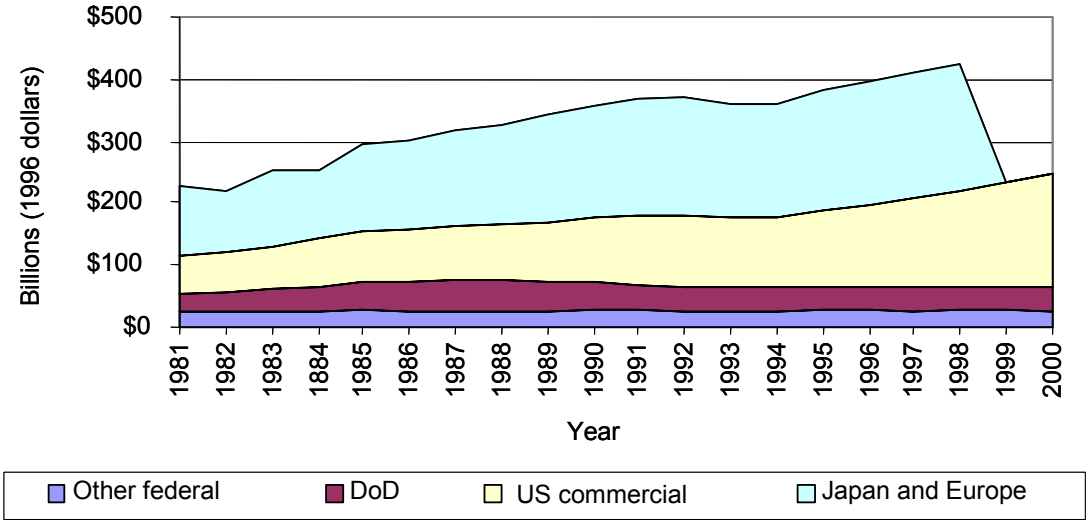
Figure 1-3 suggests that these trends are not new. Over the past two decades, commercial R&D spending has increased steadily over time, while DoD investment has remained relatively constant.

These trends suggest that DoD PMs should be more creative in integrating commercial and international technologies into defense applications. The technology can be integrated by creating partnerships between government and industry or by using DoD's direct access to industry's independent initiatives. In many cases, the technology the government needs already exists in commercial industry in some form. The government's challenge is to increase partnerships with industry to gain access to commercial technology, regardless of who provides the technology (a large or small business) and what tier supplier it is (first tier or lower).

[8] National Science Foundation, *National Patterns of R&D Resources: 1996—An SRS Special Report*, Division of Science Resources Studies, Directorate for Social, Behavioral, and Economical Sciences.

[9] Ibid.

Figure 1-3. R&D Investment



Not only has DoD's share of overall R&D decreased, but its importance in certain markets has shrunk dramatically, and with it, DoD's influence on the direction the technology. For example, DoD procures less than one percent of all semiconductors, a smaller share than the automotive industry. For this reason, unique defense requirements have little effect on the overall market, requiring DoD to use commercial technology in its military systems. Another effect of this trend is that DoD is unable to acquire intellectual property (IP) rights for commercially developed technology, as it has done for defense-funded technologies in the past, because DoD's financial involvement will be limited and its demand is not dominant compared with the worldwide commercial market. For this guide, the term "intellectual property" means patents, copyrights, trademarks, and trade secrets. PMs will need to identify alternative, more commercially friendly methods of protecting IP in order to transition commercial technology to defense systems.

A guide, "Intellectual Property: Navigating Through Commercial Waters,"[10] helps PMs identify issues and solutions for IP. During the last few years, several senior leadership policy letters have acknowledged this fundamental change in DoD's acquisition environment.[11]

Industry's Role

Industry is not a monolithic entity. It is made up of small, medium, and large companies. Some companies do business with the government routinely and others refuse to participate. We call them traditional defense contractors (TDCs) and

[10] Available at http://www.acq.osd.mil/ar/doc/intelprop.pdf.

[11] (1) USD(AT&L) Memorandum, September 5, 2000. Subject "Training on Intellectual Property." Signed by J.S. Gansler. (2) USD(AT&L) Memorandum, Jan 5, 2001, Subject: "Reform of Intellectual Property Rights of Contractors." Signed by Dave Oliver (3) USD(AT&L) Memorandum, Dec 21, 2001. Subject: "Intellectual Property." Signed by E.C. Aldridge, Jr.

nontraditional suppliers (NTS), respectively. Myriad reasons exist for the reluctance by some companies to enter the defense market, including some who may have very important technologies needed by the military. Two of the major reasons cited are the need to protect IP and stringent government cost accounting requirements. PMs, as a result, must consider the contributions, limitations, and possibilities of each segment of industry when developing strategies to access technology from industry.

Table 1-1 provides summary investment, employment, and patent filing information to illustrate some differences between small and large business participation in R&D.

Table 1-1. Business Participants in DoD Technology Development

Business segment	Small business	Large business
Dollars invested in industrial R&D, 2000	$33 billion	$148 billion
Percent of industrial R&D $	18 percent	82 percent
Employment, 1999	55,729,092	54,976,569
Percent employment	50.34 percent	49.66 percent
No. of industrial patent filings in 1999	34,020	52,102
Percent of industrial patents filed	39.5 percent	60.50 percent

LARGE BUSINESS[12]

Two distinct sectors exist in the large business community where technology can be accessed by defense PMs—TDC and NTS.

Traditional Defense Contractors

TDCs support DoD throughout the life cycle of systems, beginning with basic research and extending to production, sustainment, and disposal. TDCs may undertake high-dollar-valued fully-funded research and development contracts, some of which are large, for which their corporate investment is often very little. The number of patents issued to defense firms is very low compared to non-defense firms, yet defense firms fund approximately $2.8 billion in IR&D, often spent on technologies they want to protect.

DoD has established relationships with larger defense prime contractors for systems contracts, relying on their ability to integrate and manage systems to develop, deliver, and maintain major weapons systems. These contractors increasingly are responsible for maintaining open systems architectures, in which

[12] Usually defined as firms with more than 500 employees. Normally divided into a number of separate business units and research facilities.

alternative technology solutions offered by the subcontractor supply base are introduced. Understanding the defense business, TDCs have adapted to its peculiarities and culture over time.

To encourage favorable partnerships between large TDCs and non-traditional small and large businesses, and to encourage prime contractors to implement the best available technology solutions, the government often requests, during source selection, that potential prime contractors submit a subcontracting plan as part of their proposals. The subcontracting plan should describe how the prime contractor plans to manage the supply chain to create and maintain competitive alternatives so the government can get the best technological solution for its military needs.

Non-Traditional Large Firms

Non-traditional large firms also play a key role. Eighty-two percent of commercial R&D investment and 60.5 percent of the patent filings come from non-traditional large firms. Accessing this part of the marketplace for commercial technology is increasingly important.

Non-traditional firms also achieve more patents per firm. A 1998 analysis compared the top six defense firms with the top six integrated dual-use commercial companies (IDCCs). The study revealed that for every patent issued by a defense firm, six were issued to an IDCC firm. This comparison illustrates that DoD's direct funding of R&D makes defense firms different from non-traditional firms.

The companies responsible for the worldwide technology revolution in recent years typically are non-traditional large firms that do little or no business with DoD. The investments made by NTS are important to DoD and learning to attract them to the defense market is a difficult task. Studies indicate that non-traditional firms are reluctant to enter the defense market, primarily because of IP issues and long product development times associated with weapons systems.[13]

Leading-edge commercial firms assure their continued existence and growth primarily by selling developed products and services in the highly competitive commercial market. Virtually every technology-rich commercial business aggressively protects its proprietary data. Normally, only a relatively few trusted business and technical employees, with a vested interest in the commercial success of the development, will have access to the data until production begins.

Non-traditional firms will not enter into an agreement or share their technology with DoD if they risk losing control of their IP. Agreements that give the government the rights to use the firm's technology, or that could require compulsory licensing of the firm's technology to another entity (even if the probability of such licensing is low) can prevent a firm from entering into an agreement with the government. Because of industry's vital need to protect its proprietary data, DoD may

[13] *Conducting Collaborative Research with Nontraditional Suppliers.* Dr. Kenneth Horn et al. November–December 1997. Army RD&A, p 40.

need to use "other transaction (OT)"[14] authority to jointly develop technology. The authority for other transactions gives the government the flexibility for negotiating a balance that suits both parties and helps alleviate the concerns of commercial firms. PMs should consider using this type of authority. Even if they do not use OT authority, they must avoid including clauses in agreements that place unnecessary controls on a commercial firm's technology.

SMALL BUSINESS[15]

Small business invested $33 billion[16] in R&D in FY00 (see Table 1-1). Small businesses and independent inventors, who filed for 39.5 percent of the U.S. patents in 1999,[17] are vital to the economy. They typically work as subcontractors and lower-tier suppliers to defense contractors. They can work as prime contractors in certain situations, especially where their products are provided as government-furnished equipment to prime integrating contractors.

Small businesses can assist in transitioning technology into weapons systems. They are able to adapt to changing requirements and rapidly deploy new technologies. Traditional small businesses accommodate the defense culture and business environment more readily than do non-traditional small businesses which might not consider working for DoD.

The government may want to contract directly with a small business or obtain its support through a subcontract. The government also can encourage the traditional defense contractors to use small businesses to access technologies by putting incentives in the prime contracts, such as an award fee, for using small businesses.

Traditional Small Defense Firms

The defense small business community is large and plays a key role in defense acquisition programs through the myriad programs established to access and develop small business capabilities. One of the ways of reaching this community is through the SBIR program that funds technology programs. PMs should consider the potential associated with SBIR programs and urge their prime contractors to do the same. Primes need to treat small defense firms as an important source for accessing technology and nurture their innovative capability.

Non-Traditional Small Firms

Reasons for accessing non-traditional small firms (NTSF) are very much the same as those for large non-traditional firms. Because small companies are flexible,

[14] A description of the Other Transaction authority is provided in Chapter 2.

[15] Usually defined as firms with fewer than 500 employees.

[16] Data compiled from National Science Foundation Table 1, Table 1B National expenditures for R&D, from funding sectors to performing sectors: 1993–2000.

[17] Data collected by integrated dual-use commercial companies consortia from a Patents and Trademark Office report of 1999 patents filed.

they often can respond to market opportunities and technology breakthroughs faster than larger, more established organizations.

PMs should pay attention to the ability and interest of their traditional defense contractors in accessing technology from non-traditional small firms. As with large non-traditional suppliers, non-traditional small firms will be unwilling, and often unable, to comply with the myriad government-unique requirements for cost accounting, auditing, oversight, and use of IP.

Chapter 2
Technology Transition Planning and Tools

Technology transitions can occur within the government, and between government and industry. This chapter discusses the background and some of the issues associated with each of the two types of transitions. The chapter also addresses tools that are helpful in achieving successful technology transitions. Finally, the chapter identifies key challenges and suggests ways to overcome them.

PLANNING GOVERNMENT-TO-GOVERNMENT TRANSITIONS

Government-to-government technology transitions can occur, for example, when a government lab provides a technology to an acquisition program for application in a new weapons system. Those dealing with government-to-government transitions need to understand the environment in which transitions take place and the regulations that govern them.

Environment and Challenges

Technology transition often starts with the S&T process. This process is a pre-acquisition activity that focuses on gaining knowledge about technologies that apply to the military. The S&T community is challenged to maintain a broad-based program that addresses all sciences relevant to defense, with an emphasis on future needs and technologies that are not being investigated by industry. The S&T community oversees the developing technologies until they are mature enough to be integrated into new systems. The acquisition community then oversees the maturation of a technology until it is fully incorporated in a specific system.

The transition of oversight between the two communities does not occur at a fixed point in the development process. How and when the transition occurs depends on many factors. The transition between the S&T and acquisition communities is one of the critical phases in developing a product. To ensure the transition is successful, the two communities must communicate, their responsibilities must be clearly delineated, and funding must not be interrupted.

DoD's budgetary arrangements usually require that transitions be predicted 18 to 24 months in advance. DoD's Research, Development, Test, and Evaluation (RDT&E) budget account is divided into seven categories, each with a numerical designation, as shown in the Table 2-1.

Table 2-1. DoD RDT&E Budget Account

Community	Numerical designation	Category
Science and Technology	6.1	Basic research
	6.2	Applied research
	6.3	Advanced technology development
Acquisition	6.4	Demonstration and validation
	6.5	Engineering and manufacturing development
	6.6	Management support
	6.7	Operational systems development

Typically, RDT&E funding, which is available for obligation for 2 years after it is appropriated, is used for all efforts under this budget account.

Categories 6.1 through 6.3 comprise S&T efforts; acquisition programs are in categories 6.4 through 6.7. Traditionally, technology moves through these budget categories linearly, with a management shift from S&T to acquisition either at the 6.3 or 6.4 point. To make a seamless transition, the S&T and acquisition communities must communicate early and often. For example, the communities must discuss planned upgrades to existing acquisition programs to ensure that the S&T community's 6.3 programs meet the phasing of the acquisition community's upgrades. The Integrated Product and Process Development (IPPD) process outlined in this chapter can assist with the communication challenges and help to ensure a smooth transition.

Operating under this budgetary arrangement, the S&T and acquisition communities face a number of challenges associated with technology transition. The primary ones are:

- Contracting strategy—motivating the contractors to provide a best-value solution (in terms of overall life-cycle cost-effectiveness) and transition into procurement without losing momentum
- Interoperability—ensuring that the technology can interface with other systems on the battlefield
- Supportability—ensuring the fielded systems maintain a high state of readiness and safety, using trained operators and maintainers, and do so economically and with the smallest possible logistical footprint
- Test and evaluation—integrating testing and evaluation of both development and operations swiftly and economically to ensure that requirements are met and the system is operationally satisfactory and useful

- Affordability—setting goals for acquisition and life-cycle costs that permit CAIV trade-offs of requirements, then later design-to-cost (DTC) trade-offs within a fixed set of requirements. Sustainment issues must be addressed as early as possible, to reduce the total ownership cost associated with a system
- Funding—choosing the proper strategy for obtaining the resources necessary for acquiring the technology
- Requirements—evolving from mission need and performance goals to a formal ORD or system performance specification, then to applying the technology.

DoD's 5000 Series Documents

As the discussion of the environment suggests, technology transition involves several key players and must confront a number of challenges. The DoD 5000 series provides the framework for addressing and overcoming the challenges.

As DoD's basic acquisition policy documents, the DoD 5000 series is the basis for meeting technology challenges and creating a future when advanced technology can be delivered to our warfighters faster; at lower total ownership costs; using interoperable, affordable, and supportable systems. The DoD 5000 series documents[1] describe mandatory procedures for major defense acquisition programs (MDAPs) and major automated information system (MAIS) acquisition programs and are a model for other defense acquisition programs.

The following section is an overview of the April 2002 5000 series, which has been rescinded. A new 5000 series will be published in early 2003. Likely changes are discussed in Chapter 1.

OBJECTIVES OF THE 5000 SERIES

As introduced in Chapter 1, the previous (April 2002) 5000 series policy incorporates three objectives for acquiring new systems: (1) providing proven advanced technology for the warfighter faster, which reduces cycle time; (2) making systems more affordable; and (3) creating systems that interoperate and are supportable.

To meet the first objective—getting the best technology into the hands of the warfighters as quickly and efficiently as possible—we need to reduce the cycle time for developing new systems. That means moving to time-phased requirements and evolutionary acquisition while relying on commercial technology whenever possible. Using time-phased requirements involves developing systems based on a

[1] DoDD 5000.1 and DoDI 5000.2 can be accessed through the links at http://www.acq.osd.mil/ap/index.html.

shorter time horizon to meet foreseeable threats while developing better information about future threats. Evolutionary acquisition involves using current and proven technologies while refining tomorrow's technologies for tomorrow's systems. The combination of time-phased requirements and evolutionary acquisition gives the warfighters increasingly better capability and the most advanced technology. It also allows these systems to be upgraded as the technology evolves.

To reduce the time needed for developing new systems, the April 2002, 5000 series documents introduced a new acquisition model that extends from S&T phases, through system acquisition, all the way to operation and support. The new model has three distinct phases:

- Pre-systems acquisition, which includes developing mission needs and technology opportunities, as well as concepts for developing technology
- Systems acquisition, which includes developing, demonstrating, producing, and deploying the system
- Production sustainment, which includes operation and disposal.

To meet the second objective of the DoD 5000 series policy—making systems more affordable over their life cycles—PMs need to understand the value of a required capability to the warfighter. In other words, how much is the warfighter willing to invest in a particular system for both acquisition and support? PMs also need to have an acquisition and logistics strategy that maintains the pressure to hold down costs throughout the life cycle. Warfighters can help PMs when, as recommended by the DoD 5000 series instructions, they define requirements upfront in terms of a limited number of performance parameters as well as an affordability goal, giving the PM and industry partners adequate trade space[2] to develop affordable solutions. Another way to maintain affordability throughout the life cycle is to have competition, if not for the prime contract then at lower levels of the supply chain where the bulk of the cost for complex weapons systems is normally incurred. By ensuring head-to-head competition or by exploring alternative solutions to mission needs, PMs and prime contractors can keep new systems affordable.

Finally, to meet the third DoD 5000 series objective—ensure that a system can operate with other systems in the battle space while supporting the systems acquired—PMs need to focus on interoperability and supportability. *Interoperability* means viewing each system in the context of a family of systems. In other words,

[2] "Trade space" is a term used in the CAIV process. Requirements are divided into two categories, non-negotiable "Key Performance Parameters", and "requirements". The Key Performance Parameters must be delivered at threshold levels. The other requirements can be "traded off" (causing reductions in performance and capability in non-critical areas) to meet affordability goals. The Program Manager's ability to reduce program costs by reducing non-Key Performance Parameter requirements is the PM's "trade space."

how does each system interface with the other systems from which we seize information or support, and how does it feed information and support to other systems? *Supportability* means building support into the design and emphasizing total system support and operational sustainment. To ensure supportability and interoperability, the documents emphasize the importance of including supportability as part of the performance metrics when development begins.

MILESTONE DECISION POINTS

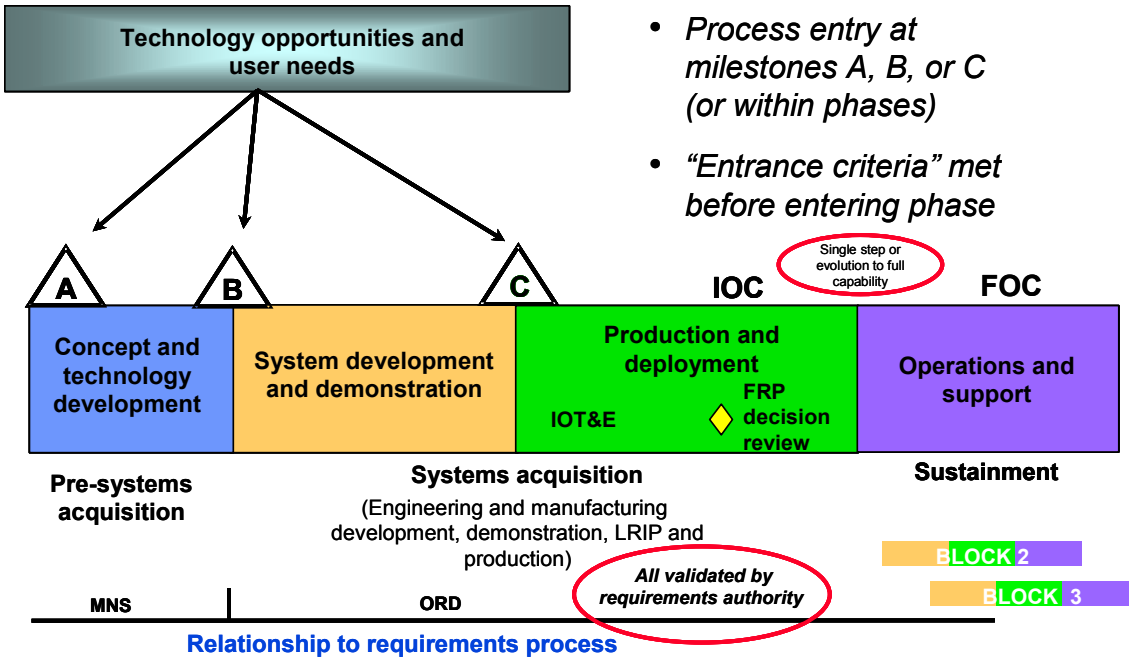
The defense acquisition system consists of a number of steps and milestones, with flexible and tailorable entry and exit points. The process begins when a mission need requiring a solution is matched with an available technology. This process can happen at one of the three following milestone decision points:

- Milestone A—the PM explores alternative concepts including mature key technologies
- Milestone B—the PM knows the system's architecture, knows the technologies are mature, and has both a requirement and funding
- Milestone C—the PM already has developed the system and it works in a way that has military utility.

After the PM has done the necessary operational testing to determine that the system is effective, suitable, and survivable, then a full-rate production decision can be made. After production, the PM can operate and support the system throughout its useful life and then dispose of it in an environmentally safe way. The 5000 series model in Figure 2-1 shows that PMs can either build on multiple blocks of increasing capability, or, if justified, immediately build full capability.

The model separates technology development from system integration, and production comes after the capabilities of the technology are demonstrated. Ultimately, the model enables PMs to reduce cycle time by concentrating on proven technology and producible systems. All of these features of the acquisition process are part of the criteria that must be met before entering each phase. Depending on the maturity of the technology and the user need, a program can begin at any phase of the development continuum.

Figure 2-1. The 5000 Series Model at End of CY02



Note: FOC = full operational capability; FRP = full rate of production; IOC = initial operational capability; IOT&E = initial operational test and evaluation; LRIP= low rate of initial production; MNS = mission need statement; ORD = operational requirements document.

TOOLS FOR INDUSTRY-TO-GOVERNMENT TRANSITIONS

In the past, DoD developed technology that it needed without much emphasis on how the technology affected, or was affected by, the commercial sector. Defense technology was ahead of commercial technology in many of the critical areas needed by the department. Now, industry's technology is the leader in many areas. DoD must seek the state-of-the-art technologies being developed by industry, and use the advantages of industry's market-driven and cost-constrained products.

In many ways, transitioning technology from industry to government involves the same issues and problems as government-to-government transitions. Therefore, the guidance and suggestions in the preceding section generally apply.

There are, however, special issues involved in transitioning technology from industry to government. Industry partners want reasonable compensation for their technologies and appropriate safeguards on their IP. Furthermore, companies that do not traditionally deal with DoD often shy away from government contracts because of unusual cost or auditing requirements. Non-traditional defense companies can be a source of innovation and technology, but they may not have the

resources to develop their technology independently to the degree needed for a particular program.

New tools exist to address the challenges of broadening the technology resources available to DoD by promoting industry-to-government technology transitions. Arrangements that would have been radical or impossible in the past are becoming routine. Under certain conditions, the government and industry can share resources while technology is being developed, and companies can use the results for their benefit. A number of tools are available, and more will become available as acquisition initiatives continue to be put in place.

Acquisition initiatives already have modified policies for collaboration, sharing costs, and offering incentives when working with industry partners. For example, contractual options exist that allow companies to retain some or all of their IP rights—a necessary precondition when DoD wants to use technology that can also be sold in large commercial markets. Other changes include a departure from restrictive military standard specifications, a more flexible menu of contracting options, the option of integrating military and commercial development and production, and a program for developing dual-use technologies.

Options also exist that will allow DoD to pool government and industry resources to tackle commercial technology programs of interest to DoD that are too large for industry alone. Incentives are available for increasing the profit margins of industry partners when they accept risk in program development. Use of these options and incentives requires detailed planning and coordination.[3]

As lessons continue to be learned, the acquisition process will improve these tools, and create new, more flexible ways to deal with industry. However, in most cases, the basic tools are in place, although to use them may require the agency to depart from its normal business and contracting processes. In some cases, the agency may resist such changes, but organizations that are familiar with the tools normally can find a way to operate that will bring industry into their programs while protecting the government. The ability to partner with industry and use its advantages in technology is critical for today's PMs and technology providers.

Understanding industry's perspective on technology transition opportunities is important. In industry, the business case analysis underlying an opportunity is usually the most important element considered. A return on investment (ROI) of 10:1 or higher is usually needed to proceed. If the ROI is less, the industry manager may not be allowed to proceed with the opportunity. Cost sharing and IP rights will be considered. If a company has a "world-class" technology, they will hold the IP rights closely. If the government wants industry to share the costs or the IP rights, the government may not have access to some of the best technologies. Understanding industry's viewpoint on specific programs also is important.

[3] A detailed discussion of this topic is in "Department of Defense (DoD) and Industry—A Healthy Alliance," master's thesis by Vicki L. John, Naval Postgraduate School, Monterey, CA 93943-5000.

For some technology development, industry will accept losing some exclusivity of its IP if the government shares some of the up-front costs. If the company can share costs and keep the IP, it may view the opportunity very favorably. Government technology personnel must understand industry's perspective about specific opportunities. They must then strike the balance that brings technology to the field, while protecting the government's interests.

Business Arrangements

Business arrangements are important considerations in planning industry-to-government technology transitions. The legislation authorizing an S&T program may include information about the specific business arrangement that must be used. Otherwise, an agency has the discretion to select from several business arrangements that are available for obtaining necessary S&T support. The legal instruments for S&T support are contracts, grants, cooperative agreements, OTs, and TIAs. Table 2-2 highlights some of distinctions among these S&T business arrangements.

Table 2-2. Distinctions Among S&T Business Arrangements

	Contract	Grant/ cooperative agreement	Cooperative R&D Agreement (CRADA)	Other transactions for prototype projects	Technology investment agreement
Principal purpose	Acquisition	Assistance	R&D	Acquisition	Assistance
Funding	Full or partial funding	Full or partial funding	Shared between partners	Full or partial funding	Full or partial funding
Publicity	FedBizOpps	FedBizOpps	Varies	FedBizOpps	FedBizOpps
Involvement level of government	Oversight only	Substantial for cooperative agreements	Partnership with CRADA partner	Substantial oversight and partnering with industry	Substantial oversight and partnering with industry
Typical S&T product	Deliverable end product	Research reports or training	Varies	Deliverable end product	Research reports
Typical recipient	Traditional for-profit government contractor	Educational or nonprofit institution	Industry, other government agencies, universities	Traditional government contractor with significant involvement by nontraditional for-profit commercial company	Traditional government contractor with significant involvement by nontraditional for-profit commercial company
Solicitation methods	Request for proposal, broad agency announcement, unsolicited proposal	Broad agency announcement, research announcement, unsolicited proposal	Selection by agency	Broad agency announcement, research announcement, program solicitation, unsolicited proposal	Broad agency announcement, research announcement, unsolicited proposal

As Table 2-2 illustrates, procurement contracts and OTs are used when the government's principal purpose is acquiring goods or services for its direct benefit. *Acquisition* is the act of acquiring goods or services that the government will use or that directly benefit the government, i.e., buying something that the government needs.[4] R&D, including S&T for meeting military needs, can be considered either goods or services, depending on the deliverable. Grants, cooperative agreements, and TIAs are assistance instruments. *Assistance* is used to support or stimulate activities for improving the public good.[5] Cooperative R&D Agreements are agreements that are not assistance instruments.

PROCUREMENT CONTRACTS

The government generally satisfies its acquisition requirements through a procurement contract. The framework for federal procurement contracts is in the Federal Acquisition Regulation (FAR) and its DoD supplement—the Defense Federal Acquisition Regulation (DFAR) Supplement. These regulations define a system whose objective is to acquire high-quality products on time and at reasonable cost. With some exceptions, the system relies on full and open competition, making the opportunity available to all responsible contractors.

Contracting begins with an agency researching the market and developing an acquisition plan. The program office, in conjunction with the ultimate user, develops a requirements document (i.e., a statement of work) and evaluation criteria to be used for selecting the source. Offers are solicited and an award is made. The award is a formal contract that defines the rights and responsibilities of the contracting parties, and describes the deliverables, schedule, and forms of payment. In general, R&D contracts are executed using the procedures of FAR Part 15, "Contracting by Negotiation."

Based on the Federal Acquisition Streamlining Act, FAR Part 12, Acquisition of Commercial Items, was created to promote the purchasing of commercial items and to enhance the opportunities for attracting commercial industry to the government marketplace. Using the streamlined procedures of FAR Part 12 to acquire commercial services—to include research-related services—furthers those objectives. In addition, recent legislative language gives incentives for using FAR Part 12 when buying performance-based services. FAR Part 12 permits DoD to procure commercially-available goods and services using terms and conditions appropriate to the private sector, and based on market prices instead of requiring detailed cost-based estimates. The prime contractor, when acquiring commercial items for use in a military system, should extend Part 12 to subcontractors. The Honorable Michael Wynne's 24 Aug 2001, memorandum about contracting for applied research states, "Although applied research … is generally suited to the use of cost-reimbursement types of contracts, some research requirements are

[4] Federal Grant and Cooperative Agreement Act of 1997, P.L. 95-224. Subsequently recodified as Chapter 63 of P.L. 97-258 (31 U.S.C. 6301 et seq.).

[5] Ibid.

suitable for acquisition with fixed-price types of contracts … provided they can be defined with a degree of clarity sufficient to enable offerors to price the effort needed to achieve the required results without assuming undue risk. However, because they are specific in nature, applied research efforts do not fall within the definition of a commercial item." The Wynne memo suggests that for research-related services (e.g., testing or lab services that may have a commercial market), the acquisition team should investigate using FAR Part 12. Under FAR Part 12, a fixed-price contract is required. For a research-related services contract, the structure would need to permit milestone-type achievements and payments, without exposing the contractor to undue risk.

GRANTS AND COOPERATIVE AGREEMENTS

As defined in the Federal Grant and Cooperative Agreement Act,[6] a grant or a cooperative agreement is a legal instrument used by a federal agency to enter into a relationship whose principal purpose is assistance (that is, the transfer of something of value to the recipient for carrying out support or stimulation authorized by U.S. law). This is in contrast to procurement contracts used to acquire goods and services for the U.S. Government's direct benefit or use. For obtaining assistance, agencies must use grants if the involvement between the recipient and the government will not be substantial; agencies must use cooperative agreements if the involvement will be substantial. Cooperative agreements are a form of financial assistance to be used when the government wants to participate in the program with the recipient. Traditionally, grants and cooperative agreements have been executed with academia and other nonprofit organizations for basic research. Under these arrangements, the recipients share their results by publishing their research findings in public forums.

OMB Circulars A-110, "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations,"[7] and A-102, "Grants and Cooperative Agreements with State and Local Governments,"[8] contain guidance about issuing grants and cooperative agreements. For DoD, the controlling regulation is the DoD Grants and Agreement Regulation (DODGAR).[9]

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS

A Cooperative Research and Development Agreement (CRADA) is a way to conduct specific R&D activities, consistent with a DoD agency's mission, with non-federal partners such as industry and universities. A CRADA is not considered a procurement contract, grant, or cooperative agreement. The document for a

[6] 31 U.S.C. 6304 and 6305.

[7] Available online at http://www.whitehouse.gov/omb/circulars/a110/a110.html.

[8] Available online at http://www.whitehouse.gov/omb/circulars/a102/a102.html.

[9] 32 CFR Part 21, 22, 25, 32, and 34.

CRADA, which should be drafted with the assistance of legal counsel, is an "agreement" and not a contracting instrument.

A CRADA[10] is a written agreement between one or more DoD laboratories or technical activities and one or more non-federal parties such as state and local governments; commercial industry; public and private foundations; and non-profit organizations. The parties to a CRADA may exchange IP, expertise, and data. They may also exchange the use of personnel, services, materials, equipment, and facilities. DoD agencies can accept funding from a CRADA partner to perform research or development of benefit to the partner, but no DoD funds can flow to the CRADA partner.

The DoD activities can provide personnel, facilities, equipment or other resources, with or without reimbursement. The non-federal partners can provide funds, people, services, facilities, equipment, or other resources.

The rights to inventions and other IP are flexible and are negotiated as a part of the agreement.

OTHER TRANSACTIONS FOR PROTOTYPE PROJECTS

"Other transactions" (OTs) is the term commonly used to refer to the 10 U.S.C. 2371 authority to enter into transactions other than contracts, grants, or cooperative agreements. This basic authority is permanent and has been incorporated by DoD into TIAs. TIAs are considered assistance agreements.

DoD has another authority, which is temporarily called "other transactions for prototype projects." This type of OT is authorized by DoD authorization acts with sunset provisions and is in the U.S. Code as a note in 10 U.S.C. 2371. Section 845 of P.L. 103-160, as amended, authorizes using OTs, under the authority of 10 U.S.C. 2371, for prototype projects directly relevant to weapons or weapons systems anticipated to be acquired or developed by DoD. This OT commonly is referred to as an OT for a prototype project, or a "Section 845 OT."[11]

In general, OTs for prototype projects are not subject to the federal laws and regulations governing procurement contracts. For this reason, they do not have to comply with the FAR, its supplements, or laws that apply to procurement contracts. For example, OTs for prototype projects allow for flexibility in accounting practices and auditing procedures, and can result in IP provisions that differ from those usually in regular procurement contracts.

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[10] For more information on CRADAs, see 31 U.S.C. 6305 and 10 U.S.C. 2371; DoD Directive 5535.3, *DoD Domestic Technology Transfer (T2) Program*, May 21, 1999; and DoD Instruction 5535.8, *DoD Technology Transfer Program Procedures*, May 14, 1999. Additionally, the Services and DoD technical activities have guidance on CRADAs, and in most cases, model CRADA agreements.

[11] For further guidance, see *Other Transactions (OT) Guide for Prototype Projects*, published January 2001 by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. The guide is available online at http://www.acq.osd.mil/ar/resources.htm.

This acquisition authority, when used correctly, is a vital tool for helping DoD integrate the civil and military technologies and management processes that are critical for reducing the cost of defense weapons systems. OT authority for prototype projects may be used when

- at least one nontraditional defense contractor participates significantly in the prototype project; or
- no nontraditional defense contractor is participating significantly in the prototype project, but at least one of the following circumstances exists:
  - A non-government party to the transaction funds at least one-third of the total cost of the prototype project.
  - The agency senior procurement executive determines in writing that exceptional circumstances justify using a transaction that provides for innovative business arrangements or structures that would not be feasible or appropriate under a procurement contract.

Agencies are encouraged to pursue competitively awarded prototype projects that can be adequately defined to establish a fixed-price type of agreement and attract nontraditional defense contractors to participate significantly.

DoD agencies using the Section 845 OT authority must consider the risks and rewards. Does the commercial firm have a technology that DoD needs? Can DoD influence the development of the technology so the firm incorporates unique military requirements? If so, does attempting to place IP restrictions on the technology that the commercial firm is unwilling to accept make sense? In most cases, the technology will be developed and marketed anyway, but DoD will have lost the opportunity to readily access the technology or influence its development.

Advantages of OTs for Prototype Projects

Integrating the government and commercial sectors of the national technology and industrial base, including commercial companies and the commercial business units of traditional defense contractors, is in DoD's best interest. Under OTs for prototype projects, traditional defense contractors should be encouraged to integrate commercial companies into the prototype projects. That is, the contractors should seek out commercial companies or commercial business units when the commercial companies have state-of-the-art technologies and off-the-shelf products that can reduce the government's acquisition costs and solve operational challenges. Using commercial practices to solicit and award commercial contracts can attract nontraditional contractors to do business with DoD.

Streamlined commercial subcontracting is one advantage of an OT for prototype projects. Section 845 OTs differ from FAR- or DFAR-based contracts, which specify mandatory prime and subcontract requirements, government oversight, and demands for access to IP. OT subcontracts can be constructed to reflect a

commercial business arrangement or can use the terms and conditions of FAR Part 12. Sometimes the prime contractor for a Section 845 OT is actually one company selected to represent a consortium of companies that bids on the project. The prime contractor may be selected for its expertise in dealing with the government, whereas the management of the consortium may operate more as a joint venture, with most or all participants actively involved, including the government PM. In some Section 845 OTs, companies may still be simply suppliers (normally for incidental aspects of the OT), rather than members of the consortium. PMs must observe subcontracts between the prime company and the others, and the normal privity of contracts, so as not to undermine the management of the OT (even if by a consortium of companies).

The authority for OTs for prototype projects allows the parties to create new supply chain relationships, which include managing the suppliers rather than the supplies. Managing the suppliers is a "best commercial practice" noted by the General Accounting Office (GAO) in its report *Best Practices: DoD Can Help Suppliers Contribute More to Weapons System Programs*.[12] This type of management means having a strategic sense to pick the most capable suppliers (i.e., judged on past performance), providing them the right incentives to perform well, and then monitoring the supply chain to observe emerging issues with technology, labor, finances, sources, etc. that may indicate weaknesses that could affect performance. In addition, this type of management means establishing long-term strategic relationships with suppliers instead of holding annual competitions, and finding other means to stimulate suppliers to be innovative and reduce costs. Often these incentives include adding years of work to the contract or offering the option of producing the subsystem or component of the prototype, if it goes into production.

The ability to establish long-term strategic relationships with key suppliers is another advantage of this authority. Both the GAO report and a 2000 RAND report, "Commercial Approaches to Weapons Acquisition," point out the problem of the FAR contract system, which requires actions that create contractual provisions that are inconsistent with the goal of establishing long-term commercial relationships. The authority under an OT for prototype projects can be used to deal directly with strategic alliances, to require no flow-down provisions to lower-tier subcontractors, and to establish trust relationships in the contractual vehicles. By using commercial practices to solicit and award commercial contracts, DoD can attract nontraditional contractors.

The ability to use payment methods that focus on technical accomplishments represents another important advantage of OTs for prototype projects. By using the OT flexibility, DoD can use performance-based payments (PBPs) as the preferred financing approach. The ability to recover funds from the contractor and reuse them for programs may represent yet another advantage of OTs for prototype projects.

[12] Chapter Report, GAO/NSIAD-98-87, March 17, 1998.

Section 845 OTs also allow defense contractors to use their IR&D funds, or commercial businesses to use the funds that were set aside for commercial investments in new technology, to expand the technology alternatives or concepts in early phases of a program. This sharing of the costs to investigate new technologies, mature existing or developing technologies, or test new technologies in a military environment, is a funds multiplier that may represent one of the biggest advantages associated with Section 845 OTs. Under FAR-based contracts, contractors are prohibited from doing any part of a project using IR&D funds.[13] In contrast, OTs permit the joint performance of the work using both government-provided assistance funding and the company's IR&D or other R&D funds.[14] By DoD policy, federal funds received for work done under OTs for prototype projects are credited to the IR&D pool.[15] These federal funds become an extension (or credit) to the funds in the IR&D pool, which the contractor uses to fund its undertakings. For example, a contractor might allocate $100,000 to do a particular IR&D project. The contractor combines this project with an OT for prototype projects and spends $200,000 in the IR&D pool. The government funds are paid under the OT for prototype projects and are credited to the IR&D pool. The result is $200,000 of work charged at the IR&D rates, but only $100,000 to the IR&D pool.

The ability to stimulate contractor investment in Section 845 OTs has restrictions. As specified by the Honorable Edward "Pete" Aldridge, Jr., Under Secretary of Defense for Acquisition, Technology and Logistics USD/(AT&L) in his 16 May 2001, memorandum, DoD should not attempt to require contractors to share costs in DoD R&D if the goal is strictly military. Contractors should be encouraged to invest only if the opportunity for commercial development exists as well. Agencies are encouraged to pursue competitively awarded prototype projects that can be defined adequately enough to establish a fixed-price type of agreement and attract nontraditional defense contractors to participate significantly.

Acquisition planning and expected follow-on activities are essential ingredients of a successful prototype project. Prototype projects should use a team approach. Early and continued communication among all parties—including program management, logistics, test and evaluation, and legal counsel—will enhance the opportunity for a successful project.

The OT authority and Section 845 OT authority has been used in more than 300 programs. It has been used in every service, as well as in DARPA and the National Imagery and Mapping Agency (NIMA). A number of OT success stories are provided in Appendix C.

[13] FAR Part 31-205.18(a).

[14] FAR 31-205.18(e).

[15] Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, *Other Transactions (OT) Guide for Prototype Projects*, January 2001.

TECHNOLOGY INVESTMENT AGREEMENTS

TIAs can be used to carry out basic, applied, or advanced research projects when it is appropriate to use assistance instruments and the research is to be performed at least in part by for-profit firms, especially as members of consortia. TIAs allow DoD Components to leverage for defense purposes financial investments made by for-profit firms in research related to commercial products and processes.

The basic idea behind a TIA is flexibility. TIAs enable DoD to contract with firms that will not, or cannot, participate in government cost-reimbursement R&D FAR contracts or standard federal assistance awards. These firms might be small, start-up technology firms supported by venture capital, leading-edge technology firms that have never worked on a government R&D contract, or industry giants that have chosen not to operate in the government market. The key advantages of TIAs are as follows:

- Many of the regulatory controls of a procurement contract, grant, or cooperative agreement do not apply to a commercial firm under a TIA. The nonapplicable controls include government audit, government cost principles, compliance with the cost accounting standards, compliance with the Truth in Negotiations Act,[16] and subcontracting requirements;

- Commercial business practices are acceptable. For example, TIAs allow using periodic payments based on achieving agreed-on technical milestones rather than simply accumulating costs under government-mandated cost accounting rules;

- Greater flexibility for negotiating appropriate terms and conditions. Patent rights for inventions and ownership of the data generated are subject to negotiation, as are the Government-Purpose License Rights clause and "march-in rights." The government can negotiate all license rights for technical data and computer software, regardless of existing regulations;

- Technical insight is gained; enhancing visibility into research at every level; and

- The leveraging of government resources reduces the risk.

Because these advantages come without the fixed contractual terms of the normal regulated FAR contract, the government PM's responsibilities are increased under a TIA. However, there are also advantages for PMs. Under the traditional contractual relationship of prime contractor–subcontractor, the PM lacks visibility into the research work at levels beneath the prime. Unlike the traditional "prime–sub" relationship of a contract, TIA team members (regardless of business size) are equal in the team organization and, more importantly, with the PM. Thus, the PM has visibility into research at all levels. This greatly increases the effects of the

[16] Public Law 87-653.

PM's advice and guidance during the program. Because the team is sharing investment and project risk, the PM must recognize the needs and desires of all team members. Being able to recover funds from a recipient and reuse the funds for programs may be another TIA advantage. TIAs also exempt some offerors' information from disclosure under the Freedom of Information Act.

Unlike contracts, which focus on completing a detailed statement of work (SOW), TIAs emphasize managing change and working with team members to meet the technology goals successfully. TIAs will be covered in DoD regulations when FAR Part 37 is published; they will also be covered in a part of the DODGARS.

VENTURE CAPITAL PROGRAMS: AN EMERGING OPTION

While not one of the official business arrangements listed above, there is increasing interest within DoD to experiment with different forms of venture capital (VC) funding to assist DoD in acquiring new technology. In simple terms, "VC funding" is funding for investing in immature, high-risk/high-payoff technologies, in the hopes of finding a technology that works well. Venture capitalists "add value" to the technology developer by providing contacts; shaping ideas; and helping with management, product development, marketing, commercialization, or funding. VC funding is normally, but not exclusively, focused on small companies or "start ups." The traditional motive and selection criteria for investing VC is profit. But only a small fraction of traditional VC investments pay off in a large way. Also, less than 1 percent of commercial start-ups receive VC funding, with 90 percent of commercial investment being in information technology (IT) and health care.

DoD's motive for using VC arrangements is the acquisition of innovative technology that reflects DoD's needs. This is a way to foster entrepreneurial behavior in DoD, and to access a broadened technology base. By investing through VC arrangements, DoD can shape the technology available up front.

This is an emerging program, and VC will be implemented differently in different organizations. Recent examples of VC approaches illustrate the possibilities. The fiscal year 2002 Defense Appropriation Act required the Army to establish a $25 million non-profit VC company. The Army's VC company will focus on providing electrical power for the infantry. The Congress directed the Navy to study VC, and they will report on their conclusions and possible implementation in April 2003. NIMA has a technology development contract with a private company. The private company voluntarily contributes its award fee to a VC fund for advancing NIMA technology.

TOOLS FOR TRANSITION PLANNING

The previous sections discussed approaches that transition technology from government to government and from industry to government. All of these approaches

require planning to meet the myriad of challenges. Fortunately, there are a number of tools available to assist the PM in this planning.

Two of the many tools that are available are the use of the IPPD method and its extensive use of integrated product teams (IPTs). Also technology readiness levels (TRLs) and engineering and manufacturing readiness levels (EMRLs) provide "yardsticks" for evaluating technological maturity. A TRL-like process, based on a Missile Defense Agency initiative, provides an additional tool for assessing engineering and manufacturing readiness.

INTEGRATED PRODUCT AND PROCESS DEVELOPMENT

The IPPD method can ensure that all necessary elements, including design and manufacturing issues, sustainability and logistics considerations are included in technology transition planning. For this method to be beneficial, the government and industry players must continually communicate with one another, beginning when the requirements are being defined. Not only must manufacturing and sustainability issues be addressed early—they must be considered as important as performance issues for allocating the resources and prioritizing the technology. Programs must remain open to better solutions, and be prepared to use technology "outside" government and industry, in order to increase capability and maintain affordability.[17]

The IPPD is a management process that integrates all activities from product conception through producing and supporting the product in the field. IPPD uses multi-functional industry and government teams to simultaneously optimize both the product, and its manufacturing and sustainment processes. The goal is to meet both cost and performance objectives. In the past, separate groups, operating independently, designed a product and then sent the design to a manufacturing organization. The manufacturing organization recommended changes to the design to facilitate manufacturing, requiring the design and manufacturing organizations to communicate back and forth continually. After the system was produced, issues of logistics supportability were discovered. The IPPD method is designed to address manufacturing and sustainability issues up front in the technology development process.

The centerpiece of the IPPD method is the IPTs that are mandated in acquisition policy guidance. The IPTs must be cross-functional and multidisciplinary, but should comprise a reasonable number of members. Getting the right members is critical. The IPTs should do the following:

- Shift the priorities from just performance to integration of performance, producibility, life-cycle cost, and implementation risk;

[17] For a discussion of the IPPD method, see the Deputy Under Secretary of Defense (Science and Technology), *Technology Transition for Affordability: A Guide for S&T Program Managers.* April 2001. For consistency, we adopted the IPPD information from this document.

- Adjust funding profiles to support the balanced priorities. Address funding for producibility, life-cycle cost, implementation risk, application of open systems, and interoperability;

- Increase capability, within resource constraints, by using other S&T programs, acquisition investments, and commercial technology programs, in order to support performance and address the other goals; and

- Review programs with senior leaders to address affordability issues and the balance between near-term performance and TOCs.

The essential elements of the IPPD method are the following:

- Obtain senior leadership support for the balanced goals and the IPPD method;

- Develop the IPTs and the support and management processes needed to maximize their effectiveness (e.g., communication with IPT members, access to IPT information, tracking system for actions);

- Develop and execute a training plan for key IPPD participants from government and industry;

- Establish affordability metrics and a system for tracking program performance;

- Develop a transition plan that identifies the team members who will influence the transition and address the long-lead-time issues (e.g., funding) at the proper time; and

- Set up the senior leadership review process.

The IPPD method can be tailored to any program. The method can be a top-level process that helps implement the concepts we discuss in this guide, including the following:

- Improved technology transition planning;

- Balanced consideration of performance and TOCs;

- Collaboration with other programs and industry to increase the solutions available to PMs;

- A high-performance IPT that can incorporate change rapidly and address all of the supporting issues (the second- and third-order effects of change). This is critical for reducing the disruption that accompanies change when transitioning technology.

TECHNOLOGY READINESS LEVELS

A key enabler for evolutionary acquisition and reduced cycle time is to have technology that is sufficiently mature to be fielded in a relatively short time. This requires having a method for measuring maturity, and a process for ensuring that technologies are sufficiently mature before being incorporated into systems that are being developed.

How does a PM determine that a technology developed by industry or a government laboratory is sufficiently ready or mature to transition to being used in a system? This is done by developing TRLs for each technology and applying them to determine whether the technology is ready for transition. Using TRLs for transitioning technology requires clear assignment of responsibilities and resources, and communication and interaction among the requirements developers, acquisition community, and S&T managers.

Table 2-3 shows the DoD 5000.2-R[18] definitions of TRLs. The table lists the TRLs and descriptions from a systems approach for both hardware and software. DoD components may have additional clarifications for software. Below the table are supplemental definitions for this table and Table 2-4.

Table 2-3. Technology Readiness Levels

Technology readiness level	Description
1. Basic principles observed and reported.	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples are paper studies of a technology's basic properties.
2. Technology concept or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and proof or detailed analysis might not be available to support the assumptions. Examples are limited to analytical studies.
3. Analytical and experimental critical function or characteristic proof of concept.	Research and development is initiated, including analytical and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Validation of component or prototype in laboratory environment.	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of ad hoc hardware in the laboratory.
5. Validation of component or prototype in relevant environment.	Fidelity of prototype technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.
6. System or subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment.

[18] "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," available through link at http://www.acq.osd.mil/ap/index.html.

Table 2-3. Technology Readiness Levels (continued)

Technology readiness level	Description
7. System prototype demonstration in an operational environment.	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle, or space. Examples include testing the prototype in a test-bed aircraft.
8. Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9. Actual system proven through successful mission operations.	Application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.

Source: DoD 5000.2-R, April 5, 2002.

Definitions used in the TRL and EMRL matrices:

Brassboard: An experimental device (or group of devices) used to determine feasibility and to develop technical and operational data. It normally is a model sufficiently hardened for use outside of laboratory environments to demonstrate the technical and operational principles of immediate interest. It may resemble the end item, but is not intended for use as the end item.

Breadboard: integrated components that provide a representation of a system/subsystem and which can be used to determine concept feasibility and to develop technical data. Typically configured for laboratory use to demonstrate the technical principles of immediate interest. May resemble final system/subsystem in function only.

“High fidelity”: addresses form, fit and function. High-fidelity laboratory environment would involve testing with equipment that can simulate and validate all system specifications within a laboratory setting.

“Low fidelity”: a representative of the component or system that has limited ability to provide anything but first order information about the end product. Low-fidelity assessments are used to provide trend analysis.

Model: a functional form of a system, generally reduced in scale, near or at operational specification. Models will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.

Operational environment: environment that addresses all of the operational requirements and specifications required of the final system to include platform/packaging.

Prototype: a physical or virtual model used to evaluate the technical or manufacturing feasibility or military utility of a particular technology or process, concept, end item or system.

Relevant environment: testing environment that simulates the key aspects of the operational environment.

Simulated operational environmental: either 1) a real environment that can simulate all of the operational requirements and specifications required of the final system, or 2) a simulated environment that allows for testing of a virtual prototype; used in either case to determine whether a developmental system meets the operational requirements and specifications of the final system.

In general, most S&T efforts stop at TRLs 4 through 6, where technology is validated in a lab or simulated operational environment. Thus, TRL 7, in which the technology is demonstrated in an operational environment, exceeds the normal S&T scope. At TRL 7, the technology has matured enough to transition to the acquisition community. They assume all management, including planning for resources.

The key to transitioning technology—whether developed by industry or government—is the availability of sufficient funds to mature technology through later TRLs. Great ideas in the laboratory many times do not translate easily into workable DoD systems. Funds to mature and test these ideas are needed; however, the budget cycle for most programs requires as much as two years of planning before funds are available. Therefore, the technology provider and the PM must agree early and plan to prevent funding lapses during development.

Also, understanding that differences exist in the amount of risk that the government and industry accept in development and production programs is important. In general, the government accepts more risk than industry, particularly the non-defense commercial industry. What is considered a "ready to go" TRL 6–7 to the government may appear to industry as a "risky" TRL 2–3. Industry may seek contractual protection against the perceived technical and business risks for such a program.

ENGINEERING AND MANUFACTURING READINESS LEVELS

The implication in the discussion of TRLs is that a technology at TRL 9 is ready for use and, therefore, ready for production. In many cases this may not be true. Nothing in the description of TRL 9 or the other TRLs requires that the technology be producible, reliable, and affordable. Consistent with the emphasis on including engineering, manufacturing, and sustainability issues early, the Missile Defense Agency extends the notion of TRLs to engineering and manufacturing readiness levels. Unlike TRLs, the EMRLs are not yet endorsed in DoD 5000.2-R, but they can be a very useful tool when properly integrated into the IPPD.[19]

The Missile Defense Agency uses EMRLs to support assessments of systems engineering and design. EMRLs help assess the maturity of the design, related materials, tooling, test equipment, manufacturing, quality and reliability levels, and other characteristics necessary for a producible and affordable product. This approach, when used with TRLs, can ensure a more complete evaluation of the maturity of the system, component, or item. Table 2-4 describes each EMRL.

Consider designing EMRLs for your programs to enable better technology assessments, integrated with your IPPD processes.

[19] For a more detailed discussion of EMRLs, see Fiorino, Thomas D., Sr. Vice President, Andrulis Corporation, "Engineering Manufacturing Readiness Levels: A White Paper," October 30, 2001.

Table 2-4. Engineering and Manufacturing Readiness Levels

EM readiness level	Description
1. System, component, or item validation in laboratory environment or initial relevant engineering application or breadboard, brass board development	Significant system engineering or design changes. System engineering requirements not validated. Physical and functional interfaces not defined. High program risk. Materials tested in laboratory environment. Machines and tooling demonstrated in laboratory environment. Manufacturing processes and procedures in development in laboratory environment. Quality and reliability levels and key characteristics not yet identified or established. Includes requirements of TRL 4 and TRL 5 as a minimum.
2. System or components in prototype demonstration beyond breadboard, brass board development.	Many systems engineering and design changes. Systems engineering requirements validated and defined. Physical and functional interfaces not fully defined. High program risk. Risk assessments initiated. Materials initially demonstrated in production. Manufacturing processes and procedures initially demonstrated. Machines and tooling require major investment. Inspection and test equipment developed and tested in manufacturing environment. Quality and reliability levels and key characteristics initially identified. Includes requirements of TRL 6 as a minimum.
3. System, component, or item in advanced development. Ready for low-rate initial production.	Few systems engineering or design changes. Prototypes at or near planned system engineering for required performance levels for operational system. Physical and functional interfaces clearly defined. Initial risk assessments completed. Moderate program risk. Materials in production and readily available. Manufacturing processes and procedures well understood and ready for low-rate initial production. Moderate investment in machines or tooling required. Machines and tooling demonstrated in production environment. Inspection and test equipment demonstrated in production environment. Quality and reliability levels and key characteristics identified, but not fully capable or in control. Includes requirements of TRL 7 as a minimum.
4. Similar system, component, or item previously produced or in production. System, component, or item in low-rate initial production. Ready for full-rate production.	Minimal systems engineering or design changes. All systems engineering requirements met. Minimal physical and functional interface changes. Initial risk assessments complete. Low program risk. Materials available. Manufacturing processes and procedures established and controlled in production to 3-sigma level. Minimal investment required in machines or tooling. Machines, tooling, and inspection and test equipment deliver 3-sigma quality in production. All key characteristics controlled to 3-sigma level in production. Includes requirements of TRL 8 and 9 as a minimum.
5. Identical system, component, or item previously produced or in production. System, component, or item in full-rate production.	No systems engineering or design changes. Identical system, component, or item in production or previously produced that met all engineering requirement for performance, quality, and reliability. Low program risk. Materials, manufacturing processes and procedures, inspection and test equipment, quality and reliability, and key characteristics controlled in production to 6-sigma level. Proven affordable product.

This table provided courtesy of the Missile Defense Agency.

SPECIAL CHALLENGES

Even with the tools for technology transition just described, PMs will encounter special challenges ranging from IP issues to incentives. This chapter concludes with a discussion of those challenges along with suggestions about how to overcome them.

Intellectual Property

In the past, DoD usually funded the programs that led to new technology. Further, the government tended to acquire technical data and computer software and patent rights for ensuring long-term competition and supporting fielded systems. Today, the reverse is largely the case—technology leadership has shifted to industry, where most R&D dollars are spent. DoD now relies on market forces for competition and commercial technical manuals and instruction booklets for support.

Today, DoD must find ways to entice commercial industry into collaborating with the department in vital research, and to acquire commercial products using commercially friendly terms. Despite legislation in the 1990s that streamlined acquisition, helping to create contracting processes for the government more like commercial contracting, some practices are still in place that represent holdovers from past decades. One such holdover policy relates to IP.

The concept of IP is fundamental to a capitalist society. A company's interest in protecting its IP from uncompensated exploitation is as important as a farmer's interest in protecting his or her seed corn. Often companies will not consider jeopardizing their vested IP to comply with the government contract clauses. These clauses often give certain government rights to IP and are holdovers from the days when DoD was the technology leader and frequently funded research programs completely. We now must create a new environment for negotiating IP terms and conditions that promotes the true interest of the government—incorporating technologically advanced solutions into the weapons systems and management systems we deploy.

On September 5, 2000, the USD(AT&L) signed a policy letter announcing a shift in focus for negotiating IP contract terms with commercial firms that ordinarily do not do business with DoD. The letter began altering DoD's thinking and putting in place the mandate to develop training materials that will assist the acquisition community in negotiating IP contract terms. As a result, the USD(AT&L) created a guide for the defense acquisition community (i.e., contracting personnel, legal counsel, and PMs) and its industry partners as a tool for equipping them with new ideas and solutions for resolving IP issues that cause fissures during negotiations. The guide was published in October 2001, and is on the Web at http://www.acq.osd.mil/ar/resources.htm.

Subsequently, USD(AT&L) signed a letter on January 5, 2001, that furthered this initiative. In addition to directing that the guide be published, the undersecretary highlighted the importance of engaging in certain practices permitted by regulation, including

- emphasizing the use of specifically negotiated license rights;[20]
- exercising flexibility when negotiating patent rights;
- using performance-based acquisition strategies that may obviate the need for data or rights; and
- acquiring only those data, or those rights to data, that are truly needed for an acquisition.

Balancing the protection of industry's IP and maintenance of the vital protections that DoD needs to support its equipment requires the PMs to strike a careful balance. On the one hand, military systems must be supportable. On the other hand, to attract the best technology for equipping warfighters, DoD must encourage commercial company involvement, including non-traditional companies, to the defense market. In striking this balance, defense officials must be creative in their approach and business strategies. The above-mentioned IP guide should help acquisition teams negotiate IP rights using the flexibility inherent in the regulations.

The Importance of Identifying Requirements

DoD is a large organization, with many entities that require, acquire, and use technology. Because of the multiple entities, technology providers in government and industry alike must find out what DoD needs. Defense contractors that have an existing relationship with government technology seekers, can ascertain DoD's needs more easily. Many large defense companies have a staff of experienced personnel devoted solely to connecting their company's technology with DoD's needs. Because no single, comprehensive list of needs or requirements can be accessed or searched by potential technology providers, small businesses or large businesses that have not worked for DoD do not know where to get the information they need. The resulting inefficient use of time and resources frustrates industry and government technology providers, and denies the government access to all the technologies available for solving its problems.

Government organizations with technology requirements can increase their access to technology by enabling potential technology providers to identify needs more easily and to contact the right personnel to pursue opportunities. A website is not enough of an access point. Government technology users must get out and "contact" the providers in meetings and symposia, and should be available and responsive when the providers contact them.

[20] DFARS 227.7103-5 (d), Specifically Negotiated License Rights, commonly referred to as "special licenses."

While websites alone are not enough, they are a key entry point for those seeking information about government requirements. Government organizations should test their websites and see how they work. PMs should go to their own websites, follow the contact and business opportunity instructions, and evaluate what happens. If an e-mail contact is given, how long did it take to receive a reply after you sent your query? Was the answer responsive to the question? Many DoD websites no longer have comprehensive contact information. Does an appropriate way exist for technology providers to reach you?

PMs should also publicize web sources that identify government needs. There are many websites that address government needs. Below we list five sites, one for each service and the SBIR program, that have information about their programs and links to other sites that contain technology requirements. The SBIR program site is an excellent example of a website that integrates with an "800 number" help desk, and has comprehensive information available.

Defense Advanced Research Projects Agency
http://www.darpa.mil/.

Office of Naval Research
http://www.onr.navy.mil/02/solici.htm.

Army Research Laboratory
http://www.arl.army.mil/main/ResearchOpportunities/default.cfm?Action=ResearchOpportunities&header=YES.

Air Force Research Laboratory
http://209.22.7.78/.

Small Business Innovation Research program
(for small businesses, covers all services' SBIR programs)
http://www.acq.osd.mil/sadbu/sbir.

Solicitation Methods

Having identified a need, how does a company make its products and services known to the government? In most cases, the government will ask for help through several solicitation methods.

Requests for proposals (RFPs) are a solicitation method described in FAR Part 15 and are applicable to procurement contracts. Using performance-based statements of work, the government describes in the RFP the results desired—or the "what"—and allows the contractor to propose the "how" they will achieve the desired results. The FAR Part 15 prescribes standard proposal formats and discusses the process for resolving disputes or errors.

Broad agency announcements (BAAs) are a method for soliciting S&T and state-of-the-art goods or services competitively that is not related to developing a specific system or hardware procurement. BAAs are announced on the Federal Business Opportunities website[21] and are general in nature, identifying areas of research interest (including criteria for selecting proposals) and soliciting the participation of all offerors capable of satisfying the government's need. The selection of multiple proposals that offer unique and innovative ideas is expected if funds exist. Award instruments under BAAs include procurement contracts, grants, cooperative agreements, OTs for prototype projects, and TIAs. When a procurement contract will not be used, the solution should be a research announcement (RA).

If the government does not ask for help in an RFP or BAA, industry can create its own contracting opportunities by submitting unsolicited proposals to do R&D or to introduce a new or improved item of potential interest to DoD. To be considered, a company's unsolicited proposal must offer the government a unique and innovative concept. The proposal should contain an abstract of the proposed effort, the method of approach, and the extent of the effort. The proposal also should contain a proposed price or estimated cost. If the proposal includes proprietary data, the company should protect against disclosure to third parties by clearly marking such data with a restrictive legend. For detailed guidance about preparing unsolicited proposals, see the publication "Selling to the Military," available at http://www.acq.osd.mil/sadbu/publications/selling/.

Incentives

DoD often relies on private industry to provide leading-edge technologies at an affordable cost throughout a system's life cycle. Consequently, DoD's suppliers must be innovative, efficient, effectives, and should be rewarded with properly constructed cash and non-cash incentives.

In the past, the government-contractor relationship has been characterized as problematic and adversarial. Disconnects existed between the contractual incentives for achieving the government's desired performance and the motivation of the contractor.

Properly structured contractual incentives, as part of the overall business relationship, can maximize value for all parties. Contractual incentives should target the business relationship between the government and the contractor in such a way as to produce maximum value for taxpayers, for the contractor, for the warfighter, and for the organization pursuing its mission. DoD not only must improve its ability to use existing contractual incentives, but also must develop a range of new and innovative contractual incentives.

[21] http://www.fedbizopps.gov/

Currently, DoD's contract policies and methods contain certain disincentives to developing and inserting beneficial technologies. These disincentives can be present in the S&T, development, production, and support phases of a system's life cycle. Inserting technology to enhance a system's performance or capabilities generally is encouraged by contract policies and methods. However, technology insertion for reducing costs over the total life cycle, often encounters financial disincentives because cost savings may lead to budget reductions that are undesirable from an agency's perspective.

CASH INCENTIVES

There are also positive incentives. Milestone payments for completing an observable technical event is a method for giving the contracting parties incentives to strive for better research results while avoiding many FAR-based requirements that are in cost-type R&D contracts.

To expand DoD's access to commercial developers and their technology, commercial incentives should be used. Factors that affect a company's decision to participate in a government project include the solicitation method, instrument structure (including cash and non-cash incentives), and contract administration methods. A commercial incentive would increase the contractor's profit, market share, or IP rights.

NON-CASH INCENTIVES

Enhanced communications also might give contractors more to participate. For example, when the presolicitation information is exchanged, the government could share the technology roadmaps for DoD's critical future requirements and compare them with industry's plans for commercial technology development.

Another non-cash approach, award-term incentives, are designed to entice the contractor to transition workload well, provide superior support, and control prices through extensions or reductions of the terms that are directly based on performance. When using award-term incentives, the government establishes objective performance parameters in the underlying contract and announces up front that it intends to shorten or lengthen the period of contract performance (to a minimum or maximum) according to the contractor's performance against the parameters. The objective of this tactic is to establish long-term contractor relationships with proven producers of products or services.

The award term structure is similar to that for an award fee, but the incentive is a performance period rather than cash. This is effective if performance metrics are objective and when a long-term business relationship is of value to the government and the contractor.

Points are awarded during each year of the contract depending on performance in each measurement category. Decisions about extending or shortening the contract

are made each year, according to a moving, multiyear average of the contractor's point total. Extensions can be set, according to performance that exceeds requirements rather than just meeting them.

Ownership of IP without government licenses, or negotiation of fewer government IP rights, is yet another form of non-cash incentive.

COST-BASED INCENTIVES

Share-in-savings (SIS) provisions are cost-based incentives, now referred to by DoD as "efficiency savings." An SIS contract encourages contractors to use their ingenuity and innovation to get the work done quickly and efficiently to share in the savings attributed to their planning and execution.

SIS provisions are best used when the anticipated ROI is large enough to make this a viable business proposition for the contractor. With this tactic, the risk shifts from the government to the contractor, with commensurate opportunity for contractor to receive rewards for performing successfully. Because of the risks, a partnership between the government and the contractor is required. The idea is to allow the contractor to use its ingenuity and innovation to efficiently deliver the requirement instead of dictating the government's preferred approach.

Currently, DoD is implementing DFARS coverage for contractors to share savings. Contractors are encouraged to reduce costs via an advance agreement. Contractor actions include reducing management costs, consolidating facilities, modernizing facilities, and outsourcing. Savings can be shared. Under proposed rules, the amount of shared savings cannot exceed 50 percent of the cost reduction realized over a period not to exceed 5 years.

Profit incentives are another form of cost-based incentive. DoD updated its weighted guidelines profit policy for the first time in 15 years as a result of a Defense Science Board Task Force examining the financial health of the defense industry. As a result, the DFARS now include a provision to increase the negotiated fee according to the contractor's use of innovative technology. This incentive is based on a Congressional desire to encourage innovation and is completely consistent with DoD's objectives.

Chapter 3
Programs That Facilitate Technology Transition

Transitioning technology does not come naturally and can be very difficult. To transition technology successfully requires positive actions by people interacting throughout the system. A marketplace for the technology and appropriate applications for those technologies is necessary. The following programs were specifically designed to assist the community with developing new technologies that could be successfully transitioned. In some cases, the programs offer another source of funds, in addition to the specific program that supports the transition.

ADVANCED TECHNOLOGY DEMONSTRATIONS

Technology development benefits when the communities work as a team, beginning early in the process. ATDs are a process for managing S&T programs that brings the team together early, and demonstrates a military capability in a joint warfighting experiment, battle lab experiment, demonstration, field test, or simulation. ATDs are used to accelerate the maturation of technology needed by warfighters for either next-generation systems or upgrades to existing legacy systems. ATDs use the IPPD process to ensure collaboration between the communities—S&T, requirements/warfighter, R&D, T&E, sustainment, and industry. The collaboration and coordination result in early interaction and exchange between the communities, permit experimenting with technology-driven operational issues, weed out unattainable technologies as early as possible, and result in more focused requirements and capability documents.

This is a process, not a program. ATDs require planning, review, and approval at the service or agency level. ATDs have a finite program duration, agreed-upon exit criteria, and typically require transition plans. Accordingly, ATDs require technologies that are mature enough to provide a capability that can be used or demonstrated during the demonstration period. Services and agencies must provide full funding for ATDs because no source of external funding exists for this process. Most ATDs are funded with 6.3 funds, respond to high-priority user needs, and have a funded target program (e.g., have a reasonable chance of transitioning to an acquisition program funded in the future years defense plan [FYDP]). ATDs also are reviewed to ensure that they do not duplicate other programs.

The ATD team evaluates technical feasibility, affordability, compliance with operational and technical architectures, operation and support issues, and user needs as early as possible. This fully integrated approach and focus on operationally-sound capabilities ensures that militarily significant capabilities can be developed, evaluated, and transitioned to the warfighter rapidly.

Participation in the Program

Services and agencies have processes for nominating and approving ATDs and have plans for managing ATDs. In general, the senior research and technology manager in the organization manages ATDs. Typical requirements for participating in the program are the following:

- A concept that addresses established S&T objectives, and could provide a significant new or enhanced military capability or more cost-effective approach to providing the capability
- A fully planned and funded program with a limited duration (usually less than 5 years, with shorter durations being better)
- Exit criteria and a transition plan that is supported by the user representative and the systems developer.

ADVANCED CONCEPT TECHNOLOGY DEMONSTRATION PROGRAM

In early 1994, the DoD initiated a program designed to help expedite the transition of maturing technologies from the developers to the users. The ACTD program was developed to help adapt the DoD acquisition process to today's economic and threat environments. ACTDs emphasize assessing and integrating technology rather than developing it. The goal is to give the warfighter a prototype capability and to support the warfighter in evaluating the capability. The warfighters evaluate the capabilities in real military exercises and at a scale sufficient to fully assess military usefulness.

ACTDs are designed to enable users to understand the proposed new capabilities for which there is no user experience. Specifically, ACTDs give the warfighter opportunities to

- develop and refine the warfighter's concept of operations to fully exploit the capability of the technology being evaluated;
- evolve the warfighter's operational requirements as the warfighter gains experience and understanding of the capability; and
- operate militarily useful quantities of prototype systems in realistic military demonstrations and, on that basis, assess the military usefulness of the proposed capability.

An ACTD can have one of three outcomes. The first outcome is that the user sponsor may recommend acquiring the technology and fielding the residual capability that remains after the demonstration phase of the ACTD to provide an

interim and limited operational capability. If the capability or system does not demonstrate military usefulness, the second outcome is that the project is terminated or returned to the technology base. A third outcome is that the user's need is fully satisfied by fielding the capability that remains when the ACTD is concluded, and no additional units need to be acquired.

There are several major differences between ACTDs and ATDs. ACTDs are programs, usually employing multiple technologies, that are reviewed by OSD and the joint requirements oversight council (JROC), and funded (in part) with OSD ACTD funds. An ATD is actually a process for managing selected high-priority S&T programs. ATDs are reviewed an approved by the services, and funded with service S&T funds.

ACTDs should work with relatively mature technologies to improve the probability of success and the likelihood of transitioning the technology into programs. A recent GAO report addresses this and other factors affecting ACTDs' success.[1] This GAO report concludes ACTD outcomes can be improved, while noting that the majority of the ACTDs examined did transition some technologies to the user. The GAO found that:

- some technology was too immature to be effectively demonstrated in the hands of the warfighter, leading to cancellations of demonstrations;
- services did not provide follow-on funding for some successful ACTD technologies; and
- military utility assessment required in ACTDs have not been done consistently.

ACTDs should consider manufacturing and sustainment issues as a part of their program. Historically, manufacturing and sustainment issues have not received a high priority in ACTDs. The long-term success of ACTD initiatives can be improved by considering all of the manufacturing, sustainment, and operational and support issues.

Participation in the Program

The Deputy Under Secretary of Defense for Advanced Systems and Concepts (DUSD [AS&C]) is responsible for selecting and approving ACTDs. Ideally, a user-developer team, having combined a critical operational need with maturing technology, will develop an ACTD candidate for consideration. The Advanced Systems and Concepts (AS&C) staff is available to assist the team with developing and refining the concept and clarifying the ACTD's basic criteria and attributes. When the details of the concept are defined, a briefing is presented to the DUSD (AS&C). The concept may be accepted for further discussion, deferred

[1] GAO Report GAO-03-52, *Defense Acquisitions: Factors Affecting Outcomes of Advanced Concept Technology Demonstrations*, December 2, 2002.

with guidance for refinement, or rejected. If accepted, a briefing is presented to the "Breakfast Club," an advisory group of senior acquisition and operational executives, for their review and assessment. The candidate ACTDs then are presented to the Joint Staff, through the Joint Warfare Capabilities Assessment and the Joint Requirements Oversight Council, for their review and recommended priority. Based on these assessments the DUSD (AS&C) makes the final funding decisions about the ACTDs.

According to an October 30, 2001, memorandum, "ACTD proposals should address the Department's most pressing and urgent military issues. Additionally, they should support the Department's transformation goals and objectives. All proposals should begin with a statement of the problem they intend to solve and the proposed capabilities addressing this problem."[2]

The ACTD website at http://www.acq.osd.mil/actd/ is another source of information about ACTDs.

COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE

The goals of the Commercial Operational and Support Savings Initiative (COSSI) were to improve readiness and reduce the costs of operations and support (O&S) by using existing commercial items or technology in military legacy systems. COSSI emphasizes the rapid development and fielding of prototypes based on current commercial technology. Although the program will end at the end of FY04, there are many COSSI success stories. Some of the COSSI processes and procedures may be of use to other programs—in particular, any program that seeks to apply commercial technology to existing systems may be able to leverage some of the COSSI processes.

Many DoD systems require maintenance long beyond the useful life initially anticipated. Extending the service life of military systems increases the costs of ownership, i.e., O&S costs. For COSSI, O&S costs are defined as the costs of owning and operating a military system, including the costs of personnel, consumables, goods and services, and investment that supports the peacetime operation of a weapons system.[3] One way to reduce O&S costs is to take advantage of the commercial sector's technological innovations by inserting commercial technology into fielded weapons systems. COSSI funding leverages technology developments made by commercial firms, reducing DoD's R&D costs.

[2] DUSD(AS&C), "Fiscal Year 2003 Advanced Concept Technology Demonstration (ACTD) Proposals," Office of the Under Secretary of Defense, October 30, 2001.

[3] Office of the Secretary of Defense Cost Analysis Improvement Group, *Operating and Support Cost-Estimating Guide*. Washington, D.C., May 1992.

COSSI is a two-stage process. In Stage I, COSSI funds are used to do the non-recurring engineering, testing, and qualifying that typically are needed to adapt a commercial item or technology for use in a military system. Selected contractors develop, fabricate, and deliver a prototype "kit" to a military customer for installing into a fielded DoD system. Each prototype kit consists of a commercial item, or a combination of commercial items, that have been adapted, qualification-tested, and readied for insertion. In general, Stage I lasts two to three years. Stage II is the purchase of production quantities of the prototype kits.

Since COSSI funding began in FY97, 77 projects have been funded through the program. COSSI has invested $234 million, and contractor spending has contributed another $143 million. The estimated total O&S savings from these projects is $1.32 billion.

Participation in the Program

The funding available for COSSI projects was eliminated beyond FY02. The services should implement its essential elements to ensure continued reduction in technology life-cycle costs. To encourage this action, Congress passed, in Section 822 of the National Defense Authorization Act for FY02, a provision that allows sole-source follow-on procurement contracts if technology development programs negotiate contractual agreements like those for the COSSI program.

DEFENSE PRODUCTION ACT TITLE III PROGRAM

The mission of the Defense Production Act Title III Program (Title III) is to create assured, affordable, and commercially viable production capabilities and capacities for items that are essential to the national defense. By stimulating private investment in key production resources, Title III helps to

- increase the supply, improve the quality, and reduce the cost of advanced materials and technologies needed for the national defense;
- reduce U.S. dependence on foreign sources of supply for critical materials and technologies; and
- strengthen the economic and technological competitiveness of the U.S. defense industrial base.

Title III activities lower defense acquisition and life-cycle costs and increase defense system readiness and performance by using higher quality, lower cost, and technologically superior materials and technologies.

Title III authority can be used to address the following:

- Technological obsolescence, i.e., when a newer technology replaces an older one and the capability to produce the older technology falls into disuse and is gradually lost. By using Title III authority, flexible manufacturing capabilities can be created to produce aging technologies efficiently and affordably. Alternatively, the authority can be used to consolidate and maintain production capabilities that otherwise would be lost because of changing market conditions, even though such capabilities are still needed for defense and still can be operated efficiently and profitably.

- Low or irregular demand (i.e., when the demand for an item is inadequate to support continuous production), so the delivery of the item is delayed because of the time needed to obtain materials for producing the item or for the time needed by the production queuing. Title III purchase commitments can be made to consolidate and level demand for key production capabilities, which gives suppliers incentives to maintaining and upgrade these capabilities, and to respond to defense acquisition needs in time. Purchase commitments can also be used to reserve production time to ensure timely access to production resources for fabricating critical defense items.

- Producers exiting the business, i.e., when companies go out of business or drop product lines that no longer fit their business plans. Title III authority can be used to support transferring production capabilities to new sources.

Participation in the Program

Virtually all Title III projects promote integrating commercial and military production to lower defense costs and enable earlier defense access to, and use of, emerging technologies. The production for both military and civilian markets represents a new thrust for the Title III program, and is referred to as "dual produce." A government–industry working group identifies dual-produce projects, develops a list of general project areas, and publishes a BAA based on the list to solicit proposals from industry and DoD organizations. Projects are selected according to potential cost savings—both direct savings from the projects themselves and indirect savings from the broader application of demonstrated capabilities to other defense items.

The Title III program is a DoD-wide initiative under the Director, Defense Research and Engineering (DDR&E). Management responsibilities include program oversight and guidance, strategic planning and legislative proposals, approval of new projects, and liaison with other federal agencies and Congress.

The Air Force is the executive agent for the program in DoD. The Title III program office, at Wright-Patterson Air Force Base, OH, is a component of the Manufacturing Technology Division of the Air Force Research Lab. The program

office identifies and evaluates prospective Title III projects, submits projects for DDR&E's approval, structures approved projects, implements contracting and other business actions for the projects, oversees active projects, provides for selling and using materials acquired through Title III contracts, and does the planning and programming support for DDR&E. For further information about the DoD Title III program, visit http://www.dtic.mil/dpatitle3/.

DUAL-USE SCIENCE AND TECHNOLOGY PROGRAM

A *dual-use technology* is one that has both military utility and sufficient commercial potential to support a viable industrial base. Funding for this program has shifted from OSD to the services. The government objectives of the Dual-Use Science and Technology (DUST) program are the following:

- Partnering with industry to jointly fund the development of dual-use technologies needed to maintain DoD's technological superiority on the battlefield and industry's competitiveness in the marketplace
- Making the dual-use development of technologies with industry a normal way of doing business in the services.

These objectives are met by using streamlined contracting procedures and cost sharing between OSD, the services, and industry.

The industry objective for the program is to achieve the following benefits:

- Leverage scarce S&T funding
- Be a vehicle for forming beneficial partnerships with other firms, defense labs, or universities
- Gain access to advanced technology
- Increase the potential for transitioning technologies to defense systems, which can lead to increased markets.

The recently published DoD guide to developing dual-use technology highlights the advantages of fostering these kinds of relationships.[4]

JOINT EXPERIMENTATION PROGRAM

Joint experimentation is defined as the application of scientific experimentation procedures to assess the effectiveness of proposed (hypothesized) joint warfighting concept elements to ascertain if elements of a joint warfighting concept

[4] Deputy Under Secretary of Defense (Science and Technology), Office of Technology Transition, *Dual-Use Science and Technology Process: Why Should Your Program Be Involved? What Strategies Do You Need to Be Successful?* July 2001. Available on line at http://www.dtic.mil/dust.

change military effectiveness.[5] The U.S. Joint Forces Command (USJFCOM) leads the Joint Experimentation program, with support from the Joint Staff, other combatant commands, services, and defense agencies. The Joint Experimentation program examines new warfighting concepts and techniques, either by modeling and simulation or through exercises with actual forces. The results of the experiments are used to shape the concepts, doctrine, and materiel systems requirements for the future joint force. One of the focus areas is joint interoperability to ensure that our service capabilities operate as one unified force during future conflicts. Selected high-payoff technologies may be examined during the joint experimentation. This program works closely with the ACTD program, assisting with improving and demonstrating ACTD products. A progress report on the program is available at http://www.dtic.mil/doctrine/jel/jfq_pubs/1325.pdf.

Participation in the Program

The Joint Experimentation program has limited funding. The majority of the funding is used to get the military units involved to participate and support the events. In general, candidate technologies must address major future joint force capability shortfalls. The technology must be sufficiently mature to demonstrate in an actual exercise. In certain cases, surrogate capabilities may be used, or the system may be represented in computer simulations. Entry is easiest for contractors that submit a fully-funded proposal.

The J-9 (Joint Experimentation) staff at USJFCOM, Norfolk, Virginia, has more information about opportunities and needed capabilities. Each service has its own experimentation programs and participates in the Joint Experimentation program. The relevant service experimentation point of contact (e.g., U.S. Army Training and Doctrine Command) can provide information about opportunities.

MANUFACTURING TECHNOLOGY PROGRAM

The DoD Manufacturing Technology (ManTech) program focuses on the need of weapons system programs for affordable, low-risk development and production. The program is the crucial link between technology invention and development, and industrial applications. The program matures and validates emerging manufacturing technologies to support low-risk implementation in industry and DoD facilities, e.g., depots and shipyards. The program addresses production issues, beginning during the development of the technology. The program continues to support the system during the transition into its production and sustainment phases. By identifying production issues early and providing timely solutions, the ManTech program reduces risk and improves affordability by addressing potential manufacturing problems before they occur. The program vision is to realize a responsive, world-class manufacturing capability to affordably meet the warfighters' needs throughout the defense system life cycle.

[5] U.S. Joint Forces Command, "Joint Forces Command Glossary," accessed August 4, 2002, at http://www.jfcom.mil/about/glossary.htm#JE.

The ManTech program uses technology created throughout the S&T base and works with performance technology demonstrations; weapons system development, production, and support; and acquisition reforms, including those for defense use of commercial items and specifications. The ManTech program collaborates with many DoD activities. Collaborative efforts also include non-DoD organizations, such as the National Aeronautics and Space Administration (NASA), Department of Commerce, Department of Energy, and the National Science Foundation (NSF). The three military departments (Army, Navy, and Air Force), the Defense Logistics Agency (DLA), and DARPA execute the program. The Deputy Under Secretary of Defense for Science and Technology (DUSD[S&T]) manages the program.

Participation in the Program

A unified planning process is used to identify and prioritize weapon system requirements and the pervasive needs of the industrial base to support those requirements. The Joint Defense Manufacturing Technology Panel, its four subpanels, and its two ad-hoc working groups coordinate the planning. The National Center for Advanced Technologies facilitates the panel's interaction with industry. By analyzing the requirements and technology base efforts, technological opportunities (projects) with direct application to DoD needs are identified for potential ManTech program investment.

For component-unique projects (i.e., those affecting the needs of only one service), the individual component executes and implements the project. For more pervasive, or joint projects, DARPA, one of the services, or DLA is designated as the lead depending on internal capability or ownership of the first demonstration application. A variety of activities are used for doing ManTech projects. These include centers of excellence, consortia, private industry, academia, and government facilities. For more information about the ManTech program, visit http://www.dodmantech.com/index.shtml.

SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Congress created the SBIR program in 1982 to help small businesses participate more in federal R&D. Each year, ten federal departments and agencies are required to reserve part of their R&D funds for awarding to small businesses under the SBIR program. Participating departments and agencies include: Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, Transportation, the Environmental Protection Agency, NASA, and NSF.

DoD's SBIR program funds early-stage R&D projects at small technology companies—projects that serve a DoD need and could be commercialized in the private-sector or military markets. The program, funded at approximately $773 million in FY02, is part of the larger ($1.5 billion) federal SBIR program.

The Small Business Innovation Research Program Act of 2000,[6] extended the SBIR program's authorization to September 30, 2008. According to Congressional findings reported in the act, "the SBIR program made the cost-effective and unique research and development capabilities possessed by the small businesses of the nation available to federal agencies and departments," and "the innovative goods and services developed by small businesses that participated in the SBIR program have produced innovations of critical importance in a wide variety of high-technology fields, including biology, medicine, education, and defense."[7]

Congress further states "the SBIR program is a catalyst in the promotion of research and development, the commercialization of innovative technology, the development of new products and services, and the continued excellence of this nation's high-technology industries… The continuation of the SBIR program will provide expanded opportunities for one of the nation's vital resources, its small businesses, will foster invention, research, and technology, will create jobs, and will increase this nation's competitiveness in international markets."[8]

As part of its SBIR program, the DoD issues an SBIR solicitation twice a year, describing its R&D needs and inviting R&D proposals from small companies, i.e., firms organized for profit with 500 or fewer employees, including all affiliated firms. Companies apply first for a six-month Phase I award of $60,000 to $100,000 to test the scientific, technical, and commercial merit and feasibility of a particular concept. If Phase I is successful, the company may be invited to apply for a two-year Phase II award of $500,000 to $750,000 to further develop the concept, usually to the prototype stage. Proposals are judged competitively on the basis of their scientific, technical, and commercial merit. After Phase II is completed, companies are expected to obtain further funding from the private-sector or non-SBIR government sources (in Phase III) to develop the concept into a product for sale in private-sector or military markets.

Participation in the Program

Eligible companies must have no more than 500 employees and must be the primary place of employment of the principal investigator. In addition, the companies must be American owned and independently operated, and a for-profit entity.

Each of the ten federal departments and agencies accept proposals and select their own R&D topics for the SBIR program. The Small Business Administration (SBA) collects solicitation information from all participating agencies and publishes it quarterly in a pre-solicitation announcement at http://www.sbaonline.sba.gov/sbir/indexprograms.html.

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[6] P.L. 106-554, Appendix 1—HR 5667, Title 1, accessed at http://www.acq.osd.mil/sadbu/sbir/pl106-554.pdf on August 1, 2002.

[7] Ibid., Section 102.

[8] Ibid.

After proposals are submitted, agencies make SBIR awards according to the small business' qualification, degree of innovation, technical merit, and future market potential. Small businesses that receive awards or grants then begin the three-phase program.

Appendix C describes a number of successes achieved by small business participants in the SBIR program. For more information about the program, visit http://www.sba.gov/sbir/indexsbir-sttr.html.

DEFENSE ACQUISITION CHALLENGE PROGRAM

The Defense Acquisition Challenge Program is a new program required by the FY03 National Defense Authorization Act.[9] The Secretary of Defense, acting through the Under Secretary of Defense (Acquisition, Technology, and Logistics) USD(AT&L), will establish a program for providing opportunities for increasing the introduction of innovative and cost-saving technology in DoD's acquisition programs.

The Defense Acquisition Challenge Program will give people or organizations inside or outside DoD the opportunity to propose alternatives, known as challenge proposals, at the component, subsystem, or system level of an existing DoD acquisition program. Challenge alternatives should improve the performance, affordability, manufacturability, or operational capability of the program.

The challenge proposal will be evaluated to determine whether the proposal

- has merit;
- is likely to improve performance, affordability, manufacturability, or operational capability at the component, subsystem, or system level of an acquisition program; and
- could be implemented in the acquisition program rapidly, at an acceptable cost, and without unacceptable disruption to the program.

More details will become available as DoD implements the program.

SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM

The Small Business Technology Transfer (STTR) program is a small business program that expands funding opportunities for federal innovation R&D. Central to the program is the expansion of the public- and private-sector partnership, including joint venture opportunities for small businesses and the nation's premier

[9] See the Defense Acquisition Challenge Program, Section 243, National Defense Authorization Act for FY 2003.

nonprofit research institutions. The program's most important role is to foster the innovation necessary to meet the nation's S&T challenges.

Small business has long been where innovation and innovators thrive, but the risk and expense of doing serious R&D can be beyond the means of many small businesses. Conversely, nonprofit research laboratories are instrumental in developing high-tech innovations, but frequently, their innovation is confined to the theoretical rather than the practical. STTR combines the strengths of both entities by introducing entrepreneurial skills to high-tech research.

Each year, five federal departments and agencies (the Departments of Defense, Energy, Health and Human Services; along with NASA and NSF), are required under the STTR program to reserve part of their R&D funds for award to partnerships between small businesses and nonprofit research institutions.

Participation in the Program

Small businesses must meet certain eligibility criteria to participate in the STTR program. They must be

- American owned and independently operated,
- for-profit, and
- have no more than 500 employees.

A nonprofit research institution also must meet certain eligibility criteria. Although there is no size limit, it must

- be based in the United States, and
- meet one of three definitions: (1) nonprofit college or university, (2) domestic nonprofit research organization, or (3) federally funded R&D center (FFRDC).

Each of the five participating federal departments and agencies accepts proposals and designates its own R&D topics for the STTR program. The SBA collects solicitation information from the participating agencies and publishes it periodically in a pre-solicitation announcement. The SBA's pre-solicitation announcements, available at http://www.sbaonline.sba.gov/sbir/indexprograms.html, are the single source for the topics and anticipated release and closing dates for each agency's solicitations.

After proposals are submitted, the agencies make STTR awards based on the qualifications of the small business or nonprofit research institution, degree of innovation, and future market potential. Small businesses that receive awards or grants then begin a three-phase program.

Phase I is the startup phase. Awards of as much as $100,000, for approximately one year, fund the exploration of the scientific, technical, and commercial feasibility of an idea or technology. Phase II awards of as much as $500,000, for as long as two years, expand Phase I results. During this period, the R&D is done and the developer begins to consider commercial potential. Only Phase I award winners are considered for Phase II. Phase III is the period during which Phase II innovation moves from the laboratory into the marketplace. No STTR funds support Phase III. The small business must find funding from the private sector or a non-STTR federal agency. For more information about the STTR program, visit http://www.sba.gov/sbir/indexsbir-sttr.html.

TECHNOLOGY TRANSITION INITIATIVE

The Technology Transition Initiative is a new program, called for in the FY 2003 National Defense Authorization Act, which will provide limited funding for selected technology transition projects. The objectives of the Technology transition Initiative are to accelerate the transition of new technologies into operational capabilities within the armed forces; and to successfully demonstrate new technologies in relevant environments.

The Technology Transition Initiative will be administered by a "Manager", designated by the USD(AT&L). The services and defense agencies will nominate projects for implementation under this Initiative. If the projects are selected, the Initiative will fund 50 percent or more of the cost of the project for up to four years.

The Manager will select the projects to be funded, based on the advice and assistance of a Technology Transition Council. The service Acquisition Executives, the Joint Requirements Oversight Council, and the science and technology executives from the services and defense agencies will be members of the Council.

The funding for this program will be limited. The Technology Transition Initiative will be a way for a relatively small number of programs to receive funding to accelerate a transition needed to get a product to the field. This program will supplement, rather than replace, existing service and defense agency technology transition programs.

Participation in the Program

The Technology Transition Initiative is a new program. Details on participation in the program will be provided by the USD(AT&L) as the program is implemented.

VALUE ENGINEERING

Value Engineering (VE) has two aspects: a financial incentive to get contractors and subcontractors to reduce the cost of our systems, supplies, and services and a

rigorous method for maximizing cost savings. Contractors who participate in VE share in net savings on the basis of their financial risk. If, for example, a contractor funds the cost for developing a VE idea, the share is normally 50 percent; if the government funds the idea development cost initially, the contractor receives 25 percent of net savings. Exact shares are defined in the FAR. VE is unique because it maintains essential functions and lowers overall cost without degrading performance, reliability, maintenance, or safety. To qualify as VE, an idea must, at a minimum, result in a change in a support contract that, when implemented, saves money. A VE incentive clause is required in non-R&D contracts of more than $100,000 and can be requested in smaller ones.

After the contract is awarded, the contractors have little reason to reduce acquisition or life-cycle cost. In fact, without VE, contractors lose money by reducing costs. Because profits are derived from cost, reducing cost without VE reduces profits. With VE, however, the situation is reversed. Contractors keep their original profit and share in net savings in four areas: their existing contract, concurrent contracts (such as foreign military sales), future contracts (normally for three years), and collateral (operations and support) savings.

Participation in the Program

Contractors are encouraged to participate in the VE program by submitting cost-reduction ideas as value engineering change proposals (VECPs) pursuant to FAR 52.248-1. Contractors who voluntarily use their own resources to develop and submit VECPs gain the most, sharing 50 percent of the savings. If a VECP is not approved, however, the government does not reimburse a contractor's development cost. This was added to the FAR to ensure that only high-quality VE ideas are proposed. VE savings typically are shared for three years after acceptable implementation. Contractors share *net* savings on their existing contract, concurrent contracts, and on future collateral savings. Collateral savings are measurable net reductions in an agency's overall projected operations, maintenance, logistics support, or government-furnished property costs. Because collateral savings are auxiliary savings, and at best a prediction of future possibilities, the share is smaller—20 percent of a typical year's operations and support savings, not to exceed the price of the existing contract price or $100,000, whichever is more. VE sharing is limited to contracts issued by the procuring office or its successor. Each buying activity funds its own VECPs and may not buy a VECP unless funds are available to develop and implement the idea. Similarly, the government may not disapprove a VECP and then use the idea. When a contractor is unfamiliar with VE, or cannot afford to voluntarily do VE, the government may choose to require a mandatory VE program. When this occurs, the government funds the entire VE process from idea generation to implementation. Because the government is accepting the full financial risk for mandatory VE, contractors share at a lower rate of 25 percent of net savings per FAR 52.248-1.

WARFIGHTER RAPID ACQUISITION PROGRAMS

The Army established a Warfighter Rapid Acquisition Program (WRAP) to address the gap in funding that exists because of the time required to plan, program, budget, and receive appropriations for procuring a new technology. WRAP was designed to shorten the acquisition cycle and be a bridge between experimentation and systems acquisition. The goal was to put new weapons in the hands of soldiers faster and cheaper. Candidates for the WRAP were selected according to urgency of need, technical maturity, affordability, and effectiveness. To promote program stability, candidates received funding for the first 2 years, which allowed time to build them into the overall budget.

The Army used WRAP for several programs: the Striker, its new artillery observation vehicle; the lightweight laser designator rangefinder, used to determine the range of a target and relay that information back to tanks, artillery, or aircraft; and the radio frequency tags, a computer tracking system used to pinpoint equipment quickly and easily. The Army is no longer funding their WRAP, but is developing other initiatives to rapidly transition technology to warfighters.

The Air Force Warfighter Rapid Acquisition Process (AF WRAP), which is an ongoing program, is a rigorous process that speeds the initial acquisition decision and allocation of funds for a small number of competitively selected projects that either increase warfighter capability or significantly reduce costs. AF WRAP can accelerate implementing and fielding of projects meeting the immediate needs of the warfighter. AF WRAP quickly makes available newly matured, often pivotal technology. The AF WRAP candidate review ensures the smooth transition of selected candidates to operational capabilities that are acquired and sustained as part of the baseline Air Force program.

WRAP funding is allocated in the execution year to support selected projects for as long as two years. Major commands selected to receive FY02 WRAP funds have committed to funding, developing, procuring, and sustaining their selected project.

AF WRAP candidates approved in FY02 include the panoramic night vision goggles (PNVG), increasing night vision goggle field of view from 40 to 100 degrees; the remote casualty locator and assessment device, a low-cost, hand-held, battery-powered device that enables the user to “see” through walls, rubble, wood, and earth to locate and assess the condition of casualties; and the Information For Global Reach—Aerovac, which provides continuous, seamless exchange of mobility- and medical-related C2 and patient health information among fixed, airborne, deploying, and deployed mobility and medical elements.

Chapter 4
Challenges and Considerations

This chapter identifies some of the issues that will be faced during the technology transition process. The issues were developed from questions and feedback received from government and industry technology transition personnel. For each of the issues, we pose a series of questions for the communities that form the technology transition team. Following each question, there is a short answer that contains information for your consideration. As with all advice, these considerations must be reviewed to ensure that they apply to your specific situation and program.

Tables 4-1 through 4-3 summarize the contents of this chapter, to assist you in locating specific issues.

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During the S&T phase of a system's development in government, industry, or academia, the focus is on developing knowledge. In the PM[1] community, the focus is on applying technology to improve the performance, operations, or affordability of specific products. The transition between these two phases requires a partnership among many communities: S&T, R&D, PMs, requirements, test and evaluation, sustainment, and financial. The transition must be managed to ensure that the warfighters receive the greatest benefit from current technology development.

This chapter describes the questions and challenges that arise during this transition, and suggests ways to address and resolve the challenges. The challenges, which address systematic problems about transitioning technology that pervade acquisition and sustainment, are organized into these broad categories:

1. Technology transition: How to quickly deploy a useful military capability to the field and upgrade that capability in later stages of a system's life cycle.

2. Cultural barriers: How to overcome the disincentives, communication shortfalls, and suboptimization that occurs among the different communities that interact in technology transition.

3. Knowledge management: How to identify useful information and activity that occurs in the different communities and share that information in ways that support technology transition.

[1] PM in this chapter means acquisition program managers.

The discussion of these challenges is organized around a series of questions that are relevant for each of the communities involved in that issue—requirements, S&T, R&D, acquisition, T&E, financial, and sustainment. In response to the questions, information is offered about policies, procedures, and management techniques that address the related issue.

ISSUE CATEGORY 1: TECHNOLOGY TRANSITION

Issue 1-A: Inserting Enabling Technology

One of the major challenges facing DoD is modernizing legacy systems using state-of-the-art technology. Therefore, from the start of an acquisition program, DoD must consider not only how to get a useful military capability to the field quickly, but also how it can upgrade a system later. Considerations include the latest technology, increasing mission performance, reducing O&S costs, and enhancing supportability.

Although basic and applied research are the foundations for meeting future technology needs, other programs—such as ATDs, ACTDs, warfighter experiments, and other approaches—are key to accelerating the transition from S&T to military weapons systems. Managers of S&T, R&D, and acquisitions must collaborate on their efforts if a technology is to be transitioned into weapons systems. For example, the Air Force Applied Technology Council specifically calls for a review and technology transition plan for each ATD. The Air Force collaborator program is another means of connecting the S&T community with users in particular technology areas. Below are some questions that must be considered for inserting technology.

CONSIDERATIONS

Requirements Community

Do your requirements documents describe the essential warfighting capabilities, but give the developer the maximum possible flexibility for selecting technologies to meet the need?

Operational requirements documents should contain as few key performance parameters (KPPs) as possible while ensuring an effective, interoperable system for the warfighter. The KPPs should be written so all appropriate technologies can compete. The non-KPP requirements should be added judiciously, even though they are in the "trade space." Requirements writers should avoid repeating boilerplate requirements from previous ORDs. Including seemingly innocuous "standard" requirements may have unintended consequences, and unnecessarily add to the developmental time, testing, and cost of a system.

Do your requirements documents use "phased" or "blocked" requirements to support evolutionary acquisition and spiral development?

The joint requirements community is attempting to make evolutionary requirements the rule, rather than the exception, for major systems. A solution that is 60 to 80 percent complete in the hands of a warfighter in combat is better than a 99 percent solution that is still being developed. By using phased requirements, or block improvements, a system can be fielded and improved as technology matures. The phases should be developed in cooperation with the S&T, R&D, and acquisition communities, and should reflect appropriate analyses of the cost–benefit tradeoffs.

Do the requirements documents support technology transition, especially technologies that reduce life-cycle costs?

As part of interoperability, requirements documents should encourage using open architectures, open interface standards, and alternatives that support inserting technology throughout the life of the system. Many times, PMs prioritize technologies that reduce cost or improve performance in the near term instead of technologies that reduce life-cycle cost. The requirements community should examine these priorities, and ensure that technologies that reduce the life-cycle cost are given the appropriate priority—even though they may not offer as great a near-term benefit. Because major systems will be out in the field for decades, they must be as capable and economical as possible, for as long as possible.

Are you involved in S&T planning and investment?

Users should participate, as appropriate, in S&T planning. Users provide information about future warfighting concepts, plans for new systems, and recommendations about S&T priorities. S&T programs need some flexibility to pursue information about subjects that currently do not line up with planned developmental programs. Applying appropriate resources to supporting critical future requirements and transition issues must be balanced with investing in items that have a near-term payoff.

Are the requirements documents available for supporting transition?

Sometimes, in programs like ACTDs, organizations fail to plan ahead and anticipate the need to rapidly transition an S&T effort into an acquisition program. ORDs are not required for ACTD programs but are necessary for transitioning the ACTD systems into mainstream acquisition. This transition may require assessing and analyzing alternatives concurrently with the ACTD so the necessary analytical framework for the ORD will be ready. The schedule for requirements documents should be an integral part of the planning for the transition.

S&T Community

Are technology programs prioritized on the basis of the scheduled needs and aligned with needs in the potential user programs?

Technology projects should be prioritized according to the warfighters' projected needs and reviewed by them periodically. S&T leaders, warfighters, and the acquisition or sustainment PMs should do the review annually, and projects should be funded according to the priorities established. As means of forcing new ideas, all programs should be evaluated for relevance and productivity. One way of forcing ideas is to eliminate the least productive projects annually, which will keep the technology more current.

Once technologies are prioritized and funded, the phasing of development and upgrades to weapons systems must be considered. Technology developments must be synchronized to meet acquisition program milestones and the need for any "phased" or "blocked" upgrades. Therefore, involving the users early, and planning strategically, are critical—technology projects should be managed with the warfighter mission in mind.

Planning for technology requires integrating warfighter needs with resources and technology opportunities. Planning should start early and outline probable paths for transition. In addition, all representatives from acquisition programs, industry, and other expert peers should participate in the planning. After the stakeholders, including the warfighter, have planned the technology and agreed to the plan, the technology can be developed. While the technology is being developed, it continues to be reviewed in the technology prioritization process and the plan is linked to the budget and the investment decisions. Planning is important because it provides structure to investing, shows where funding will occur, and gets commitments for resources and programs.

Do you have strategies and techniques for pushing government-funded technology to commercial venues?

Technology transferred to the commercial sector maximizes the government's benefits from investing in technology. By transferring its technology, the government enhances commercial firms' investment in developing better, cheaper technology solutions. The companies mature the technology and find commercial applications for it—marketing the technology and broadening its use. The technology can then become available, as developed commercial products, to the government at market prices for use in weapons systems. The National Technology Transfer Center (NTTC) teaches a course about commercializing government technologies.[2]

This type of partnering with industry is a long-term approach. For technology from government sources to grow and mature commercially, and then be used in a weapon system, can take years. The advantage to this approach, of course, is that industry provides the majority of the financial investment for development and eventually a worldwide marketplace arises that can lead to future technology tran-

[2] For more information, visit the National Technology Transfer Center's Website at http://www.nttc.edu/aboutnttc/newsdetail.asp?recnum=31.

sitions. Starting some of these projects today so the technologies can be used in weapons systems in the future is important.

Developing dual-use technologies is another way to make government-funded technology available in commercial venues so the technology can be further developed. Developing dual-use technologies, is a cost-effective way for government and industry to share in the benefits of developments.

How are you ensuring access to the latest technology from the small business community?

Contract award data for FY 2000, reveals that nearly $3 billion out of a total of $19.2 billion in DoD awards for R&D went to small businesses. These R&D awards account for 16 percent of the total DoD contract awards for small businesses. About 75 percent of the R&D awards to small business were for work on S&T—budget account categories 6.1, basic research; 6.2, applied research; and 6.3, advanced technology development. The remaining 25 percent of the small business R&D awards was for demonstration and development (categories 6.4 through 6.7). PMs should engage the small business community to ensure that the government has access to the results of this R&D.

Further, because much technology innovation originates in nontraditional firms (those firms that do little business with DoD),[3] a significant amount of R&D money should go to the prime and subcontractor businesses. When selecting the contractors for S&T contracts, source selection committees should review the contractors' plans for integrating large and small non-traditional firms, and should award contracts to prime contractors that are making the best use of these technology resources.

S&T and Test and Evaluation Communities

Have you formed a test and evaluation working-level IPT to assist in planning and integrating T&E early?

Forming a T&E IPT early, in the pre-systems acquisition phase for programs that probably will result in an acquisition program, can be very useful for fully integrating continuous T&E, which is needed for fast-moving programs. The contractor's and government's developmental test and evaluation (DT&E); operational test and evaluation (OT&E); and, if applicable, intelligence and LFT&E personnel should be members of the IPT. These people are particularly critical if the program needs a combined DT&E, OT&E, or LFT&E approach.

Acquisition and Sustainment Communities

Are your program needs prioritized so the S&T and R&D communities can respond accordingly?

[3] See Chapter 1 for a discussion of traditional and nontraditional firms.

Let the S&T and R&D community, in both government and industry; know your needs and priorities. You should state your needs as problems to be solved, allowing the technology providers latitude to determine the best technology solution. Also, challenge technology providers to refresh technology alternatives and access commercial technology. Peer reviews are one practice that industry uses to "scrub" its technologies to winnow out unproductive programs.

Do you encourage continuous competition of technology providers, e.g., through an open continuous BAA, or by nominating SBIR topics?

Be on the lookout for ways to keep your prime contractors competitive in terms of technologies they are incorporating into weapons systems. The warfighters need the most effective weapons systems possible; however, technologies used in weapons systems are not always the best available.

Government technology managers need to remain open to technologies that disrupt current plans. These types of technologies push the state-of-the-art, sometimes by using an existing technology in a way that has never been used before. These types of technologies can revolutionize mission performance and often challenge the current line of scientific inquiry, established S&T programs, or the revenue base of the incumbent contractor.

You might keep the competition among technology providers alive through the use of BAAs which identify challenges that need to be addressed by the technology community. The SBIR program is another way to seek out technology solutions in industry, where many solutions come from small businesses. Even if these technology solutions are different than the solution your prime contractor is proposing, you should direct the prime contractor to incorporate the best technology, if the technology is worth the risk.

Prime contractors should be required to submit a plan, as part of their proposal, describing how they will manage the competitive environment—that is, how they will create an environment to keep competition going at the subcontractor level and create competitive alternatives. Emphasis should be placed on the subcontracting plan, because being able to integrate new technologies throughout the program will depend on its success in stimulating the commercial technology base.

Another way to encourage access to the technology base in nontraditional businesses is by tying prime contractor incentives, such as award fees, to their use of nontraditional businesses as subcontractors.

Requirements and Test and Evaluation Communities

Does the Test and Evaluation Community participate in the requirements development process?

The interface between the requirements and T&E communities is important. The capabilities described in a requirements document must be measurable, testable, and achievable. The S&T and R&D communities provide information to requirement writers to assist them with establishing the required performance capabilities that are achievable. The T&E community can assist the requirements writers with describing how these capabilities will be measured and tested. Properly describing required capabilities that are measurable, testable, and achievable is critical for developing the phased or blocked requirements that are important to the success of evolutionary acquisition.

Acquisition Community

Is your program designed to promote open standards so new technology can more readily be integrated?

To facilitate evolutionary acquisition, use modular open systems approaches to integrate the latest technologies and products for modernizing fielded assets affordably and supportably. Using commercial interface standards as much as possible is beneficial. These standards help ensure interoperability, portability, scalability, and technology insertion.

The benefits of the open systems approach include accelerating the transition from S&T and R&D to acquisition and deployment, using commercial investment in new technologies and products, and maintaining continued access to advanced technologies and products from multiple suppliers during all phases of the acquisition process. Other benefits are that the risks of technology obsolescence are mitigated, you are not locked into proprietary technology solutions, and you do not have to rely on a single source of supply during the life of a system.

DoDI 5000.2 mandates using the open systems approach as an integrated business and technical strategy for acquisition. An open systems approach enables you to more rapidly develop weapons systems with demonstrated technology and facilitate future upgrades without major redesigns during all phases of the acquisition process. Open systems also enable you to continue to evaluate advanced technologies for implementation and eliminate your dependence on an incumbent producer's proprietary technology and support. A secondary benefit of the approach is that you can more readily analyze the business case to justify decisions for enhancing life-cycle supportability and you can continuously improve product affordability through technology insertion during initial procurement, reprocurement, and post-production support. (DUSD(S&T)'s April 2001 guide *Technology Transition for Affordability: A Guide for S&T Program Managers* is available on the Manufacturing Technology Information Analysis Center's website at http://mtiac.iitri.org/final_tech_trans.pdf.

Are these open standards and interface specifications available to third parties for inserting technology?

Take steps to disseminate your interface specifications to S&T organizations, both in and out of government, that can develop or help identify technologies of interest. You can disseminate the information through "Industry Day" meetings and other forums. Further, establishing "form, fit, and function" specifications, based on performance-based capabilities, aids greatly in implementing alternative enhancements in the future.

Sustainment Community

Is your program designed to promote open standards so new technology can more readily be integrated?

For legacy systems, the traditional approach for acquiring spare parts has been to buy a "tech package" that is basically a list of parts and detailed design specifications. The problem with this approach is that it locks DoD into the same vintage of technology that was used in the original design. Further, because the original vendor may not be available or may be using later technologies, staying with an older technology may cost more than changing to a newer one. However, transitioning older specifications to performance-based specifications has been somewhat successful. This approach gives contractors more opportunity to integrate new technology. To make this process enticing, contract incentives may be needed.

Sustainment organizations need to work with the PM to identify subsystems or components that are candidates for technology updates; to change from using "build-to-print" parts and components to "form, fit, and function interface," where this makes sense; and to collaborate on issues of obsolescence. In some cases, replacing or refreshing technology may require re-qualifying and re-certifying systems, subsystems, parts or components—particularly where they are flight critical or critical safety components.

Issue 1-B: Identifying and Selecting Available Technology

Identifying and selecting technologies are important early steps in developing or upgrading weapon systems. Technology "clearinghouses" (e.g., Tech Connect,[4] Technology Information Clearinghouse,[5] Air Force collaborator project, and Virtual Technology Expo[6]) exist for identifying technologies. Often PMs rely on prime contractors to identify and select technologies to insert into systems, believing the contractor will always use the best source for technology, and use it to develop the system. However, this is not always the case and may not be the best way to find leading technologies that are applicable to weapons systems. Working together, the communities for requirements, S&T, R&D, T&E, acquisition, and

[4] http://www.afrl.af.mil/techconn/index.htm.

[5] The Air Force Research Lab's Technology Information Clearinghouse can be accessed by calling 800-203-6451 or at http://www.afrl.af.mil/techconn/index.htm.

[6] The Virtual Technology Expo can be accessed at https://vte.dtic.mil/. See Appendix B for more information.

sustainment, must work hard to communicate program requirements and identify the technologies, regardless of their source, that most benefit the warfighters.

CONSIDERATIONS

Requirements Community

Do you want opportunities to educate technology providers and acquisition personnel about future warfighting concepts and anticipated new requirements?

Technology providers and acquisition professionals offer the best support when they understand the underlying warfighting concepts and environment. Some of these professionals understand a great deal about the warfighting environment, and some do not. Consider using briefings to inform S&T, R&D, and acquisition personnel about future warfighting concepts, or to demonstrate existing warfighting systems that show the context in which the new system will perform. In addition to educating, these sessions build relationships and communication, enabling an integrated assessment of tradeoffs when systems are being developed.

Did you seek information about available technologies from industry and government sources before developing the ORD?

An understanding of the available and future technologies will improve the ORD in two ways. First, such an understanding will ensure that requirements are achievable and affordable. Second, the understanding will ensure that ORD writers consider innovative options available for meeting the required capabilities and avoid unnecessary constraints that might limit options. Without knowing the current possible technologies, the writers could over- or understate the requirements. If the requirements are overstated, PMs might spend more time and money in development than is necessary. If the requirements are understated, the warfighter loses capabilities to support the mission. For example, a technology provider may have more than one solution in mind and PMs may be tracking two separate technologies. One may be require low investment, and have low risk and low payoff. Another may be higher risk, require a higher investment, but have a much greater payoff. If the ORD has sufficient flexibility, the PM has can maximize results in a managed-risk environment.

Is the ORD written in terms that allow the developer the maximum flexibility in meeting the requirement?

Sometimes ORDs are written in a way that limits the developer's solution. By focusing on the needed capabilities, rather than trying to describe a specific system in the ORD, the developer can allow technology providers to propose innovative solutions for providing the capabilities.

Do you have a process that maps technologies you are developing to weapons systems requirements?

Although not all S&T investments are directly aligned with future weapons systems, S&T leaders (whether government or industry) must maintain close and continuous ties with the warfighters or other users of systems, as well as with acquisition and sustainment PMs. Maintaining these ties can help ensure that S&T leaders understand the needs, develop technologies that will be useful for satisfying those needs, have a sense for the timing needed for integration, and anticipate future requirements. The ties can be maintained through formal forums or, even more effectively, through frequent interactions between technologists and acquisition or sustainment PMs. The interaction will help keep S&T projects focused on increasing the effectiveness of a mission capability while decreasing cost, increasing operational life, and incrementally improving products through planned product upgrades.

S&T leaders must ensure that information about technology development programs is continually available. S&T technology developers can publicize information about technologies they are pursuing through

- websites and publications;
- meetings, briefings, and other forums; and
- partnering directly with program offices.

S&T leaders should also assign some of their best people to become "application brokers" to link technology programs to developments in weapons systems to ensure the technology they are developing will be used in the systems. When the leaders use application brokers, they will find that acquisition and sustainment PMs may be willing to invest in, and apply, the technologies that most directly benefit their programs.

Do you have a process that identifies potential commercial technology for satisfying acquisition program needs within planned timeframes?

Government S&T should interact with industry to identify commercial technology. Because no single place or method is best for finding commercial technology, someone in the S&T organization may have to spend some effort, maybe full time, investigating commercial technology. Appendix B lists resources for locating technology. Despite the variety of available resources, attracting nontraditional contractors to work with government organizations is often difficult. You may need to work with contractors who do not normally do business with the government. Contractors should be evaluated on the basis of their performance in commercial markets and the capabilities of their technologies. To evaluate the

contractors well may involve personal contact and discussions about how projects will be mutually beneficial.

Using commercial technologies that have been successfully tested for, and integrated in, a military environment is the preferred way of doing business. However, commercial technologies may have to be modified for military use.

Acquisition and R&D Communities

Do you have effective approaches for identifying and inserting both incremental and radical technologies into your program?

DoDD 5000.1 states that "priority consideration shall always be given to the most cost-effective solution over the system's life cycle. In general, decision makers, users, and PMs shall first consider the procurement of commercially available …technologies, or the development of dual-use technologies, to satisfy user requirements, and shall work together (with system users) to modify requirements, whenever feasible, to facilitate such procurements." To do what is required, consider assigning "S&T liaisons," whose prime mission is sharing the program's needs and identifying technology available from all sources. A secondary mission for liaisons is gaining funding and other support for maturing or transitioning technology and for dual-use technology work from labs and other organizations that have budgets for this purpose. Give preference to modifying an existing commercial-off-the-shelf item to meet the need, especially if the warfighters benefit in the long term. You need to be aware of the "not-invented-here syndrome," which often impedes selecting and using the best, most cost-effective

technologies. In many instances, relevant commercial (and sometimes government) technologies are being developed that can be used in weapons systems. The challenge is to find and adapt them.

Consider implementing a process improvement team (PIT) concept in which acquisition workforce specialists (including technologists) are involved in the development of warfighting requirements. This will ensure that the art of the possible in technology is understood by the warfighter, and that the technology and acquisition communities understand the warfighter's needs.

Market research is an integral part of the process. It includes surveying market literature and news, searching the Internet, and working with other departments, government agencies, and industry contacts. It should look at the technology offerings, gain an understanding about the credentials of the firms (e.g., past performance and financial health), the terms and conditions for contracts prevalent in that industry sector, IP, pricing, and warranties. This understanding can help later in constructing the business case for implementing such capabilities, as well as selecting the best contracting vehicle, such as OTs or FAR Part 12 contracts or subcontracts, to establish a business relationship with these nontraditional com-

mercial suppliers. These contract vehicles will be especially effective with non-traditional businesses that are unwilling or unlikely to be able to afford to comply with stringent DoD business requirements, such as cost accounting standards (CAS) and Truth in Negotiation Act (TINA) requirements.

Acquisition, R&D, and Sustainment Communities

Have you researched other programs in the government (DoD, NASA, etc.) for technologies that could be transitioned into your program?

Other programs or DoD agencies could be developing technologies that may be very useful. Currently, there is no institutionalized way of easily finding the technologies. However, you can search for technologies in several places, such as the websites of S&T organizations or other programs, the Defense S&T Plan, as well as the sources (such as Tech Connect[7]) listed in Appendix B. Our list is not all-inclusive, however; one of the best ways to access these programs is still through personal contacts, often made at a technology conference or academic forum. One thing to consider is whether your program needs are similar to those of another program in your service or another service. If this is the case, a technology insertion plan may exist that could help you identify applicable technologies and their sources. Using technology developed in another program may be the most efficient way to reduce costs, gain a technology solution that fits the program, and improve supportability.

Do you require a business case analysis for selecting and inserting the best technology, regardless of source?

For assessing commercial technology, you begin by surveying experts in the field, to determine the technology options that will be available. After the survey is finished, you can evaluate the investment options for maturing the commercial technology to satisfy the warfighter's need. (A similar model can be instituted for military technologies.) Market research and analysis will help determine the availability, suitability, operational supportability, interoperability, and ease of integration of existing commercial technologies and products and of nondevelopmental items.

One way of assessing technology tradeoffs is with simulation tools. Although simulation tools can help with evaluating a technology technically, the tools do not address myriad business-related issues. For example, competitive technologies, logistics support and training issues, scheduling issues (e.g., those having a ripple effect), and budget changes might complicate the evaluation.

Analyzing the business case for a technology investment includes more than evaluating the finances. The analysis includes numerous considerations, the careful evaluation of which could lead to unintended and unexpected consequences. For example, you should consider the following:

[7] http://www.afrl.af.mil/techconn/index.htm.

- Is the system that will receive the technology still being developed or is it already fielded?
- Is the technological opportunity evolutionary or revolutionary?
- What is the maturity level (i.e., the TRL/EMRL) of the item? How will risk be managed?
- Is the source of the new technology external or in house?
- Will the new technology require changes to, or revisions in, logistics support infrastructure, training, documentation, schedule, or current or future budgets?
- What funding sources will be required for inserting, or available to support, the technology, and is funding available?
- Do expected benefits include improved performance capability, lower acquisition cost, or lower operations and support costs? Can the expected benefits be reasonably defined and quantified?
- Does inserting technology require other investments or costs? Can the costs be reasonably defined and quantified? Are existing budgets capable of sustaining the required costs?
- Could competitive technologies overtake this opportunity?

What processes exist for identifying state-of-the-art commercial technology that will improve maintainability, affordability, and system performance?

Such processes generally tend to be ad hoc. The Office of Naval Research (ONR) hosts an S&T industry conference each year,[8] the Army hosts Industry Days, and so on. Be aggressive in nurturing communications with appropriate organizations that might contribute to harnessing key technologies. For example, in working with government labs, ask them about their outreach to the commercial sector to be sure they are exploiting the potential of the latest commercial technologies.

Often the commercial sector is developing technology that would meet military needs but is hesitant to do business with the government, while the government may be wary of new companies entering defense markets. DARPA attracts private-sector developers because of its flexibility in contracting, as well as its approach to IP rights, and the agency is attempting to learn how to involve industry to a greater degree in transitioning products into acquisition programs. You should consult with DARPA when you are trying to find commercial solutions. Many of the solutions available to DARPA (e.g., OT authority for prototype projects) also are available to other agencies.

[8] See http://www.naval-industrypartners.com/Index.asp for further information.

Issue 1-C: Accessing and Using DoD Technology Development and Transition Programs

Many government programs encourage developing and enhancing high-technology solutions to meet the challenges faced by weapons systems development and sustainment programs. However, PMs often do not effectively use these programs, either because they are unaware of them or because they have not institutionalized an approach for using them to develop technology solutions.

CONSIDERATIONS

All Communities

How are you staying abreast of available programs, and what are you doing to access their resources?

Assign someone in your organization to work not only as a liaison, but to aggressively work SBIR, ManTech, and other programs for the PM. They should review applicable programs and come up with strategies for accessing their resources. Network with those who have successfully accessed these programs, and be sure proposals are thoughtfully developed and adequately address the criteria against which funding will be granted.

Several government initiatives are focused on helping small businesses gain access to the government market. One example is the Missile Defense Agency's Technology Applications Review. This review is conducted by a "board of directors" consisting of business executives from large companies, such as Boeing, that assist small companies with their business plans. Through this process, small and large companies form business relationships that eventually help deliver better systems to the government.

To access technology in commercial nontraditional laboratories, a good first step is to determine which laboratories have a track record in the technologies that can be precursors to those of interest. Then, determine whether their laboratories have technical personnel who are recognized leaders in the field, a corporate reputation in the technology, related equipment available, and/or a number of related patents and technical papers.

If a program needs advanced revolutionary technology that may have significant commercial potential, then, very likely, the only way to identity potential sources is to find firms that have funding from a university or nonprofit laboratory that is doing work in precursor technologies which have been hiring their graduates. Many of the nontraditional businesses that are funding these developments do so in order to have a leading edge product for which they will be the exclusive source for a number of years.

Acquisition, R&D, and Sustainment Communities

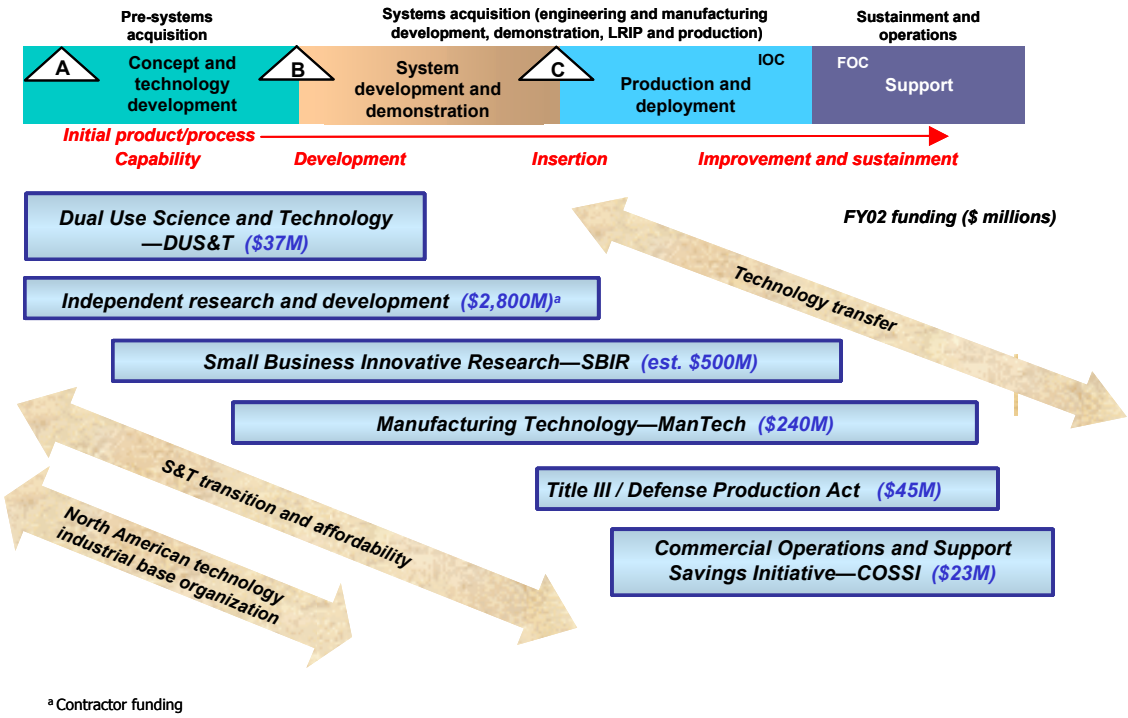
Are you providing technology topics to the SBIR program?

The SBIR program, which is funded as a tax against the DoD R&D budget, helps small businesses develop technology capabilities. The funding of technology through the SBIR program is relatively easy and streamlined. To participate, program offices submit topics for technology development to small businesses through the SBIR program and may solicit applicable topics from prime contractors. You might find that developing technologies through the SBIR program provides alternatives to the technologies that prime contractors propose using in weapons systems. Any competitive tension from your pursuit of SBIR alternatives may encourage your prime contractors to work harder to find the best technologies for the systems they are developing. Program managers should seek ways to set incentives for transitioning technology and using nontraditional technology sources in award fee guidelines.

Are you submitting high-quality proposals for defense-funded programs (e.g., ManTech, WRAP, and reduction of total operating costs (RTOC)?

As can be seen in Figure 4-1, these programs are available for the entire life of a product.

Figure 4-1. Support for the Product or Process Life Cycle



[a] Contractor funding

These programs help the S&T community—both contractor and government—transition technologies to programs. The contractors and the government have

somewhat different strategies or processes, but DoD has designed each strategy or process to emphasize transitioning technology and addressing problems that lack transition funds, definition, visibility, and priorities toward transition; and for which the S&T, acquisition, or sustainment community has differing goals and timelines. The strategies involve teaming between the communities and are focused on learning more about technologies in systems, as well as improving affordability and rapid transitions to systems. You can benefit from learning more about these programs and using them to your advantage.

Are you familiar with the timing and other requirements of budgets?

To access programs that provide funding, you must comply with the requirements of the budgetary process in your service or agency. Compliance will probably require submitting certain documents by specific dates. If you do not or cannot comply, you may not be able to get funding. Become familiar with the relevant parts of the budget process, perhaps by asking for assistance from the personnel in your service or agency who deal with RDT&E funding.

Issue 1-D: Planning for Transitioning Technology

If you are using an evolutionary approach to developing weapons systems, breaking up the program into blocks is important. Block 1, for instance, would be the initial deployment capability, and other blocks would follow in the order in which the system is developed. DoDI 5000.2 indicates the PM must describe in the acquisition strategy how the program will be funded, developed, tested, produced, and supported. The description should include the plan for technology insertion. DoDI 5000.2 also states that the PM will have a weapons system support strategy that addresses "how the PM and other responsible organizations will maintain appropriate oversight of the fielded system. Oversight shall identify and properly address performance, readiness, ownership cost, and support issues, and shall include post-deployment evaluation to support planning for assuring sustainment and implementing technology insertion to continually improve product affordability." Probably the best way to begin is to establish an IPT that can work its way through these issues.

Planning early to insert technology continually is important. DoDD 5000.1 discusses "rapid and effective transition from science and technology to products," an approach that requires the S&T community to understand and respond to the time-phased needs of the warfighters. Because the approach requires the acquisition community to plan for the initial system capability and to incrementally introduce new technology, the acquisition community must thoroughly understand the technology's readiness for transition.

CONSIDERATIONS

Requirements Community

Does the ORD support evolutionary acquisition and "phased" or "blocked" requirements?

Two basic approaches are used for writing ORDs that support evolutionary acquisition. In the first approach, the ultimate functionality can be defined at the beginning of the program, and the content of each phase clearly delineated in the ORD. This ORD method has been used for years under different names (such as preplanned product improvement). In all cases, the requirements community needs to know more or less what it wants in advance and articulate the requirements in the ORD. In the second approach, the ultimate functionality cannot be defined at the beginning of the program, and each increment of capability is defined according to the maturation of the technologies matched with the evolving needs of the user. This is new territory for most requirements writers and will require coordinating closely with the acquisition community.

Regardless of the approach, when a phase or block is defined, the threshold performance parameters, or "exit criteria," must be well delineated for each block. The delineation is necessary for a number of reasons. For one, it ensures that the users clearly understand what will be provided. The criteria used to define the early blocks are needed by the testing community so the system can pass a test for an individual block without meeting the full ORD requirements. Existing ORDs can be changed to a phased or blocked requirements structure. In the past, the JROC and Joint Staff have supported appropriately justified changes of this type. The trend is to make this evolutionary requirements structure the rule rather than the exception.

The blocks cannot be immutable. Requirements must be flexible enough to enable change as users increase the knowledge and understanding of system capabilities (e.g., from experience with the "Block 1" systems), as the threat changes, and as technology changes.

S&T Community

Do you plan for product maturation and integration?

Industry is the prime recipient of government-developed S&T. Therefore, you must work with industry to ensure your S&T is sufficiently mature and integration is planned early in the process. Providing industry with adequate information about technology developments is important so contractors can integrate the technology into weapons systems.

Do affordability metrics, a transition strategy, and exit criteria exist for transition?

Although the technical merits of a technology may be critical for satisfying warfighter needs from a performance perspective, other aspects are important. For example, the technology must be affordable. Early consideration of the TOCs of a technology will increase the probability that it will be used in the system. Further, planning for transition is vital to specific programs. Working with potential downstream PMs early will improve the likelihood of their acceptance of a program. They naturally will want to understand the exit criteria you plan to use in determining if the technology is ready for transition.

Do you have a budget and plan for contingencies to prevent the technology "valley of death," i.e., a hiatus in funding when funding shifts from 6.3 to 6.4?

The PM community often has a difficult time synchronizing the technology transition funding. The PPBS requires a two-year lead-time for funding to be approved. As a result, accommodating fast-changing S&T developments in acquisition programs can be a challenge. The PM community cannot always predict the pace of innovation two years in advance, and funding may not be available for fast-moving S&T projects that are ready for transition. Therefore, a desirable S&T project may stall for 18 to 24 months, awaiting funding. This gap is sometimes called the "valley of death."

Some flexibility in the funding process can be exploited. Sometimes changes, especially small changes, can be made in budgets as they are being finalized. Budgets are finalized in the fall of each year, about a year before funds become available. Once funds become available, and are being spent or executed, changes can be made through reprogramming. Potential reprogramming changes are usually assessed by services and agencies in the early spring of each year, although small changes can be considered at other times. In most cases, to qualify for reprogramming, changes must be unexpected and increases must be offset by reductions in other programs.

To take advantage of available flexibility in the budgetary process, you need to learn the dates and other requirements imposed by your service or agency. You can get this information by contacting the personnel in your financial community who deal with RDT&E funding. You also can minimize the chances of funding gaps by identifying and working with potential downstream PMs early in the process to plan for the necessary transition funding (often from 6.3 to 6.4 type funding). If a PM will sponsor your request, you will be more likely to be successful in exploiting available flexibility in the budgetary process.

If you do encounter serious problems with the constraints of the budgetary process, consider documenting the problems and making them available to personnel in your financial community. DoD often has asked Congress to make funding more flexible. These requests have sometimes been denied for lack of specific, documented problems. You can help in the quest for financial flexibility by documenting problems.

Do you have strategies for inserting new government-developed technologies into prime contractors' weapons systems?

In the past, defense programs were largely responsible for determining what technology was used. Today, prime contractors have a much greater role because they function more as prime integrators. Further, they tend to use performance-based specifications and have more latitude in their solutions. Therefore, when a government lab develops an innovative technology not available in the commercial marketplace, it must take on the responsibility to ensure that the technology is "packaged" so industry can use it when appropriate.

Acquisition, R&D, and Sustainment Communities

Do you have a plan for inserting technology?

A plan for inserting technology should describe the technology enhancements that will be made to a weapons system and when they will occur during the acquisition process. Such an plan would include strict exit criteria and TRLs and EMRLs used to evaluate the transition between the S&T community and the acquisition community, as well as provisions for funding. The process is similar to that employed by users when they establish performance-based requirements.

Program offices should have a plan for their system, going out at least the length of the FYDP or longer, showing major ECPs and other points where technology will be inserted. Furthermore, PMs should coordinate with other PMs for similar systems, with services that have similar systems, or with the PEO about his or her portfolio, to look for opportunities for using multi-platform joint development programs. Having this clear picture and sharing it with the warfighters, requirements staff, S&T groups, finance and budget people, industry partners, and logistics staff will ensure that inserting technology is better coordinated and reduce chances of a hiatus in funding.

For fielded systems, what processes exist for making resource decisions, including funding for the testing of improvements to maintainability, affordability, and system performance?

Different programs will require different solutions for inserting post-fielding technology. You should investigate the availability of funds and programs in your service for inserting technology, such as service implementations of COSSI-type programs. The prime contractor for sustainment should have incentives in the contract for inserting technology.

Do you have a tailored strategy for inserting technology continually, given the overall acquisition strategy (e.g., prime contractor, system integration contractor, and total system performance contractor), and for considering planned block timeframes?

Once programs are approved and a baseline for cost, schedule, and performance is established, PMs can be reluctant to investigate technology that could add risk to a program. This approval program can be a powerful disincentive for inserting technology. Instead, PMs should be rewarded and recognized for investigating new technologies and managing the attendant risk.

Do you use effective methods to transition lab technology into prime contractor solutions?

You need to be asking your technology providers how they plan to integrate their technology into prime contractor solutions. Building a relationship and trust with your providers is a start toward transitioning technology successfully. Further, you might find that the providers have collaborative agreements for enhancing such a transition. Similarly, a focus on the prime contractors may be necessary for a partnership to be successful.

Will candidate commercial technologies be there when your program needs them? If not, what measures are you taking to ensure that evolving commercial technologies are integrated into your system?

Moore's law says that computing power doubles every 18 months. Other technologies have similar benchmarks. Technology growth is exponential, and this has been causing problems for our linear acquisition strategies.

If your program is being developed using defense-unique technologies, obsolescence is the problem that is most likely to be encountered in the sustainment phase. Because technology cycle times are decreasing and the demand from the commercial market is driving much of our technology, your program must be designed to keep pace with the rapid cycle of the commercial market. No matter whether your system uses defense-unique technology or commercially-available technology—particularly in the electronics and computer components that are pervasive in many weapons systems—changes and obsolescence will be continual. The way to deal with these changes and obsolescence is to design for it, plan for it, budget for it, and have technology refreshment programs in place so improvements in both capability and affordability can be incorporated throughout the useful life of the system. Last-time or lifetime buys are not normally very efficient. Good parts-management tools are available with predictive capabilities that your program office or prime contractor should be using for managing the supply chain and sustaining the system. In some cases, you will periodically need to fund re-qualification and re-certification testing.

Issue 1-E: Teaming and Partnering

Teaming among government S&T organizations, contractor development groups, and the program office is key to identifying acquisition strategies early and the planning innovative technology solutions. You must create an environment that engenders the commitment of all players and their trust in the process.

CONSIDERATIONS

All Communities

Do you participate in teaming or partnering with relevant programs for technology transition?

Once technologies that are applicable to an acquisition program are identified, teaming or partnering between the technologists and the weapons systems developers creates a relationship in which the technologists become key members of the team and have a vested interest in developing the system.

Too often the technology organizations pursue programs that have no direct application to meeting warfighter needs. Similarly, programs may pursue development opportunities that are inconsistent with a laboratory's technology initiatives. Communication and partnering among the S&T, requirements, acquisition, and R&D communities must be continual to ensure the right technology gets to the warfighter rapidly.

Acquisition, R&D, and Sustainment Communities

Do you participate in a transition agreement with the involved communities?

A negotiated business agreement among the involved communities is a means for transitioning technology from the S&T community to the acquisition program by fostering common objectives for the program. The agreement should include plans for executing the project and for the technology demonstration milestones, transition targets, and schedules. The existence of an agreement helps ensure that each party understands expectations because the agreement must define standards of transition success clearly, and acknowledge that success when developing technology is never guaranteed, despite the best efforts of those involved. The agreement should commit the S&T community to diligence in developing technology, and the PM to supporting the technology and transitioning it to the acquisition program if it is successful. Early commitment from the warfighter is equally important. Some write agreements in which the warfighter agrees to use technology as a mission need; the technologist agrees to develop the technology according to a planned milestone schedule; and if milestones are met, the acquisition community agrees to budget and plan for introducing and integrating the technology into the program. To accommodate for the occasional failure in some technologies, contingency plans should be considered for substituting alternative mature technologies. Agreements should be signed by each party, and management should use the agreements to follow-up and control the project. Resources should be allocated on the basis these agreements.

Issue 1-F: Making Technology Ready

While technology is being developed, its readiness for inserting into current technology must continually be evaluated. You need a systematic process for measuring that enables you to determine the maturity of specific technologies and compare different types of technology.

CONSIDERATIONS

All Communities

Do you consider technology maturity when assessing technology?

Many programs have found that using TRLs is beneficial for assessing technologies. TRLs provide a systematic measurement system for assessing the maturity of a technology and for consistently comparing maturity of different types of technology. NASA has used TRLs for many years for planning its space technology, and, as described in DoD 5000.2R, use of TRLs is preferred for all new DoD programs. Furthermore, component S&T executives are required to assess technology readiness for critical technologies identified in Acquisition Category identification ACAT ID (Major Defense Acquisition Programs where the USD(AT&L) is the Milestone Decision Authority) and ACAT IAM (Major Automated Information Systems) programs before milestones B and C. PMs in other programs will also find that using TRLs is beneficial for assessing technology maturity because the definitions of the TRLs can be tailored to specific programs. In many cases, augmenting (not changing) TRL criteria is helpful for making them more useful for your own program.

What method do you use for considering engineering, manufacturing, producibility, interoperability, and integration when you assess technology?

The IPPD method is an excellent top-level method for ensuring that engineering, manufacturing, producibility, interoperability, and integration considerations are addressed up front.

Although the TRL approach is a valuable tool for assessing the maturity of technology, this approach, as currently applied, does not adequately assess the readiness of a technology for production. The milestone decision authority (MDA) is using engineering manufacturing readiness levels to assist with evaluating the maturity of their technologies.

Acquisition, R&D, T&E, and Sustainment Communities

Are you using the IPPD process and do you review product maturation, producibility, and integration with the technology provider to reach desired readiness levels and mature technologies?

If you are able to engage with a government technology developer or commercial company about their plan for advanced or next-generation technologies, request they assess technology in the context of the TRL review. If technologies are not proceeding as planned, reassessing their viability may lead to pursuing alternatives. In addition, assessing integration readiness levels is particularly important because of the general reliance on commercial technology for upgrading software.

Issue 1-G: Reducing Risk

No matter how well a technology's development is proceeding, the possibility always exists that it will not be totally successful in producing the solution needed by weapon system acquisition programs. Even if solutions become available, they may not be available in time. Therefore, some forethought is required to identify alternative approaches to ensure the program will meet its objectives.

CONSIDERATIONS

Acquisition, R&D, and Sustainment Communities

Do you plan for mitigating risks for technology failures and funding shortfalls?

You may want to define critical success factors (CSFs)—critical management activities that define an acceptable deliverable or series of deliverables for a technology solution. CSFs are activities that can be tracked and measured and are based on performance. CSFs are used in addition to the detailed project plan and other project documentation. Using CSFs requires not only identifying the factors and their appropriate measurements, but also analyzing the underlying constraints. The analysis will help you devise ways to manage risk in case technology providers are unable to deliver the technology when needed.

Another key activity in mitigating risk is to constantly explore alternatives for meeting the technology requirement. The SBIR program, in particular, is a good base of technology alternatives. Some PMs or PEOs are very aggressive and quite successful in using this program for developing alternatives to the incumbent technological approach, especially if progress is slow and milestones are missed. Competition can be an excellent motivator to the technology provider.

Issue 1-H: Changing Contractual Relationships

Accessing advanced technology from commercial sources may require using innovative contractual arrangements. You must use a new approach when trying to attract commercial sources, especially among contractor communities that typically do not work with DoD. Some companies stay away from government business because they do not want to go through the typical acquisition process, which takes time and investment and sometimes compromises their IP rights. Alternative contracting approaches are available, and you should consider them when trying to access the best technology for warfighters. The PM largely controls the acquisi-

tion strategy, and can facilitate and be an advocate for alternative contracting approaches.

CONSIDERATIONS

Acquisition, R&D, and Sustainment Communities

Are you using FAR Part 12 for modified commercial items?

Commercial item acquisition procedures that are based on FAR Part 12 are more friendly to nontraditional firms than are normal FAR contracts. The Part 12 procedures are applicable to "minor modifications" to commercial items and "modifications of a type customarily available in the commercial marketplace." In some cases, FAR Part 12 can be used for a contract with a nontraditional firm even if the item must be modified. FAR Part 12 also can be used by prime contractors to contract with their suppliers.

Are you using OTs for prototype projects where traditional contacts do not attract sufficient commercial industry involvement?

When a commercial technology becomes available from a nontraditional defense firm that will not consider a FAR-based contract, OTs for prototype projects can be used. This type of agreement is flexible, especially for IP rights—which often inhibit these firms from doing business with DoD. When pursuing OTs for prototype projects, it is vital to plan early for the protections needed to enable the long-term support of an item once it is fielded. Because technical data, computer software, and patent rights may not be part of the contract, other approaches are necessary. For example, long-term support agreements and escrow agreements can be used. Refer to the DUSD(AT&L) guide *Intellectual Property: Navigating Through Commercial Waters*[9] for further discussion.

Do the prime contractors share in the savings (or accrue other benefits) for bringing in new cost-reduction technology?

Prime contractors can be motivated to develop cost-reduction technology through programs that will provide a monetary incentive for innovation. Examples are a VE or similar shared-savings program, award-fee contract incentives tied directly to the fault-tolerance of the prime technology initiatives, and some protection of revenue base if a disruptive technology interferes with the prime business base.

Have you used share-in-savings strategies, such as VE? Has a proper cost-savings baseline been established?

According to FAR 48.101, *value engineering* is the formal technique by which contractors may

[9] A link to this document is available at http://www.acq.osd.mil/ar/resources.htm.

- voluntarily suggest methods for working more economically and share in resulting savings or
- be required to establish a program for identifying and submitting to the government methods for working more economically. VE attempts to eliminate anything that increases the costs of acquisition, operation, or support— without impairing essential functions or characteristics.

VE can be an effective technique for reducing costs, increasing reliability and productivity, improving quality, and avoiding procuring obsolete parts. It can be used for developing hardware and software, as well as producing and manufacturing. It may be introduced successfully at any point in the life cycle of products, systems, or procedures. VE is a technique for analyzing the functions of an item or process to determine best value, the best relationship between worth and cost. In other words, *best value* is represented by an item or process that consistently performs the required function and has the lowest total cost. VE could yield a large ROI and has long been recognized as an effective technique for lowering the government's cost while maintaining necessary quality levels.

VE is a management tool that can be used alone or with other management techniques and methods to improve operations and reduce costs. For example, you might use VE and other cost-cutting techniques, such as life-cycle costing, concurrent engineering, and design-to-cost approaches, as analytical tools when developing processes and products. The complementary relationship between VE and other management techniques increases the likelihood that overall management objectives of streamlining operations, improving quality, and reducing costs will be achieved.

VE can be beneficial when the costs of weapons systems increase, forcing the program office to reduce quantities. VE can enable the government to fulfill inventory requirements, thereby benefiting both the government and the contractor in the long run. It promotes a cooperative teaming environment because government and contractor organizations often form process action teams with people who analyze and brainstorm new solutions and ways to reduce costs. In addition, VE enables sharing the cost savings with the contractor. You should offer incentives to contractors for developing and implementing VE cost-reduction proposals. These incentives should account for and offset the contractors' reduced profits as costs are decreased.

Have you balanced prime system contractor or integrator interests with program interests in promoting technology insertion?

Once a contract is established for a traditional development program, the prime contractor often is not motivated to bring in new technology if it would increase the cost, technical risk, or schedule risk of the program. However, evolutionary acquisition and spiral development offers the opportunity to introduce new technology in one of the next "blocks" or "increments," especially if an open architec-

ture approach has been used. The next opportunity for such an introduction is during production, using a type of pre-planned product improvement (P3I) or block upgrade approach. A parallel development, demonstration, and validation activity could be planned so as not to disrupt either the basic development or production contracts, with the new technology being introduced when the risk had been reduced sufficiently. Although an award fee might be used as an incentive for introducing new technology, DoD's profit-weighted guidelines include a significant added benefit if new technology is shown to be incorporated in the contract being negotiated.

In the end, you must find ways to partner with the prime contractor you hold responsible for the performance and quality of the weapons system, as well as expectations for continued on-time delivery, reductions in cost, and improvements in supportability. Likewise, the prime contractor is responsible during sustainment for availability, spares, repairs, and for incorporating desired changes to improve capabilities as well as changes that are needed because of safety, obsolescence, or other factors. New technology can be a way to extend the life of a product, enhance its value to the user and, therefore, extend the production or increase the profitability of the item to the prime contractor and his entire supply chain. These are the "natural" economic factors that PMs can use in their dealings with prime contractors to balance risk and reward for all parties.

Issue 1-I: Protecting Intellectual Property

In the past, the government was the major impetus for R&D. Now, technologies shaping the economy are funded mostly by private industry, and we must foster an environment in which industry is willing to share its commercially generated technologies.[10] IP, which includes patents, copyrights, trademarks, and trade secrets, is intangible property that is critical to the financial well-being of a company. Because of the value of IP, companies, especially nontraditional businesses, want to ensure IP is protected before they do business with the government. Yet, you must consider long-term support and competitive strategies, early in the acquisition process, to protect core DoD interests. On one hand, DoD's policy is to take minimum rights; and a recent policy letter specifically states, "Much of the intellectual property mindset culturally embedded in the acquisition, technology, logistics and legal communities is now obsolete."[11] On the other hand, you must identify strategies and outcomes that will protect DoD interests and ensure that contractors invest in core technologies and do business with DoD.

The larger leading commercial (nontraditional) firms ensure their continued existence and growth predominately by selling products and services they developed in the highly competitive global commercial market. Virtually every technology-rich commercial business aggressively protects its proprietary data. This data de-

[10] USD(AT&L) Memorandum, December 21, 2001. Subject: "Intellectual Property." Signed by E.C. Aldridge, Jr.

[11] Ibid.

fines the business and its potential. These firms keep their proprietary data (especially data related to important commercial developments) well protected in the organization; usually it is as well protected as DoD protects its top secret information. Normally, only a relatively few trusted business and technical employees with a vested interest in the commercial success of the development will have access to the data.

In dealing with IP rights, the government has promulgated policies and regulations about patents, copyrights, technical data, and computer software. When acquiring IP license rights, the DoD acquisition community should consider certain core principles highlighted below.

1. Integrate IP considerations fully into acquisition strategies for advanced technologies to protect core DoD interests.

2. Respect and protect privately-developed IP because it is a valuable form of intangible property that is critical to the financial strength of a business.

3. Resolve issues before awarding a contract by clearly identifying and distinguishing the IP *deliverables* from the *license rights* in those deliverables.

4. Negotiate specialized IP provisions whenever the customary deliverables or standard license rights do not adequately balance the interests of the contractor and the government.

5. Seek flexible and creative solutions to IP issues, focusing on acquiring only those deliverables and license rights necessary for meeting the acquisition strategy.

CONSIDERATIONS

R&D and S&T Communities

Do you have a strategy to protect a companies' technology that has been committed for implementing a program?

Government mishandling of companies' IP hurts DoD in the long run. Innovative firms will leave the DoD market or sell us only old technology. So, you should protect the IP rights of your contractors aggressively, thus establishing integrity and trust. For example, be sure that

- nondisclosure agreements or disclosure limitation on markings on documents are understood and adhered to;

- proprietary information is adequately protected (e.g., locked in a safe or file cabinet) and adequately controlled; and

- employees know that unauthorized disclosure could make them and the government subject to civil or criminal penalties.

In instances when funding for developing a technology comes from both government and industry, flexibility in achieving win-win IP terms is in order. Refer to the Acquisition Technology and Logistics (AT&L) guide *Intellectual Property: Navigating Through Commercial Waters*.[12] Above all, do not wait until later in the technology development cycle to address IP—the key is planning early.

Acquisition and Sustainment Community

How does your acquisition strategy balance vital commercial IP interests?

You should not require IP rights in solicitations that will discourage nontraditional firms from doing business with DoD. If you automatically include unlimited or government-purpose rights because you believe the government is paying for the technology's development, you could cause some companies (with potentially vital technologies) to choose not to compete. If, on the other hand, your solicitations include provisions that show flexibility and a willingness to consider specially negotiated license rights, more commercial industry interest may develop. Researching the industry sector for the products or technologies you want will help determine what approach, role, and what IP rights the government wants to have and, furthermore, what licensing fees for such rights might typically be used in commercial practice. You should meet early with contracting officers, logisticians, data managers, and general council to discuss alternative strategies for creating a business environment that is conducive to accessing technology.

Is the acquisition strategy balanced with your open-system architecture IP needs?

Create alternative support strategies that use open systems, when only interface data is necessary. By using form, fit, and function, performance-based specifications, often all that is needed is the detailed design information for the key interfaces. DoD's long-term competitive interests can therefore be met through performance-based competition of the "boxes" between the interfaces.

How does your logistics support strategy fit with the IP environment?

If the system being developed relies heavily on commercial technology at the system, subsystem, or component level, the maintenance and support strategy you choose is very important. Many PMs are looking for "plug and play" maintenance concepts so detailed maintenance information is not necessary. Training information may be limited to performing the change-out. In addition, contractor logistics support (CLS) from original equipment manufacturers or systems integrators is becoming a preferred method of support. Under these circumstances, if you are concerned about long-term protection from price increases because competition is reduced, you might consider third-party licensing agreements.

[12] The guide is available on line through a link at http://www.acq.osd.mil/ar/resources.htm.

Issue 1-J: Controlling Exports

Commercial companies may be reluctant to sell to DoD, because DoD sales may restrict the future export of their technology. Controls on exporting technology discourage potential commercial technology solutions from entering defense markets. Export controls are considered excessively long and complex. Selling to DoD can introduce delays, uncertainties, and limitations that may inhibit the ability to export advanced products to worldwide commercial markets. Specifically, a firm with a dual-use technology may be reluctant to have its technology used in defense-related applications because of subsequent limitations to offshore production, the added costs of oversight by the Department of State rather than the Department of Commerce, and possible restrictions on what capabilities can be offered in commercial markets.

Exports and access to foreign markets are critical to the success of firms selling high-technology products and services. These products and services may constitute commercial and dual-use technologies or defense items and services, including commercial satellites. The rapid obsolescence of high-technology items may affect the commercial success of an item adversely if the contract process delays access to the export market.

Basically, two control regimes exist, each administered by a different cabinet-level department of the executive branch. The Department of Commerce administers exports of most commercial and dual-use technology under the Export Administration Act[13] and its implementing regulations. The Department of State administers another parallel environment (munitions export licenses) for goods, services, and software that are either critical to the military or are a part of a multilateral control of missile technology. In general, the Department of State's actions are covered by the Arms Export Control Act[14] and the International Traffic in Arms Regulations (ITAR).[15] Although DoD does not have a direct statutory or regulatory role in controlling exports, it nevertheless does affect exports.

Another law, the Invention Secrecy Act of 1951,[16] requires the government to impose "secrecy orders" on certain patent applications whose disclosure would be detrimental to national security. A secrecy order restricts disclosing an invention by withholding the granting of patents, ordering that the invention be kept in secrecy, and restricting the filing of foreign applications.

The U.S. Patent and Trademark Office imposes the secrecy orders that DoD recommends. The Armed Services Patent Advisory Board coordinates the review in DoD. Approximately 5,000 secrecy orders are in effect. This number has been

[13] Export Administration Act, 15 C.F.R. 379.

[14] Arms Export Control Act, 22 U.S.C. 2778.

[15] ITAR, 22 C.F.R. 125.

[16] Invention Secrecy Act of 1951, 35 U.S.C. 181–188.

fairly constant during the past 4 years, with about 80–150 new orders annually and about 100–200 rescinded annually.

The issue of streamlining export controls has been discussed since the end of the cold war and has gained increased attention over the past several years. A rapid improvement team (RIT) was formed several years ago, to deal with export control licensing reengineering.

CONSIDERATIONS

Acquisition Community

Have you identified the potential for export controls up front with potential technology providers? Are the export controls accurately identified and consistent with national security needs?

Many companies have been advised that if their advanced technology (even if relatively benign) is incorporated into a defense system, then they will be subject to an array of export controls that they would otherwise not have to deal with. This has happened in the past. If a technology provider has a dual-use technology with a large overseas potential, you may not get access to the technology. Ensuring that the export controls for a program are necessary and appropriate is essential. You should also make potential technology providers aware of the possibility of future export restrictions.

ISSUE CATEGORY 2: CULTURAL BARRIERS

Every PM is responsible for fostering a culture in which appropriate technology enhancements are promoted throughout the life of a program. Every PM should have a plan for transitioning technology. Unfortunately, cultural barriers for continuously enhancing technology exist in many forms. They can stem from a lack

of effective motivation and incentives; poor communications and relationships among the communities; and the failure to use effective procurement strategies for enhancing technology.

Issue 2-A: Using Motivation and Incentives

As with most aspects of human interaction, using motivations and incentives can be a key to success. Techniques, such as incentives, recognition, positive performance evaluations, and bonuses can encourage and support enhancing technology. Money is an all-purpose motivator, exerting influence by both by its presence *and* its absence. Cash awards can encourage inventors, and larger budgets can facilitate exploring new technologies. However, the lack of funds can make seeking out newer, more efficient technologies necessary. Competition is another technology motivator. Creating and maintaining technology alternatives helps keep prime contractors motivated.

Evolutionary acquisition relies on using time-phased requirements in which increasing military capability arrives in later blocks or phases. The DoD's acquisition culture tends to be risk-averse, resulting in resistance to change. New technology represents change, change threatens incumbency, and if technology fails, careers and reputations can suffer.

RECOGNITION OF INDIVIDUALS AND ORGANIZATIONS

All Communities

Are you using rewards and awards to encourage and support technology transition?

Send a message that innovators and risk-takers will be rewarded and supported. Whenever possible, use rewards and incentives at all stages in the process. Awards to individual scientists or entire labs have been effective in motivating technology enhancement.

Do you recognize your industry team members when appropriate?

Do not underestimate the effect of non-monetary recognition for your industry team members. Letters, especially from high-ranking government personnel to high-ranking company personnel, plaques, certificates, and other forms of recognition can affect employees positively. This is especially true when specific, concrete accomplishments are cited, and specific individuals are recognized.

Acquisition Community

Is the government staff motivated to identify disruptive technology opportunities?

Processes or procedures for rewarding the insertion of appropriate, but disruptive, technologies can be effective in helping you avoid the cultural barriers that might otherwise thwart enhancing technology.

The government staff must be motivated to identify technology opportunities. Specifically, performance evaluations of civilian PMs and deputies, and operational evaluation reports (OERs) of military personnel, must reflect the importance of embracing new technologies to meet warfighter needs.

Have you nominated S&T community members for awards for technology solutions?

Just as positive reviews of programs are good motivators, so are awards and public acknowledgements of jobs well done. You should nominate S&T community members for awards for technology solutions. Although rewards for appropriately enhancing technology can be excellent motivators, rewards also should given to people for planning for long-term sustainment.

CONTRACT INCENTIVES

Acquisition Community

Does the contract offer incentives for continuously inserting and refreshing value-added technology? Are these incentives motivating both the contractor's business and the technical communities?

Ensure that your contract provides incentives for continuously inserting and refreshing value-added technology. These incentives must motivate both the contractor's business and the technical community. For example, award fees measured against a baseline technology insertion plan would help to maintain a focus on technology insertion.

Sustainment Community

Does your acquisition strategy give incentives for improving reliability, maintainability, and reducing total ownership costs?

You should be sure that your acquisition strategy provides incentives for improving reliability, maintainability and reducing TOCs.

Where practical, the contract should offer the contractor to share in savings, either through VE or a share of the savings realized because of technology insertion. Contractor logistics support with shared savings can be used to motivate inserting technologies that have life-cycle payoffs.

Issue 2-B: Relationships

Barriers that limit the relationship among the requirements, S&T, acquisition, T&E, finance, and sustainment communities must give way to a culture that rewards collaboration. The six communities must collaborate to foster joint ownership and to better achieve solutions to technology challenges. Industry also must be included in the collaboration.

CONSIDERATIONS

All Communities

Are you constantly striving to foster effective relationships between the other communities? Are methods available for interacting with these communities?

All communities must constantly strive to foster effective relationships with one another and seek ways to interact with one another. By establishing cross-functional relationships, they identify and communicate best practices, participate in training courses, engage in external communications (e.g., through conferences and symposia), participate in open public forums, exchange lessons learned, and team to develop advance plans.

Issue 2-C: Contract Strategies

Procurement regimes that inhibit inserting value-added technologies or penalize consideration of disruptive technologies inhibit your ability to access and integrate technology into a system.

In its report, "DoD Research—Acquiring Research by Nontraditional Means,"[17] the GAO concluded that the authority for cooperative agreements and OTs for prototype projects appears to have given DoD the tools for using the private sector's technological knowledge and financial investment. These instruments have attracted companies, the GAO noted, that traditionally did not do research for DoD, by enabling more flexible terms and conditions than the standard provisions for financial management and IP typically found in DoD contracts and grants. The GAO noted that the instruments also appear to be helping foster new relationships and practices in the defense industry, especially for projects being undertaken by consortia.

Prime contractors may have a natural tendency to prefer internal technology because they can see the design and make it work. Prime contractors may have conflicting objectives about adopting technology from an outside provider, ranging from something as intangible as the "not invented here" syndrome to more tangible issues, such as displacing the prime contractor's revenue base. Primes may also be concerned about complex issues, such as problems with the timeliness and compatibility of technologies built by outside organizations. This last issue is sometimes referred to as a "conflict of motivation."

Acquisition strategies need to include a team approach to solving technology problems. The strategies must be flexible and motivate organizations to use their best talent for government S&T and R&D. Top-notch personnel are a premium resource that the government needs to attract high-quality technology solutions.

CONSIDERATIONS

All Communities

Use performance-based statements of work to clearly establish what the government wants; and, using that information, create performance incentives that encourage contractors to focus on providing value to the government. Having the discipline of firm goals at every stage of the process, especially under spiral development, is important. The government can define its goals (e.g., increased reliability) and measure and reward contractor performance against those goals through business arrangements, such as award-fee and incentive-fee contracts. Historically, the choice of contract type has been the primary strategy for structuring contractual incentives, but performance incentives can be used in conjunction with various contract types and are not associated with one type of contract.

[17] NSIAD-96-11, March 29, 1996.

Examine both financial performance incentives, with values derived from the worth of increased performance to the government, and nonfinancial performance incentives, such as long-term contracting.

Attract top-notch resources to create high-quality technology solutions by including fair and reasonable IP provisions. To provide incentives, allow commercial firms to retain their IP rights in key areas. Avoid using onerous government-unique provisions (e.g., an unneeded requirement for cost and pricing data, when other pricing methods can be used). Flexible business instruments can help.

S&T, R&D, and Acquisition Communities

Are strategies in place for mitigating potential conflicts of motivation or disincentives to adopting new technologies on the part of prime contractors, government labs, and commercial labs?

Use peer reviews to vet technology recommendations and solutions. This technique promotes greater integrity, but attracting the appropriate peers can be difficult. The peer team could include members from academia, small and large businesses, laboratories, and the acquisition community. Ideally, the peer reviews can be supported under a contractual arrangement in which participants are paid a stipend for their professional expertise and must sign appropriate nondisclosure statements.

Another technique for mitigating potential conflicts of interest or disincentives is to continually consider alternatives to the current solutions. Some PMs do this by aggressively pursuing SBIR programs. They contribute to the topics when the solicitations are being developed, help evaluate proposals, track the development of technologies, and continually evaluate the potential of using the technologies in their programs. Once an SBIR technology matures sufficiently to be considered for funding, you can use a peer review to determine risk and plan for implementation. Resistance from internal and external forces must be eliminated by objectively bringing the best technology to the warfighter at the lowest total ownership cost. The disruption that might occur from selecting an alternative technology may well be worth it in the end. Understanding this resistance and developing strategies to neutralize it is a major challenge.

Acquisition Community

Is continually inserting and refreshing value-added technology included in acquisitions?

By making continual value-added technology insertion and refreshment a contract deliverable, you can help ensure your program is acquiring state-of-the art technologies that will remain current throughout the life of the project. Your technology refreshment strategy should be tailored to the particulars of the program to provide cost-effective support and upgrade strategies to keep the program ahead

of the obsolescence curve. The acquisition community's support of the technology refreshment strategy is essential to ensure that the procurement method supports its approach. Open systems architecture using standard commercial interfaces wherever possible is one cost-effective strategy designed to do this.

A technology refreshment strategy has other benefits as well. For example, the strategy should result in regular upgrades instead of major end-of-life modifications or follow-on systems. The performance, reliability, availability, and readiness of the program should improve by using newer generation technology. Demands of the sustainment community should decline because "pull and replace" components interfacing with open systems require less supply chain support or, alternatively, rely on the support of contractor logistics. These are only a few of the benefits that you may accrue from developing a sound strategy.

Do you have effective methods for creating competitive alternatives in your system?

Feedback from industry is essential for you to be able to understand the feasible alternatives. "Flying blind" instead of exploring viable options can greatly reduce the probability of your program's success. Develop methods of making the prime contractor a systems-interface manager who brings multiple technologies into the fold. Do not rely on home-grown technology, or let parochial interests thwart objectively considering external technology.

Do you have effective means of planning to mitigate risks?

Effective planning for mitigating risks also is important for overcoming the barriers to continually enhancing technology. Consider trying advanced technology products and having a peer review of the technology to help decide which new developments to incorporate. Once the technology is incorporated, use a build-test process that relies on early data feedback from the field to drive design changes.

Do you use profit incentives to encourage contractor use of innovative technologies?

In response to congressional desires to encourage contractors to use innovative technology, DoD modified its weighted guidelines profit policy to add a special factor when contractors use innovative technology. This factor is intended to offer higher negotiated profits to contractors who use innovative technologies. You need to ensure that your contracting officers are using this special added factor when forming the profit objectives.

Sustainment Community

Are you using performance-based specifications?

Stating a requirement by specifically describing the design specifications of the deliverable inhibits the program's ability to incorporate new technologies that

might meet the same performance requirements better and less expensively. Use performance-based specifications to maximize flexibility for inserting technology. Under performance-based approaches, the government outlines a desired outcome—rather than specifying a required approach—and relies on industry to provide solutions. In general, performance-based contracts are fixed-price contracts, unless the contract deals with non-recurring development. The key to performance-based acquisitions is structuring the requirement so it clearly specifies what is needed but does not detail how that need is to be met. Structuring acquisitions in this manner enables the contractor to provide its most efficient solution. The government can expect competitive solutions that are successful in the commercial marketplace and increased participation by nontraditional suppliers.

ISSUE CATEGORY 3: KNOWLEDGE MANAGEMENT

Sharing of technical knowledge both in and among organizations are two essential elements of the collaboration required to ensure that technology enhancements are integral to the life of the product. Fostering a culture in which information sharing is the norm avoids repeating past mistakes, saves time, stimulates exchanging knowledge, fosters serendipity, eases communications, and leads to an exchange of ideas. A knowledge management system, or approach that facilitates these results, is a technique that will enable you and your organization to capture, build on, and disseminate technical information. Knowledge management, as a system, could be web-based or supported by software. It could also be a monthly gathering organized around a germane topic with short presentations and question-and-answer sessions.

Issue 3-A: Making Contact

One element of knowledge management involves the oldest form of communication—word of mouth. This remains an effective form of knowledge management and can be done through meetings, informal conversations, seminars, and conferences.

Inserting technology often is a contact sport—a one-on-one exchange that brings together information about user needs, technological possibilities and barriers, and program planning options.

As the developers of technologies, members of the S&T community are a critical conduit or contributor to technical information. The S&T community needs to keep current with technology, often through personal interactions at conferences, symposia, and academic meetings. Interpersonal exchanges of technical information must include the acquisition community because of the consistent influx of information received in program offices. Sharing your program's successes or knowledge can help to ensure the success of a similar program.

To overcome the cultural resistance to sharing knowledge, you need to show a strong commitment, develop and implement a plan for managing knowledge, provide incentives to reward the desired behaviors, and build a system or mechanism of promoting information flow, especially for using technology.

A key reason why technology transition can be challenging is that it requires the collaboration of four diverse communities—requirements, S&T, acquisition, and sustainment. Each group has a vital and unique mission that leads to different cultural perspectives when transition is required. Effective transition requires these communities to work together as a team, which frequently is problematic.[18]

CONSIDERATIONS

All Communities

What communication venues exist for enhancing technology insertion?

Successful communication is the cornerstone of collaboration and teamwork. The best opportunities for the players to communicate are available through neutral forums, such as websites and seminars. These venues enable the players to share success stories and information about available technology. One such example is the Defense Science and Technology Seminars on Emerging Technologies, initiated in 1998 to promote dialogue among military leaders, members of the defense science and technology community, and leading researchers from industry and academia, about topics of growing importance to DoD. The monthly seminars feature short presentations by distinguished researchers who give useful insights about a technology area offering significant military payoffs. The response from the community since the seminars began has been overwhelmingly positive. For more information, visit http://www.dtic.mil/dusdst/seminar.html. Another venue is simulations of technology insertion, in which the communities participate in a simulation of an actual program and assess the effects of the technology.

Requirements Community

Do you invite S&T and acquisition staffs to attend meetings in which warfighters are discussing future needs and lessons learned?

Having the S&T and acquisition communities routinely interact with warfighters keeps them informed about the shortcomings of current equipment and needs for future capabilities. The best technology personnel are those who understand both their technical area and the future warfighting environment. One way to do this is to ensure that S&T personnel have copies of current warfighting needs documents. The S&T community should be invited to brief about the technologies that

[18] Under Secretary of Defense for Acquisition, Technology, and Logistics, June 2001 report to the congressional defense committees on alternative approaches for ensuring that successful research initiatives are fielded timely. Required by the National Defense Authorization Act for Fiscal Year 2001.

they are developing to address warfighting needs and receive feedback to assist in prioritizing their efforts.

S&T Community

Do you participate in informal communication gatherings?

You can foster technology application through a variety of methods. Perhaps the easiest is participating in informal communication gatherings, where you can highlight the technologies with which your community is involved and their anticipated applications.

How well are your technology developments showcased in project demonstrations for the requirements and acquisition communities?

Another way to highlight developments is by showcasing them in product demonstrations for the requirements and acquisition communities. For example, the Navy hosts an annual Naval–Industry R&D Partnership Conference that offers the following:

- Partnership opportunities through the networking/showcase marketplace
- The latest updates about naval needs and requirements
- Information about innovative products and cutting-edge research
- Expert advice about transitioning technologies into products
- One-on-one-meetings with venture capitalists and technology commercialization organizers.

This conference, and similar ones in other services, is a valuable forum for you to discuss your technology with representatives of the S&T and acquisition communities.

Are you encouraging staff exchanges or liaisons with programs as a way of fostering technology transition?

You can foster technology transition through staff exchanges or liaisons with programs. For example, the ONR has an exchange program with the major Navy PEOs, specifically to be the link between the S&T and acquisition communities. This exchange program helps to improve the possibilities for transitioning technology into weapons systems.

Are you taking advantage of temporary personnel assignments with industry?

Similarly, information can be exchanged through programs that enable personnel to be assigned temporarily with industry. Such programs are gaining popularity.

R&D and Acquisition Community

Are you encouraging staff exchanges with the S&T community as means of fostering an understanding of program needs?

Encouraging staff exchanges with the S&T community is one way of fostering an understanding of program needs. Discussing what needs fixing helps technology providers focus their attention and resources in technology areas that add value. By identifying your program's challenges instead of the solutions, you free the technology provider to offer options with a variety of tradeoffs between risk and performance. Giving the S&T community some flexibility permits different approaches to be pursued simultaneously.

Are you participating in public forums, seminars, research conferences, and other venues to share your technology needs and identify potential solutions?

Because these events are well attended by the technology providers, they are an opportunity to galvanize resources to solve a program's challenges. But you cannot do it by staying in your office. If you do, you are left to depend on the incumbent team.

Issue 3-B: Lessons Learned

Lessons learned refers to knowledge or understanding gained from experience. The usefulness of lessons learned is an understanding of the factors that contribute to avoiding failure and those that lead to success. Without adequate knowledge of what has occurred before, pursuing policies and processes that lead to successful outcomes is difficult. To be effective, lessons learned should be generalized to protect classified or proprietary data.

CONSIDERATIONS

All Communities

Do you participate in forums to share lessons learned?

The sharing of lessons learned, within and among all communities, is important. Representatives of the requirements, S&T, acquisition, and sustainment communities should participate in forums available for sharing lessons learned.

From an operational perspective, services maintain lessons-learned data that may be useful to technology providers. See the Army's Center for Lessons Learned site at http://call.army.mil/ for an example of this type of resource.

You should also consider sharing problems you encounter during the budgetary process along with ways for avoiding the problems. You can share these insights directly with the personnel in your financial community who work on RDT&E issues. If you have more far-reaching concerns or suggestions, there is an annual

conference that attracts a large number of financial personnel. You can contact the American Society of Military Comptrollers, which organizes the conference, if you want to participate in their workshops. More information is available at http://www.asmconline.org/.

To help ensure the availability of a forum for sharing knowledge, the Defense Acquisition University (DAU) has established a Program Management Community of Practice (PM CoP), a web-enabled portal community to help the PM, program management team, and industry partners do their jobs more effectively by sharing knowledge. The PM CoP website is accessible at http://www.pmcop.dau.mil/pmcop/ev.php.

Sustainment Community

Do you use effective methods for communicating sustainment challenges?

Communicate sustainment challenges to help the other communities make wise technology choices earlier in the program cycle. Work with organizations specializing in outreach, such as the NTTC. Founded in 1989, the NTTC is a leader in technology transfer and commercialization. Guided by its vision to aid economic development by mapping technologies needed to technologies available, NTTC has a complete portfolio of products and services that enable U.S. companies to find technologies, facilities, and world-class researchers in the federal labs and agencies with which they can partner. NTTC is replete with lessons learned. You can access NTTC's website at http://www.nttc.edu/.

Issue 3-C: Information Access

An information access system, mechanism, or approach is simply the tool or technique the PM uses to foster a culture in which all benefit from individual successes and lessons learned. When possible, you must develop a culture that thrives on refreshing technical knowledge so your community can be an information source for the latest and greatest trends, ideas, and technologies. Access to information about technology applications will support your community's technical currency, assist in maintaining contact with private industry, and contribute to the knowledge base of ideas in your disciplines. The importance of effectively accessing information extends to the sustainment community, which needs access to lessons learned, successes, and other such information to creatively sustain a system.

CONSIDERATIONS

All Communities

Do you have access to, and do you use, the Defense Technology Information Center (DTIC) IR&D database and other relevant S&T databases?

One forum for obtaining information about IR&D projects and results is the DTIC IR&D database.[19] Participation in the database is voluntary, and contractors will add their data only if they perceive some benefit from it. Use it, contact companies, get the word out that the database is important, and you can help the database to grow. In addition to the IR&D database, the Virtual Technical Expo[20] contains information about emerging technologies, including descriptions of technology advancement, projected benefits, project milestones, and expected year of completion, in the following categories:

- Air platforms
- Battlespace environment
- Biomedical
- Chemical and biological defense
- Ground and sea vehicles
- Human systems
- Information systems technology
- Materials and processes
- Nuclear technology
- Sensors, electronics, and electronic warfare
- Space platforms
- Weapons.

This resource should continue to grow as DDR&E promotes its use and funds its expansion.

[19] Access is limited to government agencies. For more information, visit http://www.dtic.mil/dtic/submitting/ird.html.

[20] The VTE can be accessed at https://vte.dtic.mil/. See Appendix B for more information.

Do you use a particular strategy for maintaining technology currency?

A strategy for maintaining technology currency in these communities would encompass both the "push" and "pull" of knowledge. At government labs, a key objective is to push out technology developed by the government so commercialization potential is realized. The technology may then come back to the government in the form of useful products. Equally important is the extensive amount of investment being made by the commercial sector that should be accessed by the prime contractors and government labs. You should help achieve this result by attending important technology conferences, collaborating on research projects with commercial industry, maintaining open dialogue and objectivity about commercial possibilities, and guarding against the "not-invented here" syndrome that might thwart an objective review of potentially disruptive technologies.

Do you maintain awareness of joint and service future warfighting concepts?

Knowledge of future warfighting visions and concepts, and other existing S&T programs, will help you develop applications for your technologies. The Joint Vision 2020, and other service vision documents will help you understand the warfighters' best guesses about the capabilities they will need in the future. The vision documents outline the capabilities that will be needed for the future, and how they will be used. The documents leave most of the details about how to provide the capability to the technology and acquisition communities. They seek truly transformational applications of technology that will leap warfighting capability ahead. This can be done through applying either new technology or existing technology innovatively. These vision documents use the taxonomy, concepts, and language that the warfighter will use to articulate requirements. Knowing the meaning of key operational concepts, such as "full dimensional protection," and "focused logistics," will assist you with providing the capabilities that are needed for future military operations.

Do you remain current about defense technology objectives and implementation plans?

Remaining current about defense technology objectives and implementation plans can help your community ensure its developments will have useful and current applications. Without staying abreast of defense program plans, your community could make investments that do not have any application in the warfighter community. One way to avoid this outcome is to review the warfighters' requirements documents and MNSs.

S&T, R&D, and Acquisition Communities

Do you know about, and have access to, nontraditional companies' technology solutions?

A number of processes and resources for accessing information are available to the acquisition community. Nontraditional businesses, both large and small, often are the greatest innovators. You should seek information about, and access to those companies' technology solutions. A technology manager who is not responsible for executing a program could be your outreach agent. He or she should constantly review possible sources of technology outside the contractor base.

Do you maintain an awareness of DoD, service, and defense agency S&T and R&D plans for program application?

The DoD, service, and defense agency S&T and R&D plans are a quick way of understanding ongoing technology programs in your area and in related areas that may affect your program.

The "Defense Science and Technology Strategy" contains the DoD-level documents that connect the S&T community with the warfighter's future requirements. The DoD plans are complemented by service and defense agency (for those defense agencies with S&T responsibilities) plans that outline programs in their areas of responsibility. In the defense S&T strategy, the programs outlining the 6.2 and 6.3 programs that will be transitioning are shown in the Defense Technical Area Plan (DTAP) and the Defense Technology Objectives (DTOs). The DTAP documents the focus, content, and principal objectives of the overall DoD S&T effort. The emphasis is on programs that transition technology rapidly to the operational forces. The DTAP is organized by technology areas and gives a horizontal overview of programs from all services and agencies. This overview includes more than 300 specific technology efforts, including ACTDs and other initiatives, with information about summary costs, schedules, and goals. Each DTO shows a specific technology advancement that will be developed or demonstrated, provides a projected date of availability, and lists the anticipated benefits that the advancement will provide.

Similar service and defense agency documents, such as the "Army Science and Technology Master Plan," complement the DoD-level plans and contains information about additional initiatives. These documents provide good overviews of programs, a sense of what is coming up for transition, and some information about funding levels. Reviewing them is a good first step to gaining information about programs and initiatives.

R&D roadmaps and similar documents contain equivalent information about R&D programs.

Does the technology provider (government lab, commercial firm, etc.) have a process to mine current relevant technology and assess future trends?

The technology provider (government lab, commercial firm, etc.) should use information technology to identify key investments by DoD in technology. Your community should encourage this. For example, the DDR&E plans to develop a fault-tolerant information resource that gives all internal defense technology providers access to the myriad ongoing projects in DoD. Defense labs also should be accessing other available commercial research databases to exploit commercial technology.

CONCLUSIONS

Hopefully, these challenges and considerations will help you put technology transition into practice within your organization. Consider the themes in this chapter and the succeeding chapters as you engage in this "contact sport."

- Understand the interests of industry and the other communities.
- Promote early and continual communication between the communities responsible for technology transition. The IPPD process can help with this.
- Keep an eye open for new and better technologies. Some may come from nontraditional sources and small businesses.
- Identify and overcome potential barriers as early as possible.
- Use the flexibility that you have within the process to reduce barriers, such as IP issues.
- Keep the warfighter in mind. Your work is important, and your ultimate customer, the men and women in the armed services, deserve the best products that this nation can provide.

Appendix A
Resources

This Appendix contains information on programs that support the Department of Defense (DoD) technology transition activities. All the websites were active at the time of publication. The electronic versions of this document contain active links that may assist in accessing the sites.

ADVANCED CONCEPT TECHNOLOGY DEMONSTRATIONS

- "Introduction to Advanced Concept Technology Demonstrations (ACTDs)." Available on the Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics) (OUSD[AT&L]) website. http://www.acq.osd.mil/actd/intro.htm

- OUSD(AT&L) AcqWeb offers "ACTD Guidelines." http://www.acq.osd.mil/actd/guidelns/transit.htm#back

COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE

- "An Evaluation and Assessment of the DoD Commercial Operations and Support Savings Initiative Program," contains an evaluation of, and recommendations for, the Commercial Operations and Support Savings Initiative (COSSI) program. Also discusses using other transactions (OTs). http://www.acq.osd.mil/es/dut/cossi/cossireport.pdf

- "The Commercial Operations and Support Savings Initiative: Challenges and Solutions for Success." http://www.acq.osd.mil/ar/doc/cossiguide.pdf

DOD 5000 SERIES DOCUMENTS

- DoD Directive 5000.1, "The Defense Acquisition System," with Change 1, January 4, 2001. http://www.acq.osd.mil/ap/index.html

- DoD Instruction 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," April 5, 2002. http://www.acq.osd.mil/ar/doc/020405.Regulation.pdf

DUAL-USE SCIENCE AND TECHNOLOGY

- *Dual Use Science and Technology Process: Why Should Your Program Be Involved? What Strategies Do You Need to Be Successful?* Deputy Under Secretary of Defense (Science and Technology) (DUSD [S&T]), Office of Technology Transition, July 2001. Includes appendix about technology investment agreements (TIAs). http://www.dtic.mil/dust

- "Dual Use Technology: A Defense Strategy for Affordable, Leading-Edge Technology," OUSD(AT&L), February 1995. http://www.acq.osd.mil/es/dut/strategy/dufinal3.htm

- "Army Science and Technology Master Plan 2001," the Department of the Army. Also addresses technology transition issues. http://www.saalt.army.mil/sard-zt/ASTMP01/astmp01.htm

GRANTS AND COOPERATIVE AGREEMENTS

- "Grant or Cooperative Agreement," DoD Grant and Agreement Regulatory System (DODGARS). A short electronic guide. http://alpha.lmi.org/dodgars/grant_agreement.htm

INFORMATION AND ANALYSIS CENTERS

- The Air Force Research Lab's Technology Information Clearinghouse. Telephone number 800-203-6451 or website at http://www.afrl.af.mil/techconn/index.htm.

- The Defense Technical Information Center has Information and Analysis Centers (IACs) to help users locate, analyze, and use scientific and technical information. Staffed by experienced technical area scientists, engineers, and information specialists, the IACs establish and maintain comprehensive knowledge bases, including historical, technical, and scientific information collected throughout the world and pertinent to their respective technical communities. They also collect, maintain, and develop analytical tools and techniques, including databases, models, and simulations. http://iac.dtic.mil/1_about/about_iacs.htm

INNOVATION

- *Technology Horizons* is a magazine that features exclusive reports of innovative technologies developed under the Air Force Research Laboratory's (AFRL's) multi-billion-dollar research and development (R&D) budget. Each issue contains briefs about AFRL's best new inventions that are available to help industry develop products that meet their toughest engineering challenges—as well as features highlighting Air Force research programs, partnerships, contracts, and success stories. http://www.afrlhorizons.com/

INTELLECTUAL PROPERTY PROVISIONS

- "Intellectual Property: Navigating Through Commercial Waters," OUSD (AT&L). The report discusses issues and solutions for dealing with intellectual property rights. Version 1.1, October 15, 2001, is available through a link at http://www.acq.osd.mil/ar/resources.htm

"OTHER TRANSACTIONS" FOR PROTOTYPE PROJECTS

- *"Other Transactions" (OT) Guide for Prototype Projects*, OUSD (AT&L), December 2000. Available via link at http://www.acq.osd.mil/ar/resources.htm

- "Department of Defense Report on Other Transaction Awards for Prototype Projects." February 1999 and February 2000. Also discusses COSSI. Link available at http://web1.deskbook.osd.mil/htmlfiles/DBY_dod-4-Careers.asp

- "Guide on Section 845/804 OTs for Prototype Projects." November 1998. Link available at http://web1.deskbook.osd.mil/htmlfiles/DBY_dod-4-Careers.asp.

SHARE IN SAVINGS PROVISIONS

- "Development of Innovative Contract Initiatives", the draft Breakthrough Rapid Improvement Team Report, Department of Defense Change Management Center, October 4-5, 2000, contains a discussion of Share-in-Savings (SIS) provisions in Section VI. Link available at http://www.acq.osd.mil/cmc/resources/changeInitiatives/Final_Contract_Incentives.doc

SMALL BUSINESS INNOVATION RESEARCH

- "Small Business Innovation Research (SBIR) Program," sixth edition, OUSD (AT&L). Link available at http://web1.deskbook.osd.mil/htmlfiles/DBY_dod-4-Careers.asp.

TECHNOLOGY INVESTMENT AGREEMENTS

- "Technology Investment Agreement (TIA)," DODGARS. A short electronic guide at http://alpha.lmi.org/dodgars/tias/tias.htm

TECHNOLOGY TRANSITION

- "Report to Congress on the Activities of the DoD Office of Technology Transition." February 2001. Link available at http://www.dtic.mil/techtransit/refroom/docs/ar02/index.html.

- *Spinoff,* The National Aeronautics and Space Administration (NASA). NASA's annual publication featuring successfully commercialized NASA technology. http://www.sti.nasa.gov/tto/

- "Technology Transition for Affordability: A Guide for S&T Program Managers," Deputy Under Secretary of Defense for Science and Technology (DUSD [S&T]). April 2001. http://www.dtic.mil/dusdst/docs/TechTransGuide-Apr01.pdf

UNSOLICITED PROPOSALS

- "Unsolicited Proposal Guide," Air Force Materiel Command. Pamphlet 64-101. June 1997. Link available at http://web1.deskbook.osd.mil/htmlfiles/DBY_af_162-3-8-Careers.asp

- "Guide for Unsolicited Proposals," Army Materiel Command. Pamphlet 70-8. May 1998. http://www.amc.army.mil/amc/rda/70-8.html

- *Unsolicited Proposal Handbook,* Bureau of Reclamation. August 1998. http://www.usbr.gov/aamsden/usphand.html

Appendix B
Websites

This Appendix provides a list of websites that contain information on topics related to technology transition. There is a brief description of the site, and its address. Electronic copies of this document contain active links to the sites.

U.S. GOVERNMENT SITES

Advanced Concept Technology Demonstrations

The Advanced Concept Technology Demonstrations (ACTD) site discusses ACTD's accomplishments, lists points of contact, and contains articles and speeches, guidelines, and more. http://www.acq.osd.mil/actd/

Air Force Research Lab Monthly Accomplishment Reports

The Air Force Research Lab (AFRL) reports monthly on support to the warfighter, emerging technologies, technology transfer, and awards and recognition. http://www.afrl.af.mil/accomprpt/index.htm

Air Force Research Lab Success Stories

The AFRL successes are published monthly. Categories are support to the warfighter, emerging technologies, technology transfer, and awards and recognition. http://www.afrl.af.mil/successstories/

Air Force Research Lab's *AFRL Technology Horizons*

The AFRL's quarterly technology magazine, *AFRL Technology Horizons*, is available on line at http://www.afrlhorizons.com/.

Best Manufacturing Practices

The best manufacturing practices program is a unique partnership between industry and government for transferring technology that improves the global competitiveness of the U.S. industrial base. The program's site highlights news, software, surveys, library, and more. http://www.bmpcoe.org/

Commercial Operations and Support Savings Initiative

The Commercial Operations and Support Savings Initiative (COSSI) site describes the COSSI program and lists links, a calendar, points of contact, frequently asked questions, and other information. http://www.acq.osd.mil/es/dut/

Defense Advanced Research Projects Agency

The Defense Advanced Research Project Agency (DARPA) is the Department of Defense (DoD's) central R&D organization. The DARPA site contains information about the agency mission and overview, offices, news releases, budget information, and solicitations. http://www.darpa.mil/

Defense Production Act Title III Program

The Defense Production Act Title III Program creates, modernizes, or expands domestic production capability and capacity for technology items, components, and industrial resources essential for national defense.
http://www.dtic.mil/dpatitle3/

Defense Technical Information Center

A key element of the DoD Scientific and Technical Information Program, the Defense Technical Information Center (DTIC), is the central DoD facility for accessing and facilitating the exchange of S&T information. The DTIC site describes the variety of products and services available from DTIC that are designed to assist users obtain the information they need easily and quickly. DTIC is part of the Defense Information Systems Agency (DISA). http://www.dtic.mil/

Defense Technical Information Web Locator's Science and Technology Sources

The Web Locator lists hyperlinks to defense and industry S&T resources.
http://www.dtic.mil/dtiwl/toc_sci.q.html

Department of Defense Office of Technology Transition

The Office of Technology Transition (OTT) site contains information about, and links to, the OTT's programs. http://www.dtic.mil/ott/

Deputy Under Secretary of Defense (Science and Technology)

The Deputy Under Secretary of Defense (Science and Technology (DUSD[S&T]) is responsible for defense S&T strategic planning, budget allocation, and program execution and evaluation. The DUSD(S&T) site has links to director of Defense Research and Engineering (DDR&E)'s S&T sites.
http://www.defenselink.mil/ddre/oddre/

Dual Use Science and Technology Program

The Dual Use Science and Technology (DUS&T) program's site details the DoD's dual-use S&T. The site includes a fact sheet, project information, guidance, and success stories. http://www.dtic.mil/dust/

Federal Government Technology Transfer Links

The Manpower and Training Research Information System (MATRIS) project offers hyperlinks to federal government technology transfer programs.
http://dtica.dtic.mil/t2/orgt2.html

Federal R&D Project Summaries

Federal R&D project summaries is a portal to information about federal research projects, complete with full-text single-query searching of databases at different agencies. The site also is a unique window to the federal research community, enabling agencies to better understand the R&D of their counterparts in government. http://www.osti.gov/fedrnd/about.html

Federal Research in Progress

The Federal Research in Progress (FEDRIP) database gives access to information about ongoing federally-funded projects in the physical sciences, engineering, and life sciences. The ongoing research announced in FEDRIP is an important component of transferring technology in the U.S. FEDRIP is a non-bibliographic information source for research in progress. Use FEDRIP to

- avoid duplicating research,
- locate sources of support,
- find leads in the literature,
- stimulate ideas for planning,
- identify gaps in areas of investigation,

- locate individuals with expertise, and
- complement searches of completed research.

FEDRIP offers a free trial and day pass; a membership fee is charged for long-term use. http://grc.ntis.gov/fedrip.htm

GOV Research Center

The GOV Research Center is a joint venture between the U.S. Department of Commerce's National Technical Information Service (NTIS) and the National Information Services Corporation (NISC) for a single access point to valuable government information. This joint venture combines NISC's award-winning technology and NTIS's valuable content. The service is entirely web-based and has information that professionals worldwide can easily access. Scientists, engineers, and researchers will find NISC's powerful search engine enables broad based, refined search and retrieval capabilities. Individual or network subscribers can search in different modes to retrieve the most complete and relevant data available. The site offers a free trial and day pass; a membership fee is charged for long-term use. http://grc.ntis.gov

Independent Research and Development

DTIC's independent research and development (IR&D) database contains voluntary submissions from industry of their IR&D projects. DoD employees can search the database to find IR&D projects that could fulfill defense requirements. Each project is described briefly and a point of contact is given for the appropriate contractor organization. Each project is categorized to facilitate searching and analysis by technology area or application. Currently, the database contains about 4,000 active projects valued at more than $4 billion. http://www.dtic.mil/ird/

Joint Experimentation Program

The U.S. Joint Forces Command (USJFCOM) is DoD's transformation laboratory. USJFCOM's joint experimentation campaign plans are the framework for synchronizing all services to ensure that our forces are more effectively used on the basis of improvements in doctrine, interoperability, and integration. http://www.jfcom.mil/about/experiment.html

Manufacturing Technology Program

This site is the online source of information about the DoD Manufacturing Technology (ManTech) program and its projects, activities, and funding. http://www.dodmantech.com/index.shtml

National Aeronautics and Space Administration's Commercial Technology Office

The mission of the National Aeronautics and Space Administration's (NASA's) Commercial Technology Office (CTO) is to increase the competitiveness of U.S. industry by using NASA technologies, expertise, and facilities commercially. Three steps occur as the CTO aims to do its mission. The first step is to manage intellectual property (technologies, expertise, and facilities). The next step is to promote the opportunities that NASA technologies, expertise, and facilities give industry and other government R&D programs. In the last step, NASA works with partners who use NASA capabilities to improve their competitive edge and promote economic growth. http://technology.grc.nasa.gov/

National Aeronautics and Space Administration's TechFinder

NASA's TechFinder is the commercialization portal for all available NASA technology transfer success stories. TechFinder contains text and images from all 11 NASA centers. TechFinder is updated within minutes of changes made at a NASA field center. The site has a free database search. http://technology.nasa.gov

National Institute of Standards and Technology

The NIST site contains information about NIST technology, measurements, and standards programs, products, and services. http://www.nist.gov

North American Technology Industrial Base Organization

Sponsored by the OTT, the North American Technology Industrial Base Organization (NATIBO) site assists with promoting a cost-effective, healthy technology and industrial base that is responsive to the national and economic security needs of the United States and Canada. http://www.dtic.mil/natibo/

Small Business Innovation Research Program

The DoD Small Business Innovation Research (SBIR) program website contains SBIR process information, lists of current solicitations, and an SBIR Help Desk telephone number. http://www.acq.osd.mil/sadbu/sbir

Small Business Technology Transfer Program

The DoD SBIR website also has information on the Small Business Technology Transfer (STTR) program. http://www.acq.osd.mil/sadbu/sbir

Tech Connect

The Tech Connect site is a gateway for the AFRL clearinghouse for technology information, which is free of charge to government, industry, and academic customers. Customers call, e-mail, or fax their requests about technology subjects, and Tech Connect analysts research the subjects in AFRL, the Air Force, other DoD services, and the federal lab system, to find ongoing research programs or technical focal points. http://www.afrl.af.mil/techconn/index.htm

Technical Support Working Group Broad Agency Announcement Information Delivery System

The Technical Support Working Group (TSWG) broad agency announcement (BAA) information delivery system enables users to check postings regularly and participate in the rapid research, development, and prototyping of technologies to combat terrorism. Consult Federal Business Opportunities at www.fedbizopps.gov to review postings of other government development or contracting opportunities.

All visitors can download active BAA solicitations from this site; however, you must register and have an active registration on the site to submit a response. http://www.bids.tswg.gov/tswg/bids.nsf/Main?OpenFrameset&5C7Q8NTechnology%20Horizons

TechTRANSIT

The OTT's TechTRANSIT site provides access to DoD technology transfer programs, policies, and resources. http://www.dtic.mil/techtransit/

Virtual Technology Expo

The Virtual Technology Expo, sponsored by the Deputy Under Secretary of Defense (Science and Technology), gives the defense community access to the latest in research in the DoD. The site is accessible only to government employees, but in the future will accommodate several levels of security access and S&T partners from industry. https://vte.dtic.mil/

Warfighter Rapid Acquisition Program

The Warfighter Rapid Acquisition Program (WRAP) policy guidance is contained in Army Regulation 71-9, "Materiel Requirements," which is available at http://www.usapa.belvoir.army.mil/pdffiles/r71_9.pdf.

COMMERCIAL AND OTHER WEBSITES

American Association for the Advancement of Science's R&D Budget and Policy Program

Since 1976, the American Association for the Advancement of Science's R&D Budget and Policy Program has sponsored studies of and colloquia about funding and policy issues affecting R&D. The program provides timely, objective, and accurate information about federal R&D support. The website supplements the program's annual reports on R&D funding. http://www.aaas.org/spp/dspp/rd/

Community of Science, Inc.

Community of Science (COS) brings together the world's most prominent scientists and researchers at more than 1,300 universities, corporations, and government agencies worldwide. COS has tools and services, including COS Expertise, a database of detailed, first-person profiles of more than 480,000 R&D professionals; COS Funding Opportunities, a source of grant information on the web; COS Abstract Management System, an online publishing solution for universities and professional societies; and customized access to a range of professional reference databases. A notification service is free for individuals; subscriptions are free for groups & institutions. http://www.cos.com

CHI Research, Inc.

CHI Research is a research consultancy for technology and science metrics and value-added patent databases. CHI databases incorporate post-issue patent reassignments; company structures adjusted for mergers, acquisitions, and divestitures; more than a million unified non-patent references; and an advanced set of patent indicators. Custom reports can be obtained for a fee.
http://www.chiresearch.com

Community Research and Development Information Service

The Community Research and Development Information Service (CORDIS) is a free service from the European Commission's innovation program. CORDIS gives information about European Union research and innovation development. The timely and comprehensive coverage of community R&D helps you

- identify assistance for exploiting or further developing research results,
- keep up to date on current research findings and strategic directions,
- identify various funding sources for R&D,

- find partners who will cooperate in R&D activities and share expertise, and
- promote and locate transferable technologies.

The database can be searched free of charge at http://www.cordis.lu/en/home.html.

Dawnbreaker

Dawnbreaker is a professional services firm providing commercialization assistance to advanced technology firms and their investors. Dawnbreaker specializes in business planning, market research, and negotiations, using a blend of individualized mentoring, training seminars, and consulting. Two distinguishing features characterize Dawnbreaker's work: (1) the emphasis on measurable results, and (2) the use of a process to grow clients' businesses. Fifty percent of the clients receive private-sector financing within 18 months after developing business plans. Dawnbreaker has worked with more than 400 advanced technology firms through the Small Business Innovation Research Program, Advanced Technology Program, and Environmental Management. http://www.dawnbreaker.com

Delphion, Inc.

Delphion intellectual asset management solutions have business and intellectual property (IP) professionals for analyzing, managing, and leveraging IP assets—including ideas, patents, and licensing opportunities—to generate new levels of revenue and profitability from R&D investments and IP portfolios. Delphion products access patent research, IP management, and analytical tools that enable enterprises to manage their IP assets strategically. Delphion charges a membership fee. http://www.delphion.com/home

Derwent Information

Derwent Information provides patent information, value-added databases, and software tools that enable the scientific research community to access and manage published materials. Its customer base consists of the chemical, pharmaceutical, biotechnical, engineering, legal, financial, and academic sectors; research libraries; and national patent organizations worldwide. Custom reports are available for a fee. http://www.derwent.com

IP.com

IP.com has tools for quickly and economically putting information into the public domain, a necessary component of numerous IP strategies. IP.com maintains the Prior Art database as a worldwide repository of non-patent previous art (also available on IP.com). Information published to the Prior Art database is searched

by patent offices worldwide, helping to prevent competitive patents from being issued. In addition, each document you place into the Prior Art database is digitally notarized to establish its date of publication and to assure that it has not been altered, which are essential components for claiming prior art at a patent invalidity trial. Free search capability; patent publishing fee. http://www.ip.com

IP Searchengine.com

IP Searchengine.com is an IP search and management tool that gives you searchable access to more than 600 patent, non-patent art, trademark, and domain databases, and more than 100 million searchable data records from more 70 separate websites, while it records all billable time and expenses, search queries, confidential personal notes, and e-mail according to the subject, client, or job. Free patent browsing; custom report fees. http://www.ipsearchengine.com

MicroPatent

MicroPatent's Optipat subsidiary produces printed patents, patent images, and searchable text on CD-ROM, custom CD-ROM collections of U.S. patents, facsimile transmissions of U.S. patent images, full-text online searching, custom Internet and intranet databases, Internet delivery of U.S. patent images from 1974 to present, and complete weekly issues of U.S. patents on CD-ROM. Complete sets of U.S. patent images and text from 1974 to present are available. Optipat also provides U.S. patent and trademark file histories. Custom reports are available for a fee. http://www.micropat.com/

The Patent and License Exchange

The Patent and License Exchange (Pl-x) provides financially oriented IP tools to help the IP community manage, value, and market their intangible assets. These tools are designed to reduce business costs, improve cycle time, and help companies discover new sources of revenue from their intangibles. Pl-x also publishes and distributes IP valuation data and operates a global exchange. Pl-x, which not only lists patents, but copyrights, trademarks, trade secrets, and know-how, is an auction site. Free search capability; fees in auction and listing technology. http://www.pl-x.com/xhtml/homepage.jsp

University Ventures, Inc.

The University Ventures site joins those seeking cutting-edge technologies with the universities and institutions that are developing these innovations. The portal helps reshape the emerging technology transfer industry by using the Internet to accelerate the transfer of university-created technology. The portal uses the Internet to provide online resources and business opportunities to universities and businesses in the technology transfer community. UVentures.com is a central marketplace for electronically exchanging information between licensors who list

in its database information about technologies they want to license, and prospective licensees who browse and query the database looking for information about specific technologies. Free search capability; fee to list technology. http://www.uventures.com/servlets/UVMainPage

Wisdomain, Inc.

Wisdomain is a solution provider of software tools for analyzing patent information. Its PatentLab-II product is used to extract intelligence from patent data and is available for analyzing and visualizing downloaded patent data. Using two- and three-dimensional graphs, tables, and ready-made analytical reports, PatentLab-II helps you visualize relationships between patent data, and uncover insights and trends. http://www.wisdomain.com/products/overview.htm

Yet2.com

Yet2.com is a global forum for buying and selling technology on the Internet. A virtual technology marketplace, *yet2.com* offers companies and individuals the opportunity to conveniently and privately purchase, sell, license, and research intellectual assets. Spanning all industries and areas of R&D, yet2.com is a community where technology officers, scientists and researchers can unearth cutting-edge discoveries as well as new applications for tried and true technologies. Yet2.com helps companies extract value from undervalued or unused technologies by streamlining the traditionally lengthy and ineffective transferring of technology. Free search capability; fee to list technology. http://www.yet2.com

Appendix C
Success Stories

The following success stories were taken from a number of sources (see footnotes in each category). We use the stories to help the reader to envision how the different programs described in this guide can benefit the warfighter. A quick index of these stories begins on page C-31.

In addition to these success stories, some excellent and more detailed success stories about programs for inserting technology into legacy systems are in an Office of the Secretary of Defense (OSD) Office of Technology Transition document, *Improving Warfighting Capabilities by Rapidly Inserting New Technology into Legacy Systems*, October 30, 2002.

The lessons in these success stories must be used properly. Action taken for improving processes must be appropriate for your specific situation. Not all lessons are applicable to all situations. These programs show how you can influence and improve transitioning technology in DoD.

USE OF OTHER TRANSACTIONS AGREEMENTS

Evolved Expendable Launch Vehicle (Air Force)

The Evolved Expendable Launch Vehicle (EELV) program has used the two largest OTs issued by the DoD to date, with $1 billion going to two contractors, Boeing and Lockheed/Martin, who also invested $500 million each. These OT agreements were for developing a family of launch vehicles, services, and supporting systems that will significantly reduce the life-cycle cost (LCC) compared to the LCCs of today's systems. The reductions were reflected in the follow-on Part 12 commercial launch services contracts.

Members of the EELV team from the Air Force and the Aerospace Corporation received the David Packard Excellence in Acquisition Award in 1999, DoD's highest award for acquisition. The team also won the Secretary of the Air Force John J. Welch Award for Excellence in Acquisition Management, the DoD Value Engineering Achievement Award and the Secretary of the Air Force Strategic Acquisition Reform Award for Contracting. In May 2002, in just under 5 years, Boeing designed, developed and rolled out a totally new Delta IV rocket for public viewing.

Global Hawk (Air Force)

The Defense Advanced Research Projects Agency (DARPA), with Air Force, Navy and Army participating, developed the Global Hawk system between 1994 and 1999 for the Defense Airborne Reconnaissance Office. The Air Force assumed control in 1999. The program was executed using OT authority, allowing extreme flexibility in managing the program.

The U.S.-led air and missile strikes against the Al-Qaeda terrorist network and Taliban regime in Afghanistan on October 7, 2001, were preceded by the first operational deployment of the Global Hawk high-altitude, long-endurance unmanned air vehicle (UAV), 7 years after a performance-based statement of work for the desired system was introduced. A record-breaking aircraft in its own right—it was the first UAV to fly non-stop across the Pacific—the Global Hawk has been rushed from its development phase into becoming one of the U.S.-led coalition's most valuable reconnaissance assets during operations in Afghanistan. The major OT advantages demonstrated were the following:

- program management flexibility
- contractor-led Integrated Product Teams (IPTs)
- focus on military utility assessment as a goal of program
- eliminated costs for DoD- and Federal Acquisition Regulation (FAR)-based compliant processes and reporting.

DD 21 (Navy)

The Navy's program for a next-generation surface combatant, called DD 21, was being conducted under the authority of Section 845 of the National Defense Act of FY 94 (Public Law 103-160), Section 804 of the National Defense Act for FY 97 (Public Law 104-201), and 10 U.S.C. Section 2371. This acquisition approach provided greater market competition and increased industry innovation and design flexibility by using commercial products and processes. Although the program was changed (and renamed DDX) to reflect new budgetary restrictions, the OT agreements with the blue and gold teams were successful.

DD 21 set aggressive affordability goals that were achieved by involving the contractor early, using state-of-the-art engineering tools to enable "virtual prototyping" and analysis of alternatives before beginning construction, and using "cost as an independent variable" criteria.

X45A Unmanned Combat Aerial Vehicle (DARPA/Air Force)

The UCAV demonstration program started with a phase 1 solicitation in March 1998, and four awards. The program down selection was made in March 1999, and is being done under a $191 million, 56-month cost-share OT agreement that DARPA and the Air Force awarded to Boeing in March 1999. Boeing's share was $21 million.

Initial flight tests began May 22, 2002, less than 50 months after the program was begun. If the demonstration program is successful, DoD could begin using UCAV weapon systems as early as 2008. This is an example of using an OT to enable flexibly managing a program and of a spiral development acquisition strategy.

DUAL-USE SCIENCE AND TECHNOLOGY

Advanced Motor Drive[1]

The Air Force Research Laboratory (AFRL) Propulsion Directorate Advanced Motor Drive (AMD) project focused on developing an electronic motor drive to replace hydraulic systems in aircraft, and supporting the Air Force's More Electric Aircraft (MEA) initiative. The AMD is the winning project of the second annual Dual-Use Science and Technology (DUS&T) Achievement Award, which recognizes successful dual-use projects and honors the individuals in the military departments responsible for initiating and executing the projects. The AMD goal is to double the use of state-of-the-art power, with electric actuation efficiency greater than 80 percent. For an advanced future fighter, this would save 750 to 1, 000 pounds. The AMD (via MEA) supports using electric power directly for current hydraulic, pneumatic, or mechanical aircraft subsystems for flight control actuation, environmental control systems, and lubrication and fuel pumps. AMD also addresses other functions that can reduce maintenance costs and mitigate safety and environmental concerns. Global Express business jets are using the technology. Components developed as part of the AMD project will be used in future regional and business jets, with a 10-year projected commercial delivery of 4,000 units. The National Aeronautics and Space Administration is considering using this technology in the Space Shuttle Upgrade Program.

[1] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

Affordable Antenna for Weapon System Delivery and Cellular Communications[2]

Raytheon Systems Company is developing an antenna that will cost approximately 90 percent less than the current antenna used for weapon systems delivery. The new antenna will maintain or improve on the size, weight, and performance of present antennas. The technology being used will be scaleable for commercial cellular communications.

The project will result in an affordable airborne antenna that is as capable as current antennas but more reliable. In addition, the antenna can be assembled in15 minutes. More than 2,000 of the commercial version of the antenna have been sold for use in telecommunications.

Commercial Active Braking System for Medium-Duty Wheeled Vehicles[3]

Continental Teves is developing an anti-lock braking system (ABS) with low-speed traction control for the Army's High Mobility Multipurpose Wheeled Vehicle (HMMWV) and medium-size commercial tracks. The anticipation was that the braking system designed under this program would have commercial sales of at least 80,000 units per year and, because the special military requirements were considered during design, it will meet the HMMWV requirements with no major modifications.

Besides the obvious benefits of improved braking and safety, the most significant benefit of the program is access to a commercial product for meeting a military requirement at a reduced cost. The ABS developed under this program will be produced on the same line as Continental's commercial ABS and will cost the Army approximately $500 per copy. The cost of an ABS developed exclusively for the HMMWV, without a commercial base, is estimated at approximately $2,200.

This program used the OT authority granted DoD for its agreement with Teves, a non-defense-oriented commercial firm.

[2] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/ant.htm.

[3] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/abs.htm.

Commercial Radiation-Tolerant Deep Submicron Microelectronics[4]

The National Semiconductor Corporation (NSC) will establish a radiation-tolerant option for its commercial fabrication line to provide low-cost, commercial, radiation-tolerant electronics to military and commercial markets. This project will leapfrog current two-generation radiation-tolerant technology to equal the state-of-the-art for non-radiation-tolerant commercial parts.

The cost of devices fabricated as a result of this project will be reduced at least 50 to 70 percent from lines specifically designed for producing radiation-hard electronics. These savings result from the economies of scale present in a commercial production facility. In addition, the devices will add functionality not previously available, at low-power dissipation and increased performance.

This program used the OT authority granted DoD for its agreement with NSC.

Efficient Multijunction Solar Cell[5]

The efficient multijunction solar cell was a nominee for the Second Annual DUS&T Achievement Award. This AFRL Advanced Space Power Generation Group program was conceived and implemented to increase solar-cell efficiency to meet the continued growth in power requirements of large and small DoD satellites, as well as the growth in power demand of commercial satellites. The more efficient triple-junction solar cell developed through this project for military and commercial applications will generate more power for the size of the solar arrays, or smaller arrays for a power budget. The new cells enable the flexibility of increasing payload mass and power budgets, reducing launch cost by reducing power system array mass, reducing life-cycle costs, and will enable scaling up the power system for both military and commercial applications.

Electric-Powered Actuators for Aircraft Flight-Control Surfaces[6]

The Air Force Research Laboratory and Hamilton Sundstrand are collaborating on a dual-use program for developing an electromechanical actuator (EMA) to exploit the benefits of electric power technology. The focus of the program is the motor drive, which includes the controller, inverter, and motor used to control the EMA.

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[4] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/submicro.htm.

[5] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

[6] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/electric.htm.

The technology will be an AMD featuring high-power density and efficiency, which will be used to control a 270-volt DC EMA. The EMA is compatible with the requirements of a spoiler for a typical transport aircraft. The increased power density of the AMD is attractive to commercial users because reductions in weight results in improved fuel efficiency and extended range, which translates to considerable cost savings.

Enhanced Crash Protection for Occupants of Heavy Tactical Vehicles: Inflatable Restraint System and Crew Cab Delethalization Techniques[7]

This project was a nominee for the Second Annual DUS&T Achievement Award. The goal of this Army Tank-Automotive and Armament Command, National Automotive Center project has been to recommend safety products and cab design changes for the Army's heavy tactical vehicles to reduce the head, neck, and torso injuries and fatalities during crashes. Products developed, tested, and recommended include inflatable devices that are hidden in the shoulder belt and above the vehicle door until the crash sensor inflates them. Using these devices will reduce the number of injuries and deaths caused by accidents. This technology, jointly developed by Delphi Automotive Systems and Simula, Inc., has resulted in contracts totaling $50 million annually.

This program used the OT authority granted DoD for its agreement with Simula, Inc. This technology also has been incorporated into at least one model of a luxury automobile.

Freeform Manufacturing of Spares Using Lasforming[8]

The Boeing Company, together with AeroMet Corporation and Virginia Polytechnic Institute and State University, will demonstrate Lasforming as a viable freeform method for producing new and difficult-to-get titanium spare parts for aircraft and ships at low cost. Lasforming uses 3-D graphical models to build up parts in layers from metal powders that are melted and fully consolidated with a laser.

The project will result in a cost-effective process for manufacturing spare titanium parts, with 30 percent cost savings of fabricated parts, and a 75 percent reduction in delivery time. Three F/A-18 E/F wing components have been selected as candidates for demonstrating the process. Commercial potential is a fabrication method for small manufactured lot sizes of original or replacement aerospace components.

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[7] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

[8] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/laser.htm.

This program used the OT authority granted DoD for its agreement with the project team.

Future Air Navigation and Traffic-Avoidance Solution through Integrated Communications, Navigation, and Surveillance[9]

Rockwell Collins, Inc., a firm that does both defense and non-defense work, is developing and adapting commercial-grade hardware and software products for upgrading existing fighter aircraft communications, navigation, and surveillance (CNS) capabilities for air traffic control compliance while minimizing installation effects. The primary targets for the technology are tactical fighter aircraft and small commercial aviation aircraft that have size and weight constraints.

The technology benefits both cost and performance. The programmable hardware being developed will be a means for upgrading tactical fighter aircraft and smaller aviation aircraft by using the same software that is used for the commercial and large-body aircraft.

Upgrade costs will, therefore, be minimized by the many uses of the software. The software also will help with complying with future air traffic control requirements rapidly as they evolve.

High Brightness Emissive Miniature Displays[10]

An individual from the ARRL's Visual Display Systems Branch was recognized for this project, which was a runner-up for the Second Annual DUS&T Achievement Award. The project developed the first full-color, high-luminance, monochrome active-matrix organic light-emitting diode display. The characteristics of the display make it ideal for helmet display optics, and it was designated display technology of 2000, by the Society for Information Display and *Information Display Magazine*. The technology is expected to meet all military needs for helmet-mounted displays and was selected for several Air Force and Army helmet programs, including that for the Joint strike fighter. The Army's Land Warrior program will require about 3,000 units per year over the next 10 years. The low-cost and low-power consumption rates also make this display technology ideal for commercial applications. eMagin Corporation (the contractor for this project) has shipped more than 20 evaluation kits to customers, and its microdisplay is considered the best on the market. The technology already is finding applications in cell phones, computer-connected eyeglass displays, and head-mounted instrumentation displays. Future applications include medicine, computer games, and video.

[9] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/cns.htm.

[10] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

Hybrid-Electrical Family of Medium Tactical Vehicles[11]

Lockheed Martin Control Systems (LMCS) is exploring using a series hybrid propulsion system on a military 5-ton truck. The new HybriDrive system will be integrated and demonstrated on an M1086. This is a 5-ton-payload cargo-body variant of the family of medium tactical vehicles (FMTV).

Developing and incorporating a hybrid electrical propulsion system into the FMTV will result in significant enhancements to the vehicles' performance and considerable financial benefits to the Army. Vehicle performance will be enhanced with faster acceleration, improved traction, and potential for generating electric power in the field without using auxiliary power units or towed generators. Near-term applications include mobile missile launchers and radar. The new smaller and lighter components also will be used in transit buses and Class 5-7 vehicles. These components will be used on metropolitan transit buses in a major U.S. city.

This program used the OT authority granted DoD for its agreement with LMCS.

Improved Chemical Heater for Field Rations[12]

TDA Research, Inc., is a small business investigating safer and less costly alternatives to the flameless ration heater (FRH) used to heat ready-to-eat meals. The program develops a product that combines suitable heat characteristics and long shelf life with improved safety and environmental qualities that can be manufactured economically. The Army and TDA Research are working with potential producers and users to facilitate transitioning the technology to the field. Unlike the current FRHs, which drew little commercial interest because of safety concerns, the new technology has significant commercial market potential.

The estimate is that the product will cost 6 cents per heater less than the FRHs for initial procurement and save the military approximately $1.8 million per year. Moreover, because the product is safer than the current FRH and has improved environmental characteristics, the potential life-cycle savings will far exceed the initial procurement savings. These improvements in performance and cost will expand the commercial use of the heaters for camping, schools, and the workplace. The broader commercial acceptance will further reduce unit costs.

This program used the "OT authority granted DoD for its agreement with TDA Research.

[11] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/fmtv.htm.

[12] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/food.htm.

Knowledge-Access Portal Technology for Medium Brigade and Command Post XXI Decision Makers and Other Knowledge Warriors[13]

A nominee for the Second Annual DUS&T Achievement Award, this Army Communications-Electronics Command project had the objectives of developing, demonstrating, and transitioning innovative knowledge-access portal technologies for improved "cognitive readiness." In addition, the project bettered knowledge-based decision making for the brigade combat team, Command Post XXI staff, and knowledge warriors at reduced cost. Four technologies are combined: case-based planning, context-driven reachback and search, integrated plan execution and adaptation, and process-aware collaboration. Benefits include superior cognitive readiness, greater mutual awareness, the ability to operate in the opposition's decision loop, and reduced risk in planning and executing missions. Commercial applications include customer relationship management, business intelligence, strategic planning, and collaborative enterprise-complex project management.

Navy Earth Map Observer[14]

Earth Search Sciences, Inc., (ESSI) is a leading provider of commercial remote-sensing services. The project is developing a dual-use, space-based system for collecting broad-area hyperspectral imagery to characterize land and sea environments for naval forces and commercial users.

By using hyperspectral imagery, ESSI will have a means of characterizing littoral battlespace environments and developing littoral models, e.g., detailed bathymetry, water clarity. The Navy Earth Map Observer will support U.S. forces with real-time on-board processing and demonstration of a tactical downlink of hyperspectral data directly from spacecraft to the field. For the commercial user, this project will provide hyperspectral and panchromatic imaging data for applications, including land-use management, agriculture, forestry, environmental monitoring, geology, mineral exploration, and hydrology.

This program used the OT authority granted DoD for a portion of this program.

[13] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

[14] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/nemo.htm.

Next-Generation Transparency[15]

The Boeing Corporation is working with Delta Tooling Company, Ensign-Bickford Company, EnviroTech Molded Products, Pilkington Aerospace, and the University of Dayton Research Institute to use injection-molded frameless transparency technology for advanced strike aircraft. The group will design, manufacture, and qualify in flight, fully integrated injection-molded frameless transparencies.

The technology will be applicable to manned and unmanned aircraft systems requiring aircrew- or sensor-transparency subsystems with critical structural and optical requirements. The anticipation is that the technology will be used in the Joint strike fighter. A variety of potential commercial applications for reducing cost and improving safety are foreseen. These applications include window systems for aircraft and helicopters, automotive windows, medical and computer equipment, and transparent roof and floor panels for earth-moving machines.

Optical Character Recognition[16]

Applications Tech, Inc., a small commercial business, is developing a highly accurate optical character recognition (OCR) system for Arabic and Persian script to replace the inadequate commercial-off-the-shelf (COTS) systems being used. The technology has already been transitioned to the Counter Intelligence/Human Intelligence ACTD project. Applications Tech has committed funds for developing commercial applications for the technology.

The product will improve the Army's ability to collect and analyze intelligence from foreign language documents in the low-quality form that is typically found in the field by eliminating the gross inaccuracies of the COTS OCR being used. This enhanced capability will improve translations, archiving, summarization, and information retrieval—giving troops in the field the ability to quickly react to intelligence information. The technology already is being used as a prototype in Bosnia for document filtering and triage. The commercial market for multilingual OCR is growing, with special interest in documents from the Arabic world, where electronically-represented text is relatively recent and original documents must be scanned and converted.

This program used the OT authority granted DoD for its agreement with Applications Tech, a non-defense-oriented small commercial firm.

[15] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/nexgen.htm.

[16] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/ocr.htm.

Pulsed Electric Fields for Sterilization[17]

This project, a nominee for the Second Annual DUS&T Achievement Award, is part of the U.S. Army Natick Soldier Center DoD Combat Feeding Program. The objectives were to use pulsed electric fields (PEF) technology for military and commercial food products to inactivate microorganisms that adversely affect product quality, and to verify technical and economic viability. PEF technology could improve the quality and variety of field rations and commercial foods, support extreme shelf-life requirements (that normal commercial processing and packaging cannot), support future battlefield affects via PEF-treated specialty foods with performance-enhancing food ingredients, and help meet the goals of flexible logistics for the future. The project verified the technical and economic viability of the technology. Using the technology in the greater than $400 million per year commercial markets for acid foods (e.g., orange juice) and fresh tomato products will provide extended-shelf-life products and help reduce military costs.

Renewal of Legacy Software Systems[18]

CPU Technology, Inc., is demonstrating the feasibility of replacing aging or obsolete processors with hardware emulators that can execute legacy software in real time. The ability to mimic numerous processor personalities on a single chip will allow reusing software between platforms. This project will improve the ability to incrementally upgrade platforms and enables continued use of proven legacy software.

The ability to reuse existing software while simultaneously permitting growth to higher speed or the ability to develop new software using commercially available support tools for higher-order languages promises great savings in dealing with hardware obsolescence while improving system performance. The new technology will allow continued use of legacy software while improving speed and performance. The same potential benefits exist in commercial software for the aviation industry, communications, commercial computer systems, and space systems.

[17] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

[18] Defense Technical Information Center, "Success Stories," DUS&T Program website. Accessed October 2, 2001, at http://www.dtic.mil/dust/news/legacy.htm.

Robust Image Authentication and Discovery[19]

This AFRL Information Directorate project, a nominee for the Second Annual DUS&T Achievement Award, was initiated to further the progress of data-embedding technology by using image-data embedding, watermarking, and steganography (covert communication). This project resulted in a prototype digital watermarking camera, demonstration and delivery of image watermarking techniques that withstand image manipulation, development of secure watermarks for images, and demonstration of steganography techniques. These technologies enable images to contain value-added information throughout their life, and support information assurance requirements for detecting image tampering. The commercial applications are for law enforcement and prosecution by validating images of crime scenes, verifying driver's licenses and identification cards, protecting intellectual property rights, and watermarking custom postage stamps and identification cards.

Smart Starting, Lighting, and Ignition Battery[20]

This Army Tank-Automotive and Armaments Command Project, a nominee for the Second Annual DUS&T Achievement Award, integrated a control and reporting capability into batteries. The technology will report the state of charge, history, state of health, and critical operating parameters to a database for processing. This will result in better power and energy management, maintenance support, load leveling, and improved system reliability. This technology could double the life expectancy of conventional batteries. The commercial truck industry considers the smart battery a "must have" utility because of the known costs of a truck failing to start. The technology can be transferred to fuel cells and all battery chemistries, and the battery packs for electric and hybrid vehicles.

This program used the OT authority granted DoD.

Thermal Sprayed Nanostructural Coatings for Dual-Use Applications[21]

Two individuals from the Navy's Office of Naval Research (ONR) shared the Second Annual DUS&T Achievement Award for this project. The project developed a highly wear- and corrosion-resistant ceramic composite coating that can be applied using existing industrial equipment and standard thermal spray processes. The primary benefit of the technology is a reduction in life-cycle costs by increasing corrosion resistance and wear protection. In addition, thermal spray coatings are superior to hard-chrome plating and are about 60 percent less expensive be-

[19] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

[20] Ibid.

[21] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

cause of less cost for complying with environmental regulations. Navy applications for this technology are well under way, including air intake and exhaust values for submarines (expected to save $400,000 per ship, or $20 million over the next 10 years), and USS George Washington's electric motor and oil pump shafts. The technology also will be used for mine-countermeasure ships' main propulsion shafts (saving $1 million per year, per ship). These applications demonstrate the technology's military benefits for reduced total ownership costs for submarines, surface ships, and aircraft. The technology also is transitioning into commercial products. Warren Pump is using the technology to manufacture screw pump rotors for commercial gas turbines and fuel feed pumps, as well as water pan rolls for the printing industry. Inframat (the contractor for the project) has formed a new company, Nanopac, to pursue new opportunities.

This program used the OT authority granted DoD.

UL3 Imaging Infrared Camera[22]

Three individuals from the Army's Night Vision and Electronic Sensors Directorate were recognized for this project, which was a runner-up for the Second Annual DUS&T Achievement Award. This project designed, fabricated, and tested a low-cost, low-power, uncooled infrared camera that weights approximately one and three quarter ounces and is only two cubic inches. The camera's size and reduced cost makes it ideally suited for mounting on a helmet or rifle, as a battlespace sensor, and for micro air vehicles. The 10th Mountain Division is testing the camera in an unmanned aerial vehicle. The technology developed under this program has generated the warrior extended battlefield science and technology objective and a follow-on ATD, which will result in this technology being used in the field. The camera also has tremendous commercial potential. The Omega, the commercial name for the UL3, is the enabling technology for a new generation of handheld fire-fighting cameras. A total of 1,200 units were delivered in 2002. In addition, Indigo (the contractor for this project) and Autolite are introducing a new night-driving system in 2003, which is based on the Omega camera. The units are expected to cost $500, and projected 5-year sales are $400 million. These commercial sales are essential to making the camera more affordable for military applications.

This program used the OT authority granted DoD.

[22] Ibid.

Very-High-Power Electronic Building Blocks[23]

This ONR project developed a new family of products for electric power and future shipboard electric power distribution, electric propulsion, and electromagnetic launch and recovery systems. The project was a nominee for the Second Annual DUS&T Achievement Award. The very-high-power electronics building blocks (PEBB) concept incorporates progressive integration of power drivers, gate drives, snubbers, and other components into functional blocks for reduced costs, losses, weight, and size. Commercial applications in automotive, aerospace, industrial motor drives, and utilities will help reduce unit costs. The technology developed through this project will provide reliable power and energy storage to support the electric warships and combat vehicles future naval capability. The technology has resulted in $41 million of booked sales for PEBB-based systems and products, and some $34 million in sales of other directly dependent technologies.

This program used the OT authority granted DoD.

Additional DUS&T Success Stories

For more stories of successful DUS&T programs, see Appendix A of the October 2001 DDR&E guidebook *Dual Use Science and Technology Process: Why Should Your Program Be Involved? What Strategies Do You Need to Be Successful?*

SMALL BUSINESS INNOVATION RESEARCH[24]

Active Technologies, Inc.

Under the DARPA Small Business Innovation Research (SBIR) program, Active Technologies, Inc., developed a high-output, small-size alternator that led to development of the "Lightning Charger"—a highly successful commercial product with important military applications. The Lighting Charger is an engine-drive alternator that weighs 18 pounds and generates 900 watts of power—roughly one-third the weight and twice the power of previous alternators. The Lightning Charger is used for powering such equipment as emergency lights and refrigerators, and to start vehicles. In 1994, the Lightning Charger was featured in *Popular Science* as one of the best new products of the year. Active Technologies has been acquired by Coleman Powermate, which sells the Lightning Charger to consumers through major home appliance stores.

[23] Defense Technical Information Center, "2nd Annual DUST Award Brochure," February 2002.

[24] The success stories in this section were published on the DoD SBIR/STTR Fast Track website at http://www.acq.osd.mil/sadbu/sbir/success/index.htm. Accessed August 1, 2002.

This technology has yielded important military applications. Military customers include the Army, which uses it to start tank engines when the batteries have died. The Army also is funding the development of a follow-on product based on this technology—a general-purpose, man-portable generator that soldiers will carry in the field for powering communications, hospitals, and equipment.

Advanced Technology Materials, Inc.

Advanced Technology Materials (ATMI) has leveraged several SBIR awards, to grow from four employees in 1987 with no revenues to more than 400 employees today and $125 million in annual revenues. Two-thirds of the revenues are from commercial markets; one-third is from DoD or defense contractors. Among its SBIR successes, ATMI has commercialized the results of an SBIR project with MDA that enabled fabricating a device for delivering ultra-pure materials to semiconductor thin-film reactors. The device is used in Navy laboratories to prepare ultra-sensitive infrared sensors, and by Intel, Motorola, AT&T, and IBM in their semiconductor plants around the world. Another of ATMI's SBIR-developed technologies is the SDS gas source delivery system, which makes storing hazardous gases used in semiconductor manufacturing at below atmospheric pressure possible, significantly improving the safety of gas storage and increasing the capacity of each storage cylinder by a factor of five. This technology has captured ten percent of the world market; annual sales are now $30 million and have been expanding by 50 percent each year.

American Xtal Technology, Inc.

Under the DARPA SBIR program, American Xtal Technology (AXT) developed a "vertical gradient freeze" technology for producing gallium arsenide (GaAs) wafers—a critical component of integrated circuits used in the communications, satellite, radar, and defense weapons industries. This technology results in chemically and electrically uniform GaAs wafers with one to two orders of magnitude (fewer defects than the alternative production technology). Further development funds from private-sector partners, as well as DoD's Title III program, moved this technology from prototype to commercial-scale production.

On the basis of this technology, AXT has become the leading domestic manufacturer of GaAs wafers for optical and electronic applications, with customers that include TRW, Hewlett-Packard, Lockheed Martin, and many universities and government laboratories. AXT's annual sales have grown from half a million dollars in 1990 to approximately $40 million. In addition, AXT has captured approximately 15 percent of the world market in GaAs wafers and has created nearly 250 new high-tech jobs. Approximately 70 percent of AXT's sales are to DoD or its prime contractors.

Arroyo Optics, Inc.

Under the DARPA and Missile Defense Agency (MDA) SBIR programs, Arroyo Optics developed a technology that enables all-optical routing of communication signals from one fiber-optic cable to another. This technology has major advantages in cost and performance over existing technologies, which requires that all of the optical signals in the first cable be converted to electronic signals and then back to optical signals when routing a signal from one cable to another. This technology reduces the number of signals that need to be converted by an average of 70 percent and requires far less conversion equipment. The result is significantly less signal degradation, lower cost, and ultimately, higher-performing, less-expensive communications for commercial and military customers.

Arroyo obtained approximately $500,000 in funding from "angel investors" to match its phase II SBIR awards in 1996. The company has since raised an additional $26 million in venture capital and is building a production facility, with initial production orders to begin by the end of this year. Sales are projected to exceed $100 million per year by 2003.

Autonomous Technologies Corporation

Under the MDA SBIR program, Autonomous Technologies Corporation developed a laser-radar tracking technology with major military and commercial applications. The military use is in ballistic missile targeting; the commercial use is in ophthalmic laser surgery. During laser eye surgery, this technology enables the laser to automatically track tiny, rapid, involuntary eye movements and has demonstrated far superior performance for patients in a market with multibillion dollar potential. Autonomous, which began as a start-up company under SBIR in 1991, raised $20 million in a 1995 initial public offering and formed a strategic alliance with CIBA Vision for co-promoting its technology. In May 1999, Autonomous was acquired by laser manufacturer Summit Technology, Inc. At the time of the acquisition, Autonomous' stock was valued at $154 million. In 1999, the Food and Drug Administration approved the technology for use in surgery to correct near-sightedness and astigmatism.

Digital System Resources, Inc.

Under the Navy SBIR program, Digital System Resources (DSR), developed a new technology—the multipurpose processor (MPP)—that has had a major effect on the capabilities of the U.S. submarine fleet. The MPP is a submarine sonar processor based on COTS technology that is used to determine the location of submarines and ships. The MPP replaces existing military-specific processors, providing 200 times the computing power at a fraction of the cost. In 1994, the Navy awarded DSR a $40 million contract to build three engineering development models of the MPP. Subsequently, the Navy decided to

use the MPP technology to upgrade the sonar equipment on most Navy submarines (SSN 688, 688I, and SSBN 726 [Trident] submarines) and to use it on the new attack submarines as the principal acoustic signal processor.

HNC Software

Under the DoD SBIR program, HNC Software (originally known as Hecht-Nielson Neurocomputer Corporation) developed a number of technologies that have greatly improved the speed and accuracy of target recognition for Army and Navy customers and have had major commercial applications, including a new class of application software known as predictive software solutions (PSS). HNC's Falcon™ System, which embodies the PSS technology, is now widely used in the bankcard industry to uncover credit card fraud in real time to protect financial institutions and consumers. Falcon learns patterns and relationships in data, accurately detecting unusual purchasing behavior at the transaction level. Falcon technology has been applied to detect Medicare and Medicaid fraud, and to detect and manage Internet credit card fraud for online merchants and consumers. HNC's customers include Sears, Fireman's Fund, Brooks Brothers, The Home Shopping Network, and Sprint Communications. HNC's technologies also are used in Navy sonar recognition systems, enabling submarines to process sonar signals and detect objects in an underwater environment more efficiently.

HNC went public in 1995, and is a leading provider of complete predictive customer relationship management solutions for service industries. Red Herring rated HNC as one of the top 100 public companies in 1998, and in 1999, *Fortune* magazine listed HNC as one of the 100 fastest growing companies. Total sales from HNC's SBIR-developed technologies now exceed $230 million (1988 through 1998).

II-VI, Inc.

II-VI developed a process under a DoD SBIR contract that substantially reduced the defects in optical coatings used with high-energy lasers. The technology was so successful that it was commercialized during, and was in full operation by the end of, phase II. Since 1988, the technology has generated approximately $30 million in revenue, 20 to 30 percent of the sales have been to the DoD or defense contractors, including Hughes Aircraft, Raytheon, Martin-Marietta, Texas Instruments, and Westinghouse. II-VI has developed a number of other commercially successful technologies by participating SBIR, and sales from its SBIR-related product lines total more than $63 million since 1987.

Integrated Systems, Inc.

Under the DoD SBIR program, Integrated Systems developed a technology for the efficient writing of embedded software, including software for a robot that loads munitions, which had important spin-offs in the automobile industry. Cumulative sales from the SBIR-developed technology have exceeded $100 million, about 15 to 20 percent of which are from sales to the DoD or prime contractors. Integrated Systems, which began as a start-up company, is now publicly traded on the NASDAQ with a market valuation of just under $400 million.

Integrated Systems' embedded software is used in a variety of commercial applications, including the gas pumps that enable customers to pay at the pump with a credit card. Among its many defense applications, Integrated Systems' technology was used to develop all of the software for the DC-X experimental launch vehicle. According to the prime contractor (McDonnell Douglas), the software reduced both the cost and the time of software development by more than 50 percent. DC-X was the first launch-vehicle project in which software was developed ahead of hardware, and within schedule and budget.

Irvine Sensors Corporation, Inc.

Irvine Sensors Corporation developed a chip-stacking technology using funding from NASA's SBIR program and a small contract from the Air Force. The technology enables 4 to 8 computer or memory chips to be glued into a small stack in the footprint of a single chip. After phase II, IBM and Irvine Sensors invested more than $20 million to develop the technology into a manufacturable product. About half of the $10 million annual sales are to DoD or defense contractors, and the rest are to private-sector customers. Sales are expected to increase significantly.

M. Technologies, Inc.

M. Technologies developed a "smart bomb rack" under the Navy and Air Force SBIR programs and was awarded a $26 million production contract from the Air Force to produce the rack for the F-16/Block 50 aircraft (approximately 350 planes). The smart bomb rack doubles the number of smart bombs that the aircraft can carry and deploy. Smart bombs use the global positioning system to hit their targets accurately.

Magnetic Imaging Technologies, Inc.

Under the Air Force STTR program, Magnetic Imaging Technologies has developed a magnetic resonance imaging (MRI) technology, originated by a Princeton University physics professor, that creates images based on gas rather than liquid (as under the existing MRI technology). Thus, for the first time, this technology enables clear imaging of the ventilation in a patient's lungs—a major breakthrough in diagnosing lung diseases and disorders, including, for DoD, the exposure of soldiers to chemical weapons during battle.

The company initially attracted more than $1 million in outside investment to add to the DoD's funding of $600,000, including a cash investment from the individual who headed General Electric's development of the initial MRI technology 20 years ago. The company has since attracted more than $15 million in additional private investment, and was recently acquired by Nycomed Amersham, Inc., a world leader in diagnostic imaging. The technology is undergoing clinical trials and awaits final approval by the Food and Drug Administration. The company's market size exceeds $100 million.

Ophir Corporation

An infrared-absorption hygrometer, developed by Ophir Corporation under the Army's SBIR program for assessing atmospheric conditions before firing artillery, found its primary military application in the Air Force's fleet of B-2 bombers. Specifically, this technology led to developing a "pilot alert" system, which, as installed in the B-2, warns the pilot if the plane is about to produce a trail of condensation that could be detected by enemy radar. Sales to date to both the Air Force and commercial customers exceed $27 million.

ParaSoft Corporation

ParaSoft Corporation developed a software debugging program under the MDA SBIR program that has broad application for DoD, major defense contractors, and the private sector. ParaSoft's lead product, Insure++, highlights possible bugs in lines of software and gives the author an opportunity to correct them. The software is used by most major developers of commercial software (e.g., IBM, Lotus, and Microsoft) and organizations that develop software for in-house use, e.g., Naval Research Lab, Lockheed Martin, Hughes Aircraft, Boeing, Pratt-Whitney, the Internal Revenue Service, and the U.S. Postal Service. As of March 1999, Insure++ had generated more than $30 million in sales. ParaSoft has grown from three employees in the early 1990s, to 120 employees, and continues to grow rapidly.

Power Spectra, Inc.

Under a DoD SBIR contract, Power Spectra developed and tested a bulk avalanche semiconductor switch activated by a laser. The switch can deliver 15 kilovolts in less than a nanosecond and can achieve this in excess of a billion times during its life. Boeing Corp. was the principal source of financing after phase II, supplying $21 million since 1989 for developing the technology into a product with broad commercial and military applications—primarily ultra-wide-band radars for penetrating foliage and the earth. The technology has since become classified, and the primary customer is the military electronic warfare community. Cumulative sales revenues from the switch are roughly $12 million: $9 million to the DoD and $3 million to the private sector.

Savi Technology, Inc.

Savi Technology recently developed the industry's first radio computer tag, the "SaviTag," using a combination of Navy SBIR funding and private venture capital. The SaviTag—a radio transceiver with an embedded microcomputer—can be attached to military cargo containers, or any other crate or container used for transport, and will track the container's location and contents automatically. The SaviTag was developed with just $2.5 million in SBIR funding (three awards) and has become a central element in the DoD's Total Asset Visibility (the DoD effort to be able to pinpoint the location and content of every plane, ship, tank, and cargo container in transit around the world). Savi has received military contracts totaling more than $185 million, and DoD uses the SaviTag in a large segment of its logistical operations, including almost all shipments into Bosnia.

The SaviTag solves a very real problem for DoD. During Desert Storm, more than half of the 40,000 cargo containers shipped to the desert, including $2.7 billion worth of spare parts, went unused, according to a General Accounting Office report. The Army has estimated that if an effective way of tracking the location and content of the cargo containers (e.g., the SaviTag) had existed at that time, DoD would have saved roughly $2 billion. The SaviTag already has resulted in major efficiencies in our logistical operations in Bosnia, although the savings have not been precisely estimated.

The SaviTag also has major applications in the private sector, particularly in the commercial trucking, rail, and shipping industries. Savi Technology's sales to the private sector are projected to be $20 million this year and are increasing rapidly.

Science Research Laboratory, Inc.

Under four DoD and DOE SBIR awards between 1989 and 1993, Science Research Laboratory (SRL) developed a cluster of solid-state pulsed power technologies that made excimer lasers, for the first time, a commercially viable tool for the UV lithography used in writing current-generation integrated circuits onto computer chips. Specifically, these SBIR-developed technologies did the following:

- Eliminated missing laser pulses observed with the older ("thyration switch") technology, thereby stabilizing the laser power, improving dose control to the semiconductor wafer, and greatly improving chip yield
- Increased the lifespan of the laser driver by a factor of 100 and the lifetime of the laser head by a factor of 10 to 20, thereby reducing the annual maintenance costs of the laser from $250,000 to $50,000.

Because of these technologies, excimer lasers represent the state-of-the-art technology for writing circuits onto a chip. Using excimer lasers has enabled reducing the critical dimensions of the circuits from 0.35 microns to 0.25 microns with the existing KrF laser technology, and ultimately will lead to critical dimensions of 0.1 microns with the new ArF laser technology. The result has been a significant increase in the computing power of virtually every military and commercial system developed in recent years.

SRL commercialized these technologies through a license to Cymer, Inc., which went public in 1996 on the basis of these technologies. Cymer now produces and sells approximately $200 million annually in lasers for Cannon, Nikon, and ASML.

Silicon Designs, Inc.

Under the Navy and MDA SBIR programs, Silicon Designs developed the "accelerometer" used in most DoD missile systems, including Patriot PAC-3, AIM-9X, ESSM, Hellfire 2, and Javelin. The accelerometer is a sensor that tells the missile to arm itself when it reaches a certain speed. This technology replaced a mechanical switch used in earlier missile systems, which was significantly less reliable and cost five times as much.

Silicon Design's accelerometer also is used in all new Ford and Chrysler automobiles produced in the United States. In the automobiles, it triggers the inflation of the airbags when the car decelerates abruptly during an accident. As in the missile systems, this technology replaced a mechanical switch, which was significantly less reliable, several times as expensive, and, unlike the accelerometer, could not be tailored to respond differently to different types of impacts.

Total sales of the accelerometer to DoD and commercial customers are $40 million per year. DoD's initial SBIR investment was just $1.2 million.

Taylor Devices, Inc.

A computer program developed by Taylor Devices under the Air Force's SBIR program for determining how the MX missile could be protected against different shocks (such as a nuclear bomb attack on a missile silo) is used in virtually every major defense system built in recent years, including the Seawolf-class submarine, Los Angeles-class submarine, Aegis cruiser, Arleigh Burke destroyer, B-2 bomber, Tomahawk missile, THAAD missile, and M109 A-6 Paladin. For example, on the Seawolf submarines, the Navy used this technology to determine that a particular COTS isolator was the most cost-effective way of protecting the submarines against the shock of mine detonation and torpedoes, which resulted in millions of dollars in savings over using a much more expensive military-specific alternative. This technology also has had significant commercial applications protecting buildings in seismic risk areas, including the San Francisco Civic Center, against earthquake damage. Sales since 1992 exceed $29 million, of which roughly 75 percent have been to the private sector.

ViaSat, Inc.

Under the Air Force SBIR program, ViaSat developed a "demand assigned multiple access" networking technology that is now used for both military and commercial satellite communications. Subscribers equipped with this technology can access a satellite channel on demand—which means that each subscriber uses satellite resources only for the time they are communicating rather than setting up a dedicated channel (as was necessary under the previous technology) for an extended period. The network can serve approximately 10 times as many users during a day. ViaSat's military sales and orders to date are approaching $90 million for subscriber and network control terminal equipment. Initial commercial sales (to AT&T, Hutchison, and others) are $7 million and increasing rapidly, with commercial satellite communication markets reaching into the hundreds of millions of dollars annually.

Vista Controls Corporation

Vista Controls Corporation developed an advanced electronic computing card through the SBIR program. The card is used in military tanks, helicopters, and training and simulation systems, as well as in commercial vehicles, such as railroad cars. Cumulative sales to DoD customers—including the Army, Air Force, and Marines, through such prime contractors as United Defense, General Dynamics, and Lockheed—total approximately $20 million. Cumulative sales to private-sector customers, including Union Switch and Signal, total about $5 million.

TECHNOLOGY TRANSFER

Although this guide does not specifically treat technology transfer,[25] we offer these success stories[26] because much of the technology that is transferred from government to industry later returns to the government as commercial products.

Applied Research Laboratory at the Pennsylvania State University

Technology transfer and deployment are principal missions of the Applied Research Laboratory at the Pennsylvania State University. The laboratory champions the transfer of advanced technologies and manufacturing processes, in partnership with industry and Navy R&D centers, to acquisition programs and the fleet. The laboratory's charter promotes transferring technology for economic competitiveness and supports congressional and DoD mandates for transferring federally-funded technology to the commercial sector. Technology transfer projects range from assisting with implementing COTS technology for enhancing productivity, to implementing advanced technologies for developing new products or processes.

The Applied Research Lab at the Pennsylvania State University developed many technologies under federal projects and non-sponsored departmental research. The laboratory's relationships with small companies; its teaming skills with government, industry, and academia; and its problem-solving focus, all have consistently led to transferring and deploying technology effectively. In addition, the lab continues to expand and upgrade its facilities and develop new strategic government and commercial alliances. The lab hosts national symposia, highlighting areas of technical expertise, and sponsors detailed hands-on workshops for transferring technology to government and industry.

Technology transfer is particularly concentrated on supporting economic development for industry in Pennsylvania. These efforts include transferring Navy, DoD, and other government-funded developed technology, and directly developing technical support and proposals; directly supporting contracts; and training and teaching continuing education. Industrial development programs take several forms. The lab can work for other projects under a contract, or do the work itself under a contract to industry. Other forms of assistance include consortia programs and projects and state-funded efforts.

State funding and assistance programs give the lab the opportunity to work with small, entrepreneurial companies in ways that lead to developing thriving companies and new industries. One example is GEO-Form, a small, environmental engineering startup in Girard, Pennsylvania. The lab helped GEO-Form design and

[25] *Technology transfer* is the process of sharing knowledge gained in federal laboratories with the private sector, generally for encouraging new commercial markets and applications.

[26] Accessed in October 2001 from the Defense Technical Information Center's "TechTransit" Web site at http://www.dtic.mil/techtransit/.

manufacture a biological reactor system prototype for municipal wastewater treatment to meet the Pennsylvania Department of Environmental Resources' certification trials. The result was an all-composite design that outperformed existing and competing systems many-fold, and met performance and cost requirements. Each component is produced by the most efficient available manufacturing process. The system is being installed at all highway rest stops in Pennsylvania, and the company is expanding worldwide.

The Lab's technology transfers and deployment have been successful in many technology areas, such as shearography, spectroscopy, turbine-blade stripping, laser cladding, spectro/paint characterization, fatigue amelioration, and welding of lightweight structures. Industrial success stories include laser cutting and welding of aluminum for automotive applications, laser cladding of struts for fabricating and repairing heavy equipment components, laser welding of medical equipment, laser cutting of bicycle frame components, development of lightweight composite frames for high-performance bicycles, and improvements in laboratory centrifuges. Details of these and similar success stories are on the ManTech program's website at http://www.dodmantech.com/successes/index.shtml and on the Applied Research Laboratory at Penn State's website at http://www.arl.psu.edu.

Department of Energy

At the Oak Ridge Operations, Department of Energy, dedication to technology transfer has been manifested in several ways, including appointing a vice president and strong support staff. The Licensing Program is another example and has established 75 licenses that have generated more than $2 million in royalties from more than $66 million in sales. A program of royalty sharing uses the receipts for payments to inventors, awards to other personnel, payment of patent and technology transfer costs, and federal income taxes. The Partnership Development Program bridges the gap between government-funded R&D and technology commercialization. It promotes a range of relationships, including cooperative research and development agreements (CRADAs). Today, the 66 CRADAs in effect are valued at more than $97 million. Other companies and entities can use some of the most advanced facilities in Oak Ridge. The Oak Ridge Centers for Manufacturing Technology have been established and modern equipment has been moved to the more accessible Y-12 facilities. Relationships also have been established with the state of Tennessee and the southeast region to assist manufacturers.

NASA

Technology transfer always has been a major thrust for the NASA centers. In the past, NASA's Marshall Space Flight Center (MSFC) focused its technology transfer resources on assisting industry and small businesses. The NASA field agents located industry problems and provided companies with as much as 40 hours of free technical assistance. However, such services eventually put a strain on

MSFC's resources and detracted from the center's primary mission. Inadequate resources were applied to partnerships for developing and deploying technology, managing intellectual property, licensing patents, transferring technology, and doing case studies about success stories. To better meet the needs of internal and external customers, MSFC restructured its technology transfer program in 1997.

The structure of the new technology transfer program was changed from a hierarchical, stovepipe framework with little communication or interaction among units to a flat organization with an integrated, cross-trained team. In addition, the center shifted its primary focus away from gratuitous extension services and set up eight interdependent mission areas: technology development; small business programs; new technology reporting; facilities commercialization; technology and software commercialization; technology deployment partnerships; national, regional, and local strategic alliances; and technology education and outreach projects for economic development. These areas give MSFC a more cost-effective, balanced portfolio of high-quality products and services. New objectives were identified to help U.S. industry become more globally competitive, specifically through national goals for the civilian space program and responsibilities of transferring NASA technology. Under this new approach, MSFC applied business principles to government technology transfer processes to gain efficiencies, improve performance, and align with mission requirements. The infusion of this strategy into NASA's traditional technology transfer mechanisms revitalized the overall program. As a result, numerous methods and agreements now exist for transferring NASA technology to the private sector, such as the following:

- Research and development agreements: Arrangements between NASA and private companies, for which the expenses of NASA facilities, personnel, equipment, technology, or capabilities are fully reimbursable, partially reimbursable, or non-reimbursable by the private companies.

- Joint research agreements: Arrangements that are jointly funded and undertaken by NASA and one or more private-sector companies.

- SBIR program and small business technology transfer contracts: Programs designed to benefit small and disadvantaged businesses.

- Cooperative agreements, grants, and contracts: Methods used to stimulate technology development and commercialization. Many NASA technologies are available for licensing with flexible agreements and mutually beneficial exclusive and non-exclusive arrangements.

NASA uses different publications to highlight its technology transfer opportunities and success stories. *NASA Tech Briefs* is a monthly magazine that features technical articles about emerging technologies from the NASA centers. This magazine is published electronically (http://www.nasatech.com) and in hard copy.

Aerospace Technology is a bi-monthly news summary about how NASA technology is being used, and it covers the intricacies of actual technology transfer. This news summary is accessible at http://www.nctn.hq.nasa.gov. *NASA Spinoffs* is an annual compilation of success stories of NASA technology being used for improving medical, environmental, manufacturing, construction, transportation, safety, consumer, and computer products. This publication is available electronically (http://www.sti.nasa.gov/tto) and in hard copy. Users who visit the website will find a searchable database for browsing technology transfer case studies. Additional information can be obtained directly from the MSFC Technology Transfer Office by visiting its website (http://www.nasasolutions.com) or by contacting the office at 256-544-6700.

Since implementing its new approach to technology transfer, MSFC has compiled success stories in all eight mission areas and satisfied its customers, both internally and externally, better. Technology is transferred to all mission areas interactively and synergistically. During the past year, the number of patent licenses increased by 108 percent and the number of partnerships increased by 67 percent. The entire effort is contributing directly to U.S. national objectives for developing and commercializing space technology.

TECHNOLOGY TRANSITION

These success stories represent the efforts of recent ONR technology transition initiatives. Dr. James DeCorpo, Chief Technology Officer, ONR, provided the "2,000 CTO Successful Transition Stories" during an interview in Arlington, Virginia, on November 29, 2001.

Advanced SEAL Delivery System Propulsion Batteries

A 2-year collaborative effort among six government organizations will transition the Advanced SEAL Delivery System (ASDS) from current silver-zinc to lithium-ion battery propulsion. Using lithium-ion batteries increases mission capacity, provides 20 times more charge-discharge cycles, requires less maintenance, and allows more training time. Submarines carrying ASDS will avoid installing the nitrogen system required for silver-zinc batteries. This transition avoids $200 million in ASDS life-cycle costs for batteries, maintenance, and submarine modifications.

All-Optical Towed Array

The state-of-the-art, all-optical towed array features improved cost, reliability, and performance and will be purchased for installation onboard SSN-688 and SSN-774 class submarines by fiscal year 2004. This transition capitalizes on previous research by ONR and a proposal to the SBIR program, leading to a full engineering and manufacturing development program by Naval Sea Systems Command (NAVSEA) commencing in 2003.

Commercial Emulator for E-2C Group II Mission Computer

The Navy plans to operate Group II E-2C aircraft until approximately 2015. In 1999, Litton stopped supporting the L-304 mission computer (designed in the mid-1960s); all spare parts must now be obtained from stricken aircraft. An emulator has demonstrated executing the L-304 binary code on a COTS microprocessor. The emulator contains a virtual component environment that allows concurrent execution of legacy and modern C++ binary code, made possible by the additional throughput and memory of modern processors. This transition saves $140 million in costs over 15 years, saves 600 pounds of aircraft weight, and increases the mean time between failures to more than 100 times that of the current computer.

Commercial Steel Certification for CVNX

The CVNX requires a service life allowance of 2,000 long tons to accommodate additional or heavier equipment, machinery, and configuration changes over the ship's initial 20 years of service life. An efficient way to achieve this weight allowance is to build the hull and other ship structure with commercially-available HSLA-65 steel, which exhibits significantly greater strength and toughness than the steel presently used in hull structure of aircraft carriers. This transition enables certifying the HSLA-65 steel for use in the new CVNX carrier and will allow all future Navy surface ships to be built with this modern steel.

Conformal Acoustic Velocity Sonar

The transition conducts a crucial at-sea patch test of piezoelectric array components with potential for reducing the weight and cost of submarine acoustic arrays. Using piezoelectric sensors in the conformal acoustic velocity sonar array will also be an evolution path for future submarine technology. When successful, it will save an estimated $8 million to $13 million per ship compared with the current lightweight wide aperture array.

Electronics Thermal Management for AAAV and EA-6B

As electronic components become more compact and powerful, they generate more heat inside their racks, cabinets, and enclosures. This transition is the first military exploration of a new form of thermal management for these largely COTS components. It tests the new technology in the harsh environment of the advanced amphibious assault vehicle to determine its maturity and effectiveness. The EA-6B program is monitoring the results for including the technology at Milestone C in 2003.

Environmentally Adaptive Algorithms for AN/SQQ-89 Sonar

Progress made by ONR in algorithm, software, and computing designs now can be transitioned into environmentally adaptive software for shallow-water operations using legacy deepwater sonar systems. This transition is an at-sea test of the concept using “clip-in” computers loaded with experimental shallow-water processing software. The at-sea testing will enable gathering operator feedback data and fine-tuning of the algorithms before including the software changes into the AN/SQQ-89 systems that will be procured after the tests. These tests are the first steps toward “adaptive control” of sonar pulses so they fully exploit existing water conditions, shallow or deep.

F/O Fibre Channel Data Backbone for F/A18 E/F

The original program plan to construct F/A-18 E/Fs with copper wire in the avionics backbone has been overtaken by newly available COTS fiber data transmission technology. Moving this technology into aircraft production not only reduces weight, volume, and total ownership cost, and it eliminates the need for modifying the backbone later to carry greater amounts of information. This transition reduces the cost of virtually every future avionics upgrade.

High-Performance Missile Batteries

New technology can provide lifetime batteries for the D-5 strategic missile system. This transition identifies the technical elements, demonstration, and engineering development needed to insert these high-performance, long-life batteries. This transition eliminates periodically replacing batteries throughout the missile’s service life.

Intelligent Shock Mitigation and Isolation System for LPD-17

Using a computer chip inside a sophisticated shock absorber to control its response, shocks experienced by electronics cabinets can be reduced to COTS levels. Each of the 12 ships of the LPD-17 Class will have more than 100 electronics cabinets that must be technologically refreshed periodically, largely with unmodified COTS components. The Intelligent Shock Mitigation and Isolation System (ISMIS) technology will isolate these electronics cabinets from routine vibration and shock loads. ISMIS produces an “ultra-low g” environment that reduces or eliminates shock qualification testing for these cabinets and the components in them. This reduction in testing time and expense will facilitate quicker and less costly technology refresh, opening up more COTS options at substantially lower costs.

Marine Communication Interface Module

The Marine Communication Interface Module (MCIM) is a common set of interface modules for HF/VHF/UHF bands. MCIM permits multiple legacy radios, and future digital radios when available, to connect with existing antennas and other system components without needing costly component-specific developments. The module also resolves co-site interference issues and efficient allocation of resources for voice, video, and data; and it decreases command and control (C^2) platform costs, weight, and footprint. MCIM will be a standard C^2 interface that will transition into upcoming block upgrade schedules for Marine Corps UOC, LAV-C2, and UH-1 programs. It has potential application to various other naval platforms.

Precision Terrain-Aided Navigation

Recent advances in terrain-aided navigation make possible a highly accurate (and GPS-independent) navigation system for tactical Tomahawk cruise missiles. This transition has the technical elements, criteria, modeling and simulation, captive-carry flight tests, and other technical information needed to bring this navigation system into Tomahawk engineering and manufacturing development.

Reactive Material Warheads

Capitalizing on previous ONR and NAVSEA R&D investments, this transition is a short, intense, collaborative program for maturing reactive warhead material technology. The transition will generate a large (approximately 50 percent) increase in warhead lethality for three frontline missile systems against many types of targets.

Synthetic Aperture Sonar for Long-Term Mine Reconnaissance System AN/BLQ-11

Rapid transition of synthetic aperture sonar (SAS) will provide ultra-classification (near ID) of mine-like objects at six times the range and three times the coverage rate of existing classification systems. The increased capability will improve the long-term mine reconnaissance system (LMRS) area coverage rate and extract additional features to improve classifying targets. In shallow water, SAS will enable classifying and potentially identifying actual mines among the hundreds of objects that may appear to be mines. This transition provides technology integration, modeling, analysis, and demonstrations needed to move SAS into producing the AN/BLQ-11 mine reconnaissance systems.

Virginia-Class Multi-Level Security

This transition develops a COTS multi-level security system in software in a single tactical network aboard Virginia-class submarines, instead of adding hardware. The system will be developed in cooperation with the National Security Agency and will provide multi-level security for data routing, network transmission, and information storage. This avoids the estimated $76.8 million for integration and design costs of a hardware solution.

Wave Division Multiplexing/Fiber-Optic Network for EA-6B

DoD relies on the Navy EA-6B for radar support missions. The existing mission equipment has been modified at least five times. Capturing recently developed wavelength division multiplexing technology from the commercial world, this transition will eliminate copper coaxial cables for RF and enable huge increases in data transfer rates, speed and efficiency. At the same time, it will reduce weight, and give wider bandwidth and improved resistance to electronic attack.

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Appendix D
Technology Transition Planning and Pathways

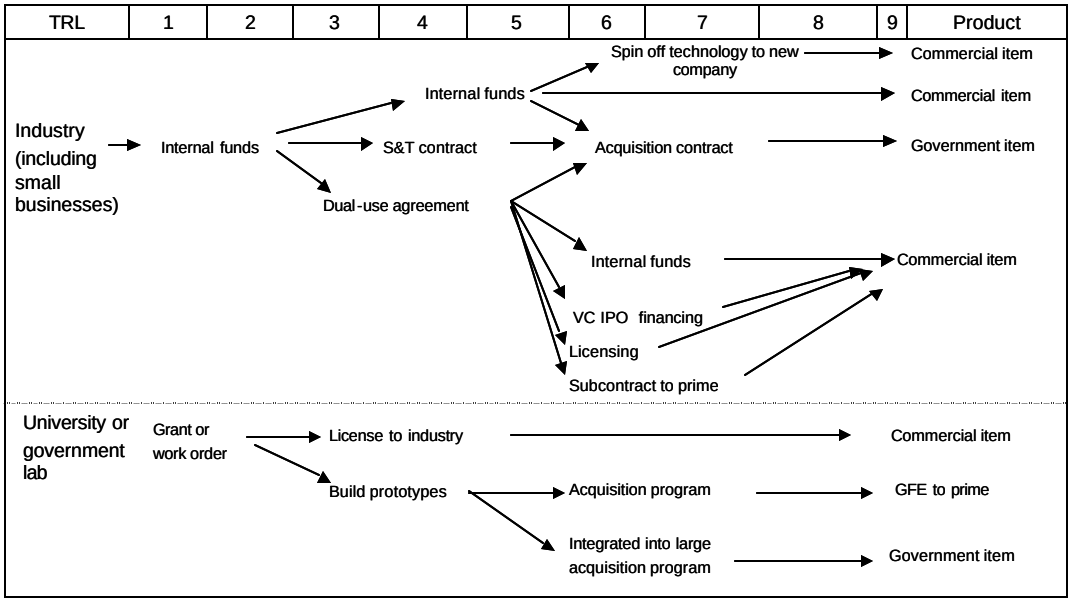
The basic elements to consider when developing technology transition plans are summarized below. The general pathways to transitioning technology, shown in Figures D-1 and D-2, are ways in which technology can be provided to the DoD user.

TECHNOLOGY TRANSITION PLANS

No generic template is available for a successful technology transition plan. However, all technology transfer plans have elements in common. In general, technology transition plans should have the following elements:

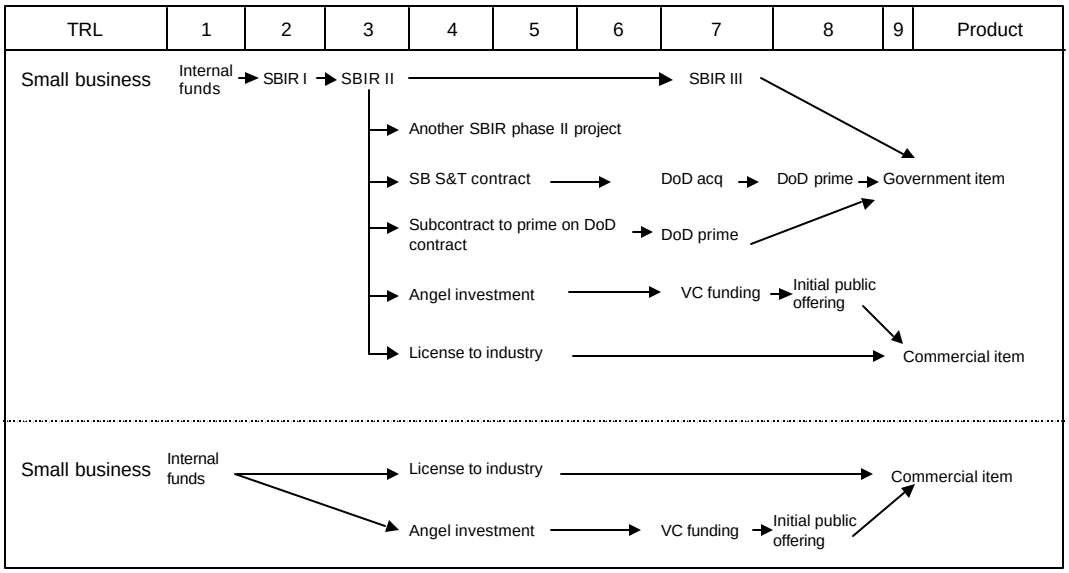
- A technology development outline. This describes the technology development pathway in detail.
- Expected outcomes of the project. The outcomes should be measurable and achievable "exit criteria".
- Funding strategy. The strategy names the resources to be provided according to source, amount, and timing.
- Schedule and milestones, including a transition or handoff schedule.
- Identification of the "customer."
- Acquisition strategy and integration plan.
- Issues and risks—for cost, schedule, technical, manufacturability, sustainment.
- Signed "customer" and program manager agreement for funding, schedule, and deliverables.
- "Customer" funding strategy for acquisition and fielding.
- Plan from multiple sources for using the technology, and encouraging innovation in the program.

Figure D-1. Pathways to Transition



Note: "Pathways to transition" outlines the major funding decision points in relationship to DoD technology readiness levels (TRLs). The TRLs shown are representative of typical decision points, but are not fixed. "Contract" means a contractual instrument appropriate for the situation, such as FAR Part 12, FAR Part 15, modifications (e.g., value engineering change proposals), or other transactions.

Figure D-2. Small Business-Unique Pathways to Transition



Note: "Pathways to transition" outlines the major funding decision points in relationship to DoD TRLs. The TRLs shown are representative of typical decision points, but are not fixed. "Contract" means a contractual instrument appropriate for the situation, such as FAR Part 12, FAR Part 15, modifications (e.g., value engineering change proposals), or other transactions.

Appendix E
Research and Technology Protection Planning

Research and technology protection (RTP) planning should begin early during pre-acquisition and extend through to demilitarization and disposal.

Although science and technology information is usually suitable for unlimited public release, sometimes the information is classified for national security. Also, sometimes the information becomes controlled unclassified information (CUI) because of restrictions imposed by regulation or statute. The research, development, test and evaluation (RDT&E) site directors are encouraged to monitor their classified information and CUI to find technologies whose intrinsic military value is so clear that the site director wants to encourage people from classified information (CI) and security to give specialized support in these technology areas. Technical information recommended by the site directors for specialized support is known as designated science & technology information (DS&TI).

Once an acquisition program is established, the program manager is responsible for reviewing technologies in the program to determine if critical program information (CPI) exists. If the program has CPI, a program protection plan (PPP) must be developed to ensure that the protection of information continues, not only during acquisition but through demilitarization and disposal as well.

Protection of DS&TI and CPI will range from educating scientists and engineers performing fundamental research about threat awareness to implementing a PPP. The Department of Defense Directive (DoDD) 5200.39 outlines protecting information. Information about establishing a security classification guide is in DoDD 5200.1-R or DoDD 5220.22-M.

DoD CI organizations have specially-trained individuals who give tailored CI support to protecting research and technology. A CI support plan (CISP) will outline how CI specialists will work with the owners of the information and processes to protect the research and technology information from inadvertent compromise and threats. A CISP must be developed for each RDT&E facility and each acquisition program with CPI.

The PPP is the single-source document used for coordinating and integrating all protection designed to deny CPI access to anyone not authorized or not having a need-to-know. In addition, the PPP prevents this type of information from being inadvertently disclosed to foreign interests. The PPP must contain provisions for denying inadvertent or unauthorized access by foreign interests. If there is to be

foreign involvement in the program's development or foreign access to the system, the PPP will include a technology assessment and control plan (See DoDD 5530.3).

When applicable, the PPP will address anti-tamper techniques and system security engineering (SSE). Acquisition program managers responsible for U.S. systems that may be co-developed by or sold to foreign governments, or that might not remain in U.S. control (e.g., theft, battlefield loss) must develop and implement these measures. The measures allow the United States to meet foreign customer needs for advanced systems and capabilities while ensuring that U.S. technological investment and equities are protected.

PROTECTION IN INTERNATIONAL PROGRAMS

In the current global environment, the DoD tries to include foreign allies and friendly foreign countries as partners in developing, acquiring, and managing the life cycle of defense systems. Early involvement with foreign partners is encouraged; such cooperative foreign government partnerships should begin whenever possible when requirements are being defined. By successfully developing programs cooperatively, the desirable objectives of standardization, commonality, and interoperability will be promoted. The U.S. government and its foreign government partners will benefit from shared development costs, reduced production and procurement savings from economies of scale, and strengthened domestic industrial bases. Similarly, DoD is pivotal in executing security cooperation programs that support national security objectives and foreign policy goals. U.S. defense system sales are a major aspect of security cooperation.

The overall protection of technology has many facets as it moves through research and acquisitions. Proper marking of technical data, and up-to-date classification guides assist in the process. Before discussing technology with a potential international partner, DoD must review the technology to be disclosed and make a decision about disclosing the technology as described in DoDD 5230.11 "Disclosure of Classified Military Information to Foreign Governments and International Organizations." Non-government laboratories and private companies participating in the program must consider export-licensing requirements even to begin discussions with non-U.S. persons. Visits and assignment of foreign persons to a DoD location to participate in the programs must be arranged in accordance with DoDD 5230.20 "Visits, Assignments and Exchanges of Foreign Nationals."

Partnering with the larger "security community" during an endeavor in which foreign participation is a possibility will mitigate risk of compromising technology and prevent security requirements from becoming an obstacle to the program progressing. The security community has established working relationships with their counterparts in other nations for standardizing requirements and resolving problems expeditiously. Make the relationships a resource for your success.

Appendix F
Glossary

Acquisition	The act of acquiring goods or services for directly benefiting the government or for its use, e.g., buying something that the government needs.
Acquisition community	The program managers, product managers, staffs, and organizations that manage the development, procurement, production, and fielding of systems. They provide new, improved, or continuing materiel, weapons systems, or information system capabilities or services for a validated operational or business need.
Advanced Concept Technology Demonstration (ACTD)	ACTDs are pre-acquisition programs designed to enable users to understand proposed new capabilities for which no user experience base exists. Specifically, ACTDs provide the warfighter an opportunity to develop and refine its concept of operations to fully exploit the capability under evaluation; evolve its operational requirements as it gains experience and understanding of the capability; and operate militarily useful quantities of prototype systems in realistic military demonstrations, and on that basis, assess the military usefulness of the proposed capability.
Advanced Technology Demonstration (ATD)	A process for managing science and technology programs that demonstrates a military capability in a joint warfighting experiment, battle lab experiment, demonstration, field test, or simulation.
Affordability objective	An indication by the warfighters of the relative economic value a capability has when compared to alternative or competing priorities for budget resources.
Application brokers	Acquisition and sustainment program managers who link technology programs with weapons system developments to ensure the technology being developed will be applied to systems.
Arms Export Control Act	The International Security Assistance and Arms Export Control Act, Public Law (P.L.) 94-329
Assistance	Supporting or simulating activities for improving the public good.

Award-term incentive	A performance-based (non-cash) incentive designed to entice a contractor to transition a workload well, provide superior support, and control prices by extending or reducing the term directly depending on performance.
Best value	Represented by an item or process that consistently performs the required function and has the lowest total cost. Best value includes increased performance as well as reduced costs for developing, producing, acquiring, and operating a system.
Blocked requirement	Also known as a "phased" requirement. One approach to developing requirements or capability documents to support evolutionary acquisition. Rather than waiting for the final capability, a system can be developed and fielded in "blocks," which progressively increases the capability for the warfighter.
Broad Agency Announcement (BAA)	A competitive solicitation method, which can be used for basic and applied research (science and technology) and for developing "state-of-the-art" goods or services not related to developing a specific system or procuring hardware. The BAAs are announced on the Federal Business Opportunities website[1] and are general in nature, describing areas of research interest (including criteria for selecting proposals) and soliciting the participation of all offerors capable of satisfying the government's need.
Capability analyses	Builds on the mission analyses and determines capability-based mission needs, usually expressed as opportunities and deficiencies. Capability analyses help determine needs for future doctrine, organization, training, leadership, materiel, personnel, and facilities capabilities.
Colors of money	A term used to describe funding according to the different appropriations used by the Department of Defense (DoD), e.g., research and development, operations and maintenance.
Commercial industry	For profit and not-for-profit nongovernmental and non-academic entities.
Contracting strategy	Motivating the contractors to provide a best-value (from the perspective of the overall life-cycle cost-effectiveness) solution and transitioning into procurement without losing momentum.
Contractor logistics support (CLS)	Maintenance and support done by the original equipment manufacturers or systems integrators.

[1] http://www.fedbizopps.gov

Cooperative agreement	A legal instrument used by a federal agency to enter into a relationship whose principal purpose is assistance (that is, transferring something of value to the recipient for carrying out support or stimulation authorized by U.S. law). A form of financial assistance for circumstances in which the government wants to participate jointly with the recipient and to be substantially involved in the program. (See grant.)
Critical success factor (CSF)	Critical management activities that define an acceptable deliverable or series of deliverables for a technology solution. CSFs are activities that can be tracked and measured and are based on performance.
Cultural barriers	The disincentives, communication shortfalls, and suboptimization that occurs among the different communities that transition technology.
Defense Acquisition Challenge Program	A new program required by the fiscal year FY03 National Defense Authorization Act. The Secretary of Defense, acting through the Under Secretary of Defense for Acquisition, Technology, and Logistics, will establish a program to enable increasing the introduction of innovative and cost-saving technology in the DoD acquisition programs.
Defense Acquisition System	A system for securing and sustaining the nation's investments in technologies, programs, and product support needed to achieve the National Security Strategy and support the United States Armed Forces. The primary objective for the system is to acquire high-quality products that satisfy user needs with measurable improvements to fulfilling a mission and operational support, in time, and at a fair and reasonable price.
Defense contractor	A commercial entity that traditionally does a significant part of its business with DoD.
Defense industry	The commercial companies that support DoD.
Defense Production Act Title III Program (Title III)	This act creates assured, affordable, and commercially viable production capabilities and capacities for items that are essential to the national defense by stimulating private investment in key production resources.
Defense Technical Area Plan (DTAP)	Documents the focus, content, and principal objectives of the overall DoD science and technology (S&T) effort. DTAP is organized according to technology areas and is a horizontal overview of programs from all services and agencies.

Defense Technology Objective (DTO)	Objective that is used to guide the investment in S&T. Each DTO describes a specific technology advancement that will be developed or demonstrated, the anticipated date of technology availability, the specific benefits resulting from the technology advancement, and the approximate funding required to achieve the new capability.
Developmental test	Any engineering-type test used to verify the status of technical progress, verify that design risks are minimized, substantiate achieving contractually required technical performance, and certify readiness for initial operational testing.
Defense Technical Information Center (DTIC) Independent Research and Development (IR&D) database	A forum for obtaining information about IR&D projects and results.
Dual-use technology	A technology that has both military utility and sufficient commercial potential to support a viable industrial base.
Engineering and Manufacturing Readiness Level (EMRL)	Extends the idea of technology readiness levels (TRLs) to engineering and manufacturing issues. EMRLs use engineering and manufacturing readiness levels to support assessments of the system engineering and design, and the maturity of the resulting design, related materials, tooling, test equipment, manufacturing processes, quality and reliability, and key characteristics for ensuring a producible and affordable product.
Evolutionary acquisition	An acquisition strategy that defines, develops, produces or acquires, and fields an initial hardware or software increment (or block) of operational capability. Evolutionary acquisition is based on technologies demonstrated in relevant environments, time-phased requirements, and demonstrated manufacturing or software deployment capabilities.
Execution of funds	The process of obligating and committing funds.
Export Administration Act	Act that administers the exportation of most commercial and dual-use technology.
Fielded systems	Systems that have been procured and provided to operational elements.

Financial Community	The government organizations and personnel who manage the resources needed by the other communities, and fund the programs and systems needed for transitioning technology. The financial community is in charge of financial activities, budget officers who prepare and defend defense budgets, and personnel who manage the spending or execution of those budgets. The community also provides financial support by paying defense contractors and supplying accounting information and services.
Financial Management System	The system in which the funding is justified, obtained, and allocated. The system provides needed resources to DoD's warfighters.
Fixed-price contract	These contracts provide for a firm fixed price or, in appropriate cases, an adjustable price. See the Federal Acquisition Regulation, subpart 16.2.
Focused logistics	One of the key operational concepts in Joint Vision 2020, the joint force vision for the future. Focused logistics is the ability to provide the joint force the right personnel, equipment, and supplies, in the right place, at the right time, and in the right quantity, for all military operations.
Full dimensional protection	One of the key operational concepts in Joint Vision 2020, the joint force vision for the future. Full dimensional protection is the ability of the joint force to protect its personnel and the other assets needed for executing assigned tasks decisively.
Funding	Choosing the proper strategy for obtaining the resources necessary for acquisition.
Grant	A legal instrument used by a federal agency to enter into a relationship whose principal purpose is assistance (that is, transferring something of value to the recipient for carrying out support or stimulation authorized by U.S. law). When assisting, agencies must use grants if the federal agency does not contemplate substantial involvement between it and the recipient. (See cooperative agreement).
Integrated architectures	A representation, as of a current or future point in time, of a defined "domain" in terms of its component parts, what those parts do, how the parts relate to each other, and the rules and constraints under which the parts function.
Integrated Product and Process Development (IPPD)	A management process for developing technology that integrates all activities from product concept through production and field support. The process uses multifunctional industry and government teams to simultaneously optimize the product and its manufacturing and sustainment to meet the objectives for cost and performance.

Integrated product team (IPT)	Cross-functional and multidisciplinary teams that are used in S&T and acquisition programs to address program management and technical issues.
Intellectual property rights	A company's rights in patents, copyrights, trademarks, and trade secrets.
International Traffic in Arms Regulations (ITAR)	Regulations that provide a broad authority for denying or modifying proposed exports for reasons of national security or foreign policy.
Interoperability	The ability of systems, units, or forces to provide services to, and accept services from, other systems, units, or forces and to use the services to enable them to operate effectively together. The degree of interoperability should be defined when referring to specific cases.
Interoperability requirement	A requirement that ensures the interoperability of systems in a service, between services, and with allies and coalition forces. The requirement also ensures that the technology can interface with other systems on the battlefield.
Invention Secrecy Act of 1951	Act that requires the government to impose "secrecy orders" on patent applications whose disclosure would be detrimental to national security.
Joint experimentation	The application of scientific experimentation procedures to assess the effectiveness of proposed (hypothesized) joint warfighting concept elements to determine if elements of a joint warfighting concept change military effectiveness.
Joint Requirements Generation System	System responsible for reviewing requirements that support major defense acquisition programs and other programs of special interest to the joint community. Under the oversight of the chairman of the Joint Chiefs of Staff.
Knowledge management	Collaborative effort for sharing technical knowledge in and among organizations to ensure that technology enhancements are woven into the product life cycle and transition technology.
Legacy systems	Military systems and software whose acquisition has been completed, and are in operation within the Services.
Lessons learned	Knowledge or understanding gained from experience.
Manufacturing technology (ManTech)	A DoD program that focuses on the need of weapons system programs for affordable, low-risk development and production. It provides the crucial link between technology invention and development, and industrial applications. It matures and validates emerging manufacturing technologies to support low-risk implementation in industry and DoD facilities, e.g., depots and shipyards.

Materiel systems	Weapons and other hardware systems.
Mission analysis	Provides a vision of the future, considering future strategy, policies, threats, capabilities, doctrine, technology, and their budgets. It helps identify needs for future doctrine, organization, training, leadership, materiel, personnel, and facilities capabilities.
Modular open system	An integrated business and technical strategy that facilitates the integration of the latest technologies and products that facilitate affordable and supportable modernization of fielded assets.
National Technology Transfer Center (NTTC)	A leader in technology transfer and commercialization. NTCC aids economic development through the mapping of technologies needed to technologies available. It offers a complete portfolio of products and services that enable U.S. companies to find technologies, facilities, and world-class researchers within the federal labs and agencies with which they can partner.
Non-traditional supplier (NTS)	An entity that does not normally provide goods and services to the Department of Defense.
Operational Requirements Document (ORD)	A formatted document that contains operational performance requirements for a proposed system or concept. These operational performance requirements are tailored for the specific system (e.g. ship, missile, aircraft, vehicle, or communications system) and identify system-level performance capabilities such as range, speed, survivability, and interoperability. It is also used to develop the test and evaluation performance requirements for the system.
Operational test	Field tests, under realistic conditions, of any item (or key component) of weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment, or munitions for use in military operations by typical military users, and the evaluation of the results of such tests.
Other Transactions (OT)	Term commonly used to refer to the 10 United States Code (U.S.C.) 2371 authority to enter into transactions other than contracts, grants, or cooperative agreements.
Other Transactions for Prototype Project.	Authorizes the use of OTs, under the authority of 10 U.S.C. 2371, for prototype projects directly relevant to weapons or weapons systems proposed to be acquired or developed by the DoD. They generally are not subject to the federal laws and regulations governing procurement contracts.

Phased requirement	Also known as "blocked." One approach to developing requirements/capability documents in support of evolutionary acquisition. Rather than waiting for the ultimate capability, a system can be developed and fielded in "phases" which progressively provides an increased capability for the warfighter.
Process improvement team (PIT)	A team of acquisition workforce specialists (including technologists) who provide early involvement in the development of warfighter requirements, from both the warfighting community (operators) and the major commands (product users), before it solidifies their requirements.
Procurement contract	A system by which the government generally satisfies its acquisition requirements. The framework for procurement contracts is Federal Acquisition Regulations (FAR) and Defense Federal Acquisition Regulations (DFARs) based, and those regulations define a system that provides for quality products on a timely basis at reasonable costs. The system relies on full and open competition (with some exceptions) and is available to all responsible contractors.
Profit incentive	A provision in DFARS to increase the negotiated fee based on contractor use of innovative technology. This incentive is based on a Congressional desire to encourage innovation and is completely consistent with DoD's objectives.
Requests for proposal (RFP)	A solicitation method described in FAR Part 15 applicable to procurement contracts. Using performance-based statements of work, the government describes the results desired—or the "what"—and allows the contractor to propose "how" they will achieve the desired results.
Requirements Community	The warfighters or their representatives who develop new warfighting concepts and outline the capabilities needed to support them. It validates the military requirements for new capabilities and describes the specific performance parameters that are required for new systems.
Requirements Generation System	The system in which the vision of future warfare and development of specific needs occurs. It also provides information on the future mission needs of warfighters
Research and Development (R&D) Community	The scientists, engineers, and other professionals that provide the expertise necessary to field the technologies in military systems. Its focus is on developing and supporting technologically superior and affordable systems for warfighters. It evaluates technologies, conducts applied research, performs engineering and design work for candidate systems and components. It is responsible for getting the technology to the field.

Science and Technology (S&T) Community	The academics, scientists and managers of S&T programs who develop knowledge in the key technologies that will be needed for future systems and equipment. It includes technology development sources such as government labs, agencies (e.g., the Defense Advanced Research Projects Agency), and industry labs. It focuses on developing and understanding technologies.
Security Community	The intelligence, counterintelligence, security, and foreign disclosure organizations, staffs, and personnel who provide advice to the communities concerning technologies desired by adversaries, capabilities for obtaining such technologies, countermeasures for protecting the technologies, and authorizations to transfer the technology to other countries.
Seed money	Contracts, grants, cooperative agreements or other transactions.
Share-in-savings (SIS) provision	Cost-based incentives now referred to by DoD as "efficiency savings." A SIS contract encourages contractors to apply ingenuity and innovation to get the work done quickly and efficiently to share in the savings attributed to their planning and execution.
Simulation and Modeling for Adaptive Real-Time Networks (SMART Net)	Program uses a series of modeling and simulation tools to help evaluate technology tradeoffs.
Small Business Innovation Research (SBIR)	A program create by congress in 1982 to help small businesses more actively participate in federal R&D.
Small Business Technology Transfer (STTR)	A small business program that expands funding opportunities in the federal innovation R&D arena. Central to the program is the expansion of the public/private sector partnership to include joint venture opportunities for small businesses and the nation's premier nonprofit research institutions.
Solution space	The maximum flexibility allowed developers in determining how essential capabilities are met.
Subcontract integration plan	A plan that encourages favorable partnerships between large and small businesses, and encourages prime contractors to implement the best technology solutions. It describes how a prime contractor plans to maintain the competitive technology environment at the subcontractor level and create competitive alternatives.
Supportability	Building support into the design and emphasizing total system support and operational sustainment. Ensuring the fielded systems economically maintain a high state of readiness and safety, with trained operators and maintainers, with the smallest possible logistical footprint.

Sustainment Community	The operators, program and product managers, item managers, and logisticians who operate, maintain and improve the equipment through the decades of service that are expected for major systems. It provides a support environment that maintains long-term competitive pressures and improves weapons system reliability, maintainability, and supportability through technology refreshment and other means.
Tech package	A list of parts and detailed design specifications.
Technological obsolescence	When a newer technology replaces an older one and the capability to produce the older technology falls into disuse and is gradually lost.
Technology investment agreement (TIA)	Allows the DoD to enter into agreements with firms that will not or cannot participate in government cost-reimbursement R&D FAR contracts or standard federal assistance awards.
Technology readiness level (TRL)	How a program manager determines that a technology developed by industry or a government laboratory is ready or mature enough to transition into a production of quantities to satisfy the military users.
Technology refreshment	A strategy to provide cost-effective support and upgrade strategies, to keep a program ahead of the obsolescence curve. This strategy should result in regular upgrades instead of major end-of-life modifications or follow-on systems.
Technology roadmapping	Involves the process of integrating warfighter needs with resources and technology opportunities by mapping probable paths for transition.
Technology transition	The process of applying critical technology in military systems to provide an effective weapons and support system—in the quantity and quality needed by the warfighter to carry out assigned missions and at the “best value” as measured by the warfighter.
Test and evaluation community	The government organizations and personnel who ensure that the systems perform as intended, and are safe to operate in the challenging military operational environment. It provides an independent assessment of how well systems perform technically, how well the system fulfills the requirements in requirements documents, and whether systems are safe, operationally effective, and suitable and survivable for their intended use in military operations.
Traditional defense contractor (TDC)	An entity that normally provides goods and services to the Department of Defense.
Unfunded mandates	Establishing a requirement for a capability without providing the resources necessary to acquire the capability.

Unsolicited proposal	Where industry creates its own contracting opportunities by submitting unsolicited proposals to perform R&D work or to introduce a new or improved item that may be of interest to DoD.
Valley of death	Hiatus, or gap, in funding, as when a project "stalls" for months awaiting funding.
Value engineering	Has two aspects: a financial incentive to get contractors and subcontractors to reduce the cost of systems, supplies, and services and a rigorous methodology to maximize cost reduction. Contractors who participate in VE share in any net savings based on their financial risk. The VE process is unique because it maintains essential functions and lowers overall cost without degrading performance, reliability, maintenance, or safety.
Value Engineering Change Proposal	A proposal to change an existing contract for a product or services, without impairing essential functions or characteristics, to reduce the overall cost to the agency.
Venture capital funding	Funding provided to invest in immature, high-risk/high-payoff technologies, in the hopes of "picking a winner." Venture capitalists "add value" to the technology developer by providing contacts, idea shaping, management, product development, marketing, commercialization, or funding. It is normally, but not exclusively, focused on small companies or "start ups."
Virtual Technology Expo (VTE) (see Appendix B)	A website that provides information to the defense community on emerging technologies, including descriptions of technology advancement, projected benefits, project milestones, and expected year of completion.
Warfighter	Includes both organizations and personnel that conduct combat operations, and the many other organizations and personnel that support the warfighting capabilities.
Warfighter Rapid Acquisition Program (WRAP)	A program established to address the gap in funding resulting from the time necessary to plan, program, budget, and receive appropriations for the procurement of a new technology. Its goal is to shorten the acquisition cycle and provide a bridge between experimentation and systems acquisition.

Appendix G
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Appendix H
Abbreviations

ACAT IC	Acquisition Category I (Component)
ACAT ID	Acquisition Category I (Defense)
ACAT IAM	Acquisition Category I (Major Automated Information Systems)
ACTD	Advanced Concept Technology Demonstration
AFRL	Air Force Research Laboratory
AF WRAP	Air Force Warfighter Rapid Acquisition Program
AS&C	Advanced Systems and Concepts
ATD	Advanced Technology Demonstration
AT&L	Acquisition, Technology and Logistics
BAA	Broad Agency Announcements
CAIV	cost as an independent variable
CAS	cost accounting standards
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
CLS	contractor logistics support
COSSI	Commercial Operational and Support Savings Initiative
CRADA	cooperative R&D agreement
CRD	Capstone Requirements Document
CSF	critical success factors
DARPA	Defense Advanced Projects Research Agency

DAS	Defense Acquisition System
DAU	Defense Acquisition University
DFARS	Defense Federal Acquisition Regulation Supplement
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency
DoD	Department of Defense
DODGARS	Department of Defense Grant and Agreement Regulatory System
DPG	Defense Planning Guidance
DDR&E	Director, Defense Research and Engineering
DTAP	Defense Technical Area Plan
DTC	design-to-cost
DT&E	developmental test and evaluation
DTIC	Defense Technical Information Center
DTO	Defense Technology Objectives
DUSD(AS&C)	Deputy Under Secretary of Defense for Advanced Systems and Concepts
DUSD(S&T)	Deputy Under Secretary of Defense for Science and Technology
DUST	dual-use science and technology
EMRL	Engineering and Manufacturing Readiness Level
FAR	Federal Acquisition Regulation
FEDRIP	Federal Research in Progress
FFRDC	Federally Funded R&D Center
FMS	Financial Management System
FOC	full operational capability

FRP	full rate of production
FYDP	Future Years Defense Plan
GAO	General Accounting Office
IAC	Information and Analysis Center
ID	identification
IDCC	integrated dual-use commercial company
IOC	initial operational capability
IOT&E	initial operational test and evaluation
IP	intellectual property
IPPD	Integrated Product and Process Development
IPT	integrated product team
IR&D	independent research and development
ITAR	International Traffic in Arms Regulations
J-9	joint experimentation
JFCOM	Joint Forces Command
JROC	Joint Requirements Oversight Council
JWCO	Joint Warfighting Capability Objective
KPP	key performance parameters
LCC	life cycle costs
LFT&E	live fire test and evaluation
LRIP	low rate of initial production
MAIS	Major Automated Information System
ManTech	manufacturing technology
MATRIS	Manpower and Training Research Information System
MDA	milestone decision authority

MDAP	Major Defense Acquisition Program
MNS	mission need statement
NASA	National Aeronautics and Space Administration
NIMA	National Imagery and Mapping Agency
NISC	National Information Services Corporation
NSF	National Science Foundation
NTIS	National Technical Information Center
NTTC	National Technology Transfer Center
NTS	nontraditional suppliers
NTSF	non-traditional small firms
OER	officer evaluation reports
OMB	Office of Management and Budget
ONR	Office of Naval Research
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
O&S	operations and support
OT	other transactions
OT&E	Operational Test and Evaluation
OTT	Office of Technology Transition
OUSD(AT&L)	Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics)
P3I	pre-planned product improvement
PBBE	performance-based business environment
PBP	performance-based payments
PEO	Program Executive Officer
PIT	process improvement team

PMs	Program Managers
PM CoP	Program Management Community of Practice
PNVG	panoramic night vision goggles
POM	Program Objective Memorandum
PPBS	Planning, Programming, and Budgeting System
R&D	research and development
RA	research announcement
RDT&E	research, development, test, and evaluation
RFP	requests for proposal
RGS	Requirements Generation System
RIT	rapid improvement team
ROI	return on investment
RTOC	reduction in total operating costs
S&T	science and technology
SBA	Small Business Administration
SBIR	Small Business Innovation Research
SIS	share-in-savings
SMART Net	Simulation and Modeling for Adaptive Real-Time Networks
SOCOM	Special Operations Command
STTR	Small Business Technology Transfer
T&E	test and evaluation
TDC	traditional defense contractors
TIA	technology investment agreement
TINA	Truth in Negotiation Act
Title III	Defense Production Act Title III Program

TOC	total ownership cost
TRL	Technology readiness level
USD(AT&L)	Under Secretary of Defense (Acquisition, Technology and Logistics)
USJFCOM	U.S. Joint Forces Command
USSOCOM	U.S. Special Operations Command
VC	venture capital
VE	value engineering
VECP	value-engineering change proposal
WIPT	working-level integrated product team
WRAP	Warfighter Rapid Acquisition Program

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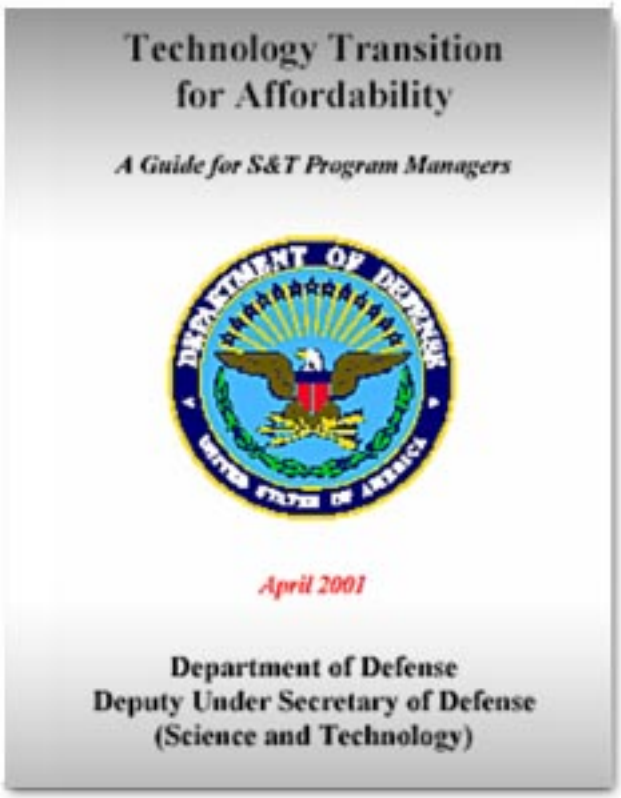

Technology Transition for Affordability

A Guide for S&T Program Managers

April 2001

Department of Defense
Deputy Under Secretary of Defense
(Science and Technology)

The Defense Department's Science and Technology (S&T) Program ensures that the warfighters today and tomorrow have superior and affordable technology to support their missions, and to give them revolutionary war-winning capabilities. S&T program products provide the technological edge that deters aggression and minimizes the endangerment of our young men and women in battle when deterrence fails. However, S&T needs to be more rapidly transitioned to an operational capability to compensate for constrained DoD budgets and to keep pace with commercial availability of advanced technologies. It is imperative that, to accelerate technology transition, the S&T community, acquisition staff, and military users work together to reduce development time for fielding critical technology while balancing cost with performance.

Our S&T Affordability Task Force (ATF) continues to promote activities that speed the transition of technologies from the laboratory to weapon systems. As a result of feedback from program managers in both the S&T and weapon system acquisition community, the ATF developed guidelines on "Technology Transition for Affordability."

This document is a guide that provides S&T program managers, particularly those involved in managing 6.3 advanced technology programs or other programs targeted for transition, with strategies for implementing best practices to achieve technology transition. Technology transition is the process of inserting critical technology into military systems to provide an effective weapon and support system at the best value, as agreed to by the developer, acquisition manager, user, and maintainer.

Technological superiority is a critical component to our national security. In peace, it provides deterrence; in crisis, it provides options; in war, it provides the necessary edge.

Delores M. Etter

Delores M. Etter
Deputy Under Secretary of Defense
(Science & Technology)

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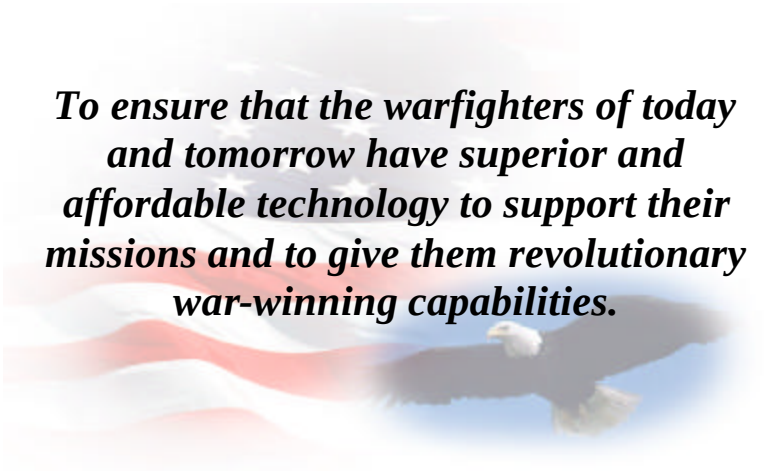
Introduction

This document provides S&T program managers – particularly those involved in managing 6.3 advanced technology development programs, e.g., Advanced Technology Demonstrations (ATDs), Advanced Concept Technology Demonstrations (ACTDs), and Experiments (both joint and Service-specific), with a guide for the implementation of best practices to achieve technology transition for affordability. Other S&T managers – those involved in managing Basic Research (6.1) and Applied Research (6.2) programs – may also improve transition of their technology into military systems, or to the next phase of development, with the adoption and application of selected practices within these guidelines. It is a brief compendium to assist in understanding what needs to be achieved and how to achieve it. Key resources available are also identified.

What is Technology Transition for Affordability?

The Defense Department has been very successful at producing highly effective military systems. However, to compensate for DoD diminishing resources and to keep pace with the commercial availability of advanced technologies, the DoD must reduce costs and field critical technology in a more timely manner by implementing affordability concepts. That is, the DoD must put into practice methods that lead to the best balance among a system's performance, life-cycle costs, and availability. Technology transition for affordability is the process of inserting critical technology into military systems to provide an effective weapon and support system – in the quantity and quality needed by the warfighter to carry out assigned missions – at the "best value" as measured by the warfighter. "Best value" refers to increased performance as well as reduced costs of development, production, acquisition, and life-cycle operations.

The rapid and affordable transition of new technologies into military systems is essential to ensure we stay ahead of potential adversaries who can readily obtain enhanced technology, such as weapons of mass destruction and state-of-the-art information technology from the global marketplace. Technology transition for affordability is an important element of the Defense Science and Technology Strategy, as well as the Under Secretary of Defense Acquisition, Technology, and Logistics goal to accelerate the Revolution in Business Affairs. The Defense S&T Strategy states that "DoD acquisitions will not meet the warfighters' needs within current budgets unless we achieve reduced costs of development, procurement, and life-cycle operation in the S&T program." The strategy includes technology transition as a key element to achieve the S&T mission that is:



The new DoD 5000-series documents (i.e., Defense Acquisition System), available at http://www.acq.osd.mil/ar/#5000, emphasize the evolutionary development of systems. The Policies and Principles section of DoDD 5000.1 discusses "Rapid and Effective Transition from Science and Technology to Products." This approach requires the S&T community to understand and respond to the time-phased requirements of the users of the technology. It requires the systems acquisition community to plan for initial system capability and incremental introduction of new technology and hence to have an intimate knowledge of the readiness of the technology for transition. The goal of the new policy is a significant reduction in technology cycle-time and cost, while increasing the ability to incrementally introduce new technologies to military systems. This evolutionary acquisition process provides risk mitigation by allowing phased integration of technologies into the product. Open systems architecture or the application of common components across multiple systems is also addressed as an enabling practice to increase affordability and facilitate evolutionary development.

Department of Defense Instruction (DoDI) 5000.2 includes a section on technology opportunity activities. This section details responsibilities of the Deputy Under Secretary of Defense for Science and Technology (DUSD(S&T)) and Component S&T Executives. The responsibilities that relate to transition are: supporting the use of commercial technologies and dual use technology development; advising program managers of new developments and providing technical advice throughout the acquisition process; and conducting and evaluating technology assessments to determine technology maturity for transition.

DoDD 5000.1

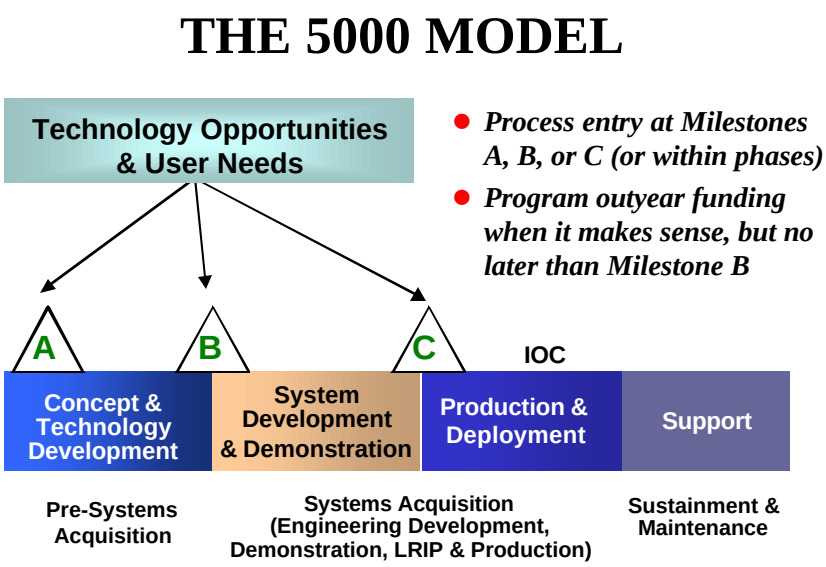
- **Rapid Transition From S&T to Products**
- **Emphasis on Affordability**

DoDI 5000.2

- **Focus on S&T Solutions in Pre-Acquisition**
- **Use Mechanisms with User & Acquisition Customer to Ensure Transition**

DoD 5000.2-R

- **Establish Technology Readiness Levels for Critical Technologies**



The S&T Role in Evolutionary Acquisition

Department of Defense Regulation 5000.2-R requires the major system acquisition program manager identify critical technologies and conduct technology assessments prior to milestone decision points B and C to assess technology maturity. Inherent in this process is the use of a technology readiness level (TRL) for each critical technology. Additional discussion on use of TRLs is included in the last section of the guidelines.

Although the S&T Program is viewed as pre-acquisition, its inclusion in the acquisition policy documents should serve to focus resources (i.e., people and dollars) on improving transition. The implementation of DoDI 5000.2 and DoD 5000.2-R will yield increased connectivity, visibility, and communication between the S&T community, the acquisition community, and the users — all of which are important for effective transition.

In the balance of this guidance document, affordability guidelines and criteria are reviewed and best practices for technology transition are provided to assist the S&T manager in achieving technology transition for affordability. The technology transition process for affordability contained in the handbook, "Addressing Affordability in Defense Science and Technology" is summarized. Key Service, Defense Advanced Research Projects Agency (DARPA), Defense Threat Reduction Agency (DTRA), Ballistic Missile Defense Organization (BMDO), and other OSD initiatives to improve technology transition are also discussed. Lastly, resources for information including training courses on Integrated Product and Process Development (IPPD) and acquisition management are provided.

What are the Key Elements to Achieve Technology Transition for Affordability?

- **Identify the Customer** – The S&T manager must understand the "real" needs and requirements of the customer for the technology. This begins with identification of the customer. For the S&T manager, the customer may be another S&T office or a weapon systems acquisition program office. In other cases, it may be a logistics support organization or even the end user (e.g., a warfighter). In any case, the communication with the customer must begin early so that user needs are considered in the S&T program.

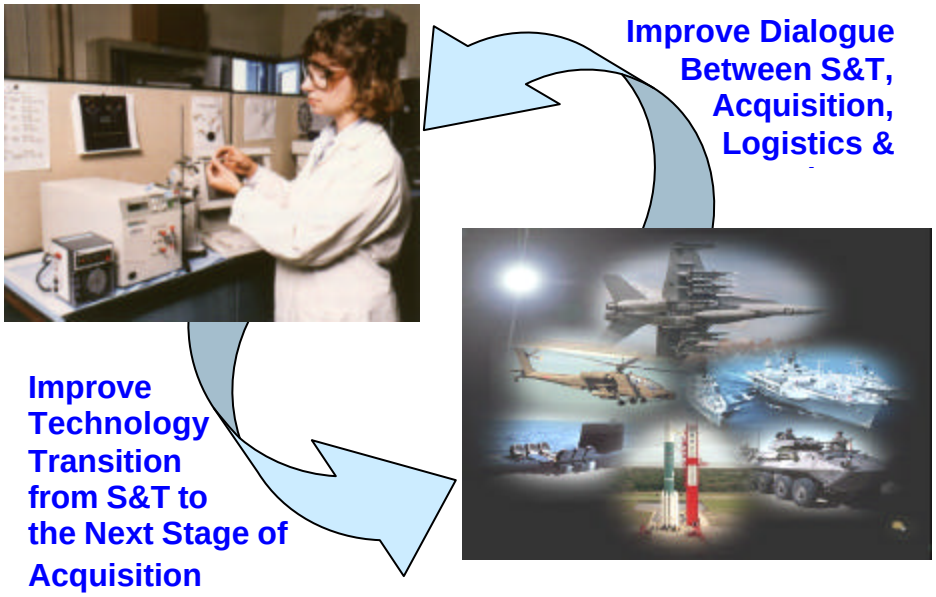
- **Team with the Customer** – The S&T manager must team with the customer (e.g., the acquisition program manager) to ensure technical attributes, schedules, costs, and other warfighter needs can be reasonably met. This team should also include S&T and acquisition contractors, government laboratories, test and evaluation personnel, and other appropriate government/industry stakeholders. The customer's definition of the readiness and timeliness of the technology for transition must be clearly understood and agreed upon by the team. Since the customer may not necessarily be the end user, it is important to communicate with the user to ensure the technology will, in fact, be a timely, usable, and affordable solution to the user's needs.

- **Consider Affordability Early On** – The S&T manager must recognize that decisions made during research and development (R&D) affect product affordability and must apply available tools and techniques to weigh the impact of each decision before it is made. The earlier affordability is considered, the more effectively the S&T manager can influence the life cycle costs and the affordability of products for insertion into military systems. Early implementation of tools such as IPPD coupled with the use of metrics (e.g., technical and programmatic goals) is important. An S&T integrated product team (IPT) consisting of the S&T manager, the S&T contractor, the customer and/or user and their contractors, and test and evaluation representatives is effective for addressing cost and performance trade-offs and for defining metrics.

- **Plan for Transition** – Technical, financial, and schedule issues must be agreed upon with the customer, and there must be clear assignment of responsibilities. The S&T manager will most successfully transition technology by working closely with the customer to plan for accepting and implementing the technology.

What are Some Guidelines for Technology Transition?

S&T program planning should focus on developing technology to meet the needs of the warfighter – in both the near term and far term. It is important for the S&T community – particularly those managing ATD, ACTD, and Experiments (joint and Service) – to be aware of system needs and to make 'choices' that favorably affect the utility and supportability of the final product. While the primary role of S&T managers is to develop technology not yet fully recognized or accepted by the acquisition community and warfighters (e.g. IR countermeasures for large aircraft), the S&T manager must also consider affordability and transition as R&D proceeds. Decisions made during S&T will have a dramatic impact on the ultimate affordability of the technology and, hence, on its eventual acceptance and implementation.



Communication is Key!

It is equally important for the customer to be aware of S&T and to be involved in planning the transition of technology across systems. Perhaps one of the best practices to achieve technology transition for affordability is for the customer – that is the DoD weapon system program office or systems integrator – to be involved early on in the development and planned transition of technology. System program managers are normally interested in communicating the attributes of their system and do not want to be surprised by new technology.

The handbook, "Addressing Affordability in Defense Science and Technology" published in October 1999, provides best practices and procedures captured in the form of criteria for S&T managers to address affordability and to ensure successful transition to acquisition. These criteria are summarized as follows:

- **Obtain Management Support to Meet Affordability Goals –** Top-level managers should motivate personnel at every level to clearly identify objectives and identify weapon system program office needs in order to plan an effective S&T program that focuses on technology transition. S&T program managers work most successfully in an environment that promotes goal setting, teamwork, and recognition of accomplishments from the management chain.

- **Implement the IPPD Methodology –** It is important to implement IPPD methods in which IPTs –government/industry multidisciplinary teams that include the "warfighter" customer – work together to ensure that customer needs are addressed during the technology development stage. IPTs should address life cycle and support issues early on in the design process to mature technologies that require fewer costly changes later in the product development process.

- **Develop and Execute a Training Plan –** An increasing number of courses and literature resources provide S&T managers with the skills, knowledge, and tools of how to transition technology. It is a best practice to conduct training as a team, including training of the industry partners and warfighters. S&T program managers are encouraged to take advantage of these resources as well as participate in the various Service, DARPA, DTRA, BMDO, and other OSD initiatives for technology transition outlined in the next section.

- **Establish and Track Affordability Metrics –** An S&T program manager must establish quantitative metrics to track the progress of an S&T program and set exit criteria to identify when a technology is ready to be transitioned. All stakeholders should agree upon metrics, especially the acquisition manager receiving the technology. By tracking technical performance and programmatic metrics, an S&T manager can identify actions and resources necessary to successfully satisfy requirements. Examples of metrics and/or exit criteria are unit cost, operating and support costs, life cycle cost savings or avoidance, lead-time reductions, and performance improvements resulting in a more affordable system.

- **Develop a Transition Strategy –** A clear commitment between the S&T program manager and the customer is the goal for implementing technology results. The best evidence of a transition commitment is the inclusion of funds in either the S&T budget or acquisition budget to bridge the gap from S&T to the next acquisition phase. Where this is not practicable, other actions impacting successful transition include: early identification of customer needs, formal program office support (with a memorandum of understanding or transition plan), development of affordability metrics against which to track progress, and addressing producibility and sustainability throughout the S&T program.

In addition to these criteria, there are additional affordability factors to consider while planning and conducting an S&T program. It is important to know when and how to "market" a technology that is ready for transition to a military system. Best practices for "marketing" a technology and successfully transitioning it include:

- **Block Improvement or Upgrade to Legacy System –** the technology feeds a weapon system block improvement that meets the operational need with greater return-on-investment (ROI) than the existing capability.

- **Fills Militarily Unique Need –** the new technology fills a specific defense need for which there are no existing technology alternatives (e.g., stealth).

- **Commercial-Off-The-Shelf –** COTS technology is adapted to reduce the overall life cycle cost of the military system.

- **Mature Technology "In-time" –** the technology for potential transition will be ready by the time the system program needs it – prototypes will have already been developed and/or the technology tested.

- **Customer Buy-In –** the customer or weapon systems acquisition program manager participates in the S&T program and is financially supportive of its insertion (e.g., through POM funding).

- **Industry Support –** the industry system integrator agrees to use the new technology and establishes an insertion process into the program acquisition strategy.

- **Application of Open Systems Concepts –** the technology improves affordability by extensive use of common components (including COTS) that may be applicable across multiple systems. Cost and manufacturability, as well as performance improvements, are addressed up-front in design.

- **Producibility –** the program addresses how to manufacture the product more efficiently and at a lower cost.

- **Total Ownership Cost (TOC) –** TOC has been addressed during program formulation, with identification of cost drivers, pursuit of unit price targets, and a mechanism to trace TOC.

- **Spiral Development –** there is a partnership between S&T, acquisition, contractor, and warfighter organizations to provide timely information on the development and implementation of new technology. System development is planned to allow the introduction of new technology during the development cycle.

What are the Key DoD Initiatives to Improve Technology Transition?

The Army, Navy, Air Force, DARPA, DTRA, BMDO, and OSD are pursuing initiatives that are resulting in transition improvements and facilitating insertion of technologies into weapon systems. Updates to these activities, as well as new Service actions, are routinely briefed and discussed at the DUSD (S&T) Affordability Conferences and workshops sponsored by the individual services. A brief overview of the current activities follows:

Army:

- The Army is placing emphasis on **ACTD/ATD programs** to help speed the maturation, assessment, and transition of advanced technologies through demonstrations conducted with the user. The tool for this transition process is the Master Plan (MP), an executive level document required from the Program Manager (PM) to ensure ACTD/ATD success. The MP embraces IPPD activities and addresses key areas, including objectives, program description, cost, schedule, exit criteria, risk, and transition. All major stakeholders are required to sign the MP, including the appropriate systems acquisition PM to whom the technology would transition if successful.

- **Technology Readiness Levels (TRLs)** are being implemented as a measure of technology maturity and its readiness to transition to the next acquisition phase. TRLs are becoming a critical consideration for technology transition and have been institutionalized for use throughout the Army S&T community. All S&T Objectives, Defense Technology Objectives, ATDs, and ACTDs incorporate TRLs. Inclusion of TRLs not only in the weapon systems program, but in all aspects of S&T technology development, ensures the Army S&T Community, Program Management offices, and industry have a common understanding of the exit criteria for program transition.

- The **Future Combat Systems (FCS)** is the Army's highest priority Transformation Campaign Plan program. The Army and DARPA seek greater technological innovation and leverage each other's investments in advanced technologies. In May 2000, DARPA awarded Section 845 agreements to four industry teams to develop design concepts for FCS. Through a series of competitions, at least one design will be selected and validated by a demonstration, leading to the System Development and Demonstration in FY2006 and fielding this decade. The Army has established a Task Force, led by a two-star general, to facilitate technology transition.

Navy:

- The Navy has invested in twelve **Future Naval Capabilities** (FNCs) that represent the highest priority clusters of technology needs of acquisition programs and operating forces. An IPT, composed of program managers from acquisition, OPNAV and S&T, oversees each FNC. In addition, a team consisting of a transition agent and personnel from both S&T and identified acquisition programs or System Commands, manages the S&T programs in each FNC.

- The Navy's **Chief Technology Officer** (CTO) is the senior advocate for the movement of technology, identifying emerging technologies of interest and mediating the transition of technology between the provider and the acquisition program. Assigned to the Office of Naval Research, the CTO focuses on matching acquisition

program needs with technology opportunities; provides independent, system-oriented technology assessments; and develops policies to improve utilization of technology.

- Responding to top-level requirements for affordability, the Navy's Corporate S&T Board designated reduction of **Total Ownership Cost** (TOC) an FNC. The IPT converged on a strong life cycle cost reduction S&T program that is fleet integrated, product focused, and project oriented. The TOC consists of four thrusts - Corrosion Technology to address long-life corrosion control technologies; Smart Systems for Condition Based Maintenance to reduce the fleet maintenance burden; Turbine Engine Technology to reduce turbine engine acquisition and maintenance costs; and Cost Analysis Tools for predicting weapon system design and manufacturing costs.

Air Force:

- The Commander, Air Force Research Laboratory (AFRL) published an affordability policy letter in February 2000 that requires the use of **IPPD on all transition programs** (ATDs and Integrated Technology Thrust Programs (ITTPs)), the calculation of return-on-investment (ROI), and tools and training to implement affordability metrics. An instruction and handbook are expected to follow. ITTPs are groupings of related, high visibility S&T programs focused on meeting critical Air Force operational capability needs.

- An **Affordability Council** has been formed with members from each of the AFRL technology directorates. The council identifies and shares best practices, reviews progress of affordability programs, develops affordability strategy and implementation plans, and monitors and supports the implementation of the S&T Affordability Program strategy.

- An **Applied Technology Council (ATC)** consisting of senior-level management from the MAJCOMS, Product Centers, and the Laboratory has been established to provide a forum to facilitate the timely and affordable transition of technology to improve warfighting capabilities. The ATC reviews all 6.3 ATD candidates, assesses warfighter support, and provides a plan and funding for Technology Transition.

Deputy Under Secretary of Defense
(Advanced Systems & Concepts):

- The Deputy Under Secretary of Defense for Advanced Systems & Concepts manages and oversees Advanced Concept Technology Demonstrations (ACTDs), which are designed to **expedite the transition of maturing technologies from the developers to the users**. ACTDs emphasize technology assessment and integration rather than technology development. The goal is to provide a prototype capability to the warfighter and to support him in the evaluation of that capability.

- ACTDs are evaluated based on several criteria, including response to user needs, maturity of technologies, and potential effectiveness. A key goal is to **move ACTDs into the appropriate phase of formal acquisition without loss of momentum**, assuming the user makes a positive determination of military utility. Each ACTD has a clear acquisition goal for the post-ACTD phases. In addition, there must be provisions for the development of operational requirements, interoperability, life cycle cost, manning, and training; and preparations for supportability.

- Information concerning the process for nominating programs, success stories, and focal points for the ACTD program is available at http://www.acq.osd.mil/actd/

Defense Advanced Research Projects Agency (DARPA):

- DARPA programs **address affordability as one metric in the set of metrics and exit criteria** guiding each high risk, high payoff technology program. The relative emphasis of cost in each program depends on the desires of the transition partner and the program's technological maturity.

- Aggressive cost targets are often established in DARPA programs to reduce the life cycle cost of military systems to which the technology is being transitioned. For example, the **NetFires** program goal is to reduce operations and support costs by 85% and unit production costs by 33 percent. The overall objective of the NetFires program is to provide non line-of-sight tactical missile capability for future dominance on the battlefield, as articulated by the Future Combat Systems vision. NetFires will develop and demonstrate containerized, vertically launched missiles that can be remotely launched directly from the shipping container, fundamentally impacting the way small missiles are manufactured, transported, and used.

- One mechanism DARPA uses to improve affordability is through the use of conventional commercial-off-the-shelf components and processes. For example, the **Low Cost Cruise Missile Defense (LCCMD)** uses a commercial, composite-sheet molding process used by the automobile industry, a computer processor similar to those used in soda dispensing machines, and a commercially available Global Positioning System unit. The goal of the LCCMD program is to design, develop, demonstrate, and transition an affordable seeker for use on a missile interceptor system to defeat raids of unsophisticated air vehicles. The seeker subsystem is the predominant cost driver in an interceptor system and can account for over two-thirds the cost of the entire system.

Defense Threat Reduction Agency (DTRA):

- DTRA technology **development programs support and safeguard America and its allies from weapons of mass destruction (WMD)** – chemical, biological, radiological, nuclear and high explosives – by reducing the present threat and preparing for the future threat. DTRA conducts R&D that

transitions to military counterproliferation operations, such as the development of offensive and defensive tools to counter WMD threats, and creates and operates modeling and simulation tools for operations planning and hazards prediction.

- The **Threat Reduction Advisory Council (TRAC)** is a federally chartered advisory group that reviews DTRA strategic S&T investments for future WMD aspects and provides timely technical scientific and policy related advice to the SecDef, the DepSecDef, Under Secretary of Defense (Acquisition, Technology, and Logistics), and the Director of DTRA. The DTRA Corporate Council (DCC) provides a forum for DTRA strategic planning, business planning, and performance measurement. The DCC oversees all DTRA corporate activities to include the approval of investments in its S&T programs.

- Several key **technologies expected to transition to the warfighter** include the Counterproliferation ACTD Advanced Unitary Penetrator Hard Target Smart Fuse and Bomb Impact Assessment Module; the Counterproliferation Analysis and Planning System; and the Hard Target Defeat.

Ballistic Missile Defense Organization (BMDO):

- BMDO is investing to **build an integrated, affordable ballistic missile defense (BMD) architecture** that uses evolutionary acquisition and spiral development concepts to significantly reduce cycle time and costs while improving the ability to incrementally introduce new technologies into current and future BMD acquisition programs. Continuous phased integration of technologies into the BMD architecture provides a critical risk mitigation element to the Major Defense Acquisition Programs (MDAPs). A commitment to an open systems architecture approach, and maximum use of commercial-off-the-shelf components, increases affordability and facilitates technology infusion.

- BMDO **evaluates and manages technology development and transition through the use of TRLs** to ensure that technology is matured and tested before transition to systems acquisition. Throughout the acquisition life cycle, the BMDO Chief Scientist provides technical advice to the MDAPs and conducts technology assessments at milestone reviews to determine technology maturity prior to transition.

- **Key programs being transitioned include**: (1) the Gallium Arsenide (GaAs) Yield Improvement Advanced Radar Technology project to develop new designs that allow improved chip yields manufactured from high performance GaAs materials; and (2) the Advanced Master Frequency Generator (AMFG) Atmospheric Interceptor Technology project to conduct a form, fit, and function component redesign of the AMFG, a component of the PAC-3 missile's RF seeker.

ODUSD(S&T) Office of Technology Transition:

The DUSD(S&T)'s Office of Technology Transition provides management of several programs that are facilitating integration of commercial and military technologies into DoD weapon systems. These programs are developing dual use technologies, leveraging commercial technology for application to DoD products, establishing production capacity, and promoting technology exchange between DoD and the private sector. A brief description of key programs is found below, with additional details available at http://www.dtic.mil/ott/.

- **Dual Use Science and Technology (DUS&T)** partners with industry to jointly fund and develop dual use technologies and make this a normal way of doing business in the DoD.

- **Manufacturing Technology (ManTech)** nvests in new and improved defense-driven manufacturing techniques to acquire affordable equipment for the warfighter.

- **Commercial Operations and Support Savings Initiative (COSSI)** adapts commercial technologies for use in military equipment to reduce O&S costs and improve the performance of legacy systems.

- **Defense Production Act Title III** creates, modernizes, or expands domestic production capability and capacity for technology items, components, and industrial resources essential for national defense.

- **Technology Transfer (T2)** program provides a unique, noncompetitive avenue for DoD laboratories to work with private industry via various instruments, such as Cooperative Research and Development Agreements.

- **Small Business Innovative Research** harnesses the innovative talents of our nation's small technology companies to fund early-stage R&D projects that have a DoD need and the potential for commercialization in the private sector.

- **Independent Research & Development (IR&D)** ensures the DoD has superior and affordable technology by monitoring commercial industry R&D investments, and sharing the results of military technology with industry.

- The **North American Technology and Industrial Base Organization (NATIBO)** promotes a cost effective, healthy technology and industrial base that is responsive to the national and economic security needs of the United States and Canada.

How Can I Learn More about Technology Transition for Affordability?

There are a growing number of resources available to S&T program managers on the use of affordability tools, affordability best practices, and technology transition methods. The following list contains key resources available to the S&T program manager:

Education and Training

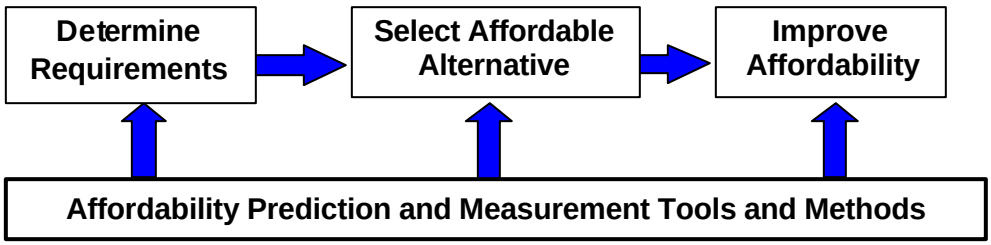
- **Addressing Affordability in Defense S&T: A Handbook for S&T Managers.** This handbook was published for S&T program managers in October 1999. It captures ideas, concepts, and best practices in implementing affordability concepts in S&T. This handbook provides guidelines on how to address affordability in an S&T program and is based on the principle that the earlier affordability is considered, the more effectively affordability and life cycle costs of products for insertion into military systems are impacted. A copy of the handbook is available at http://mtiac.iitri.org/.

- **Affordability in Science & Technology (S&T): An Introduction.** The Air Force Research Laboratory (AFRL) is investing in affordability training tools to characterize the risk and maturity of a technology and to assess its readiness for transition into product development. AFRL offers a 2-day S&T Affordability introduction course targeted for 6.2 and 6.3 program managers that emphasizes exposure to the IPPD/IPT process, including hands-on exercises for balancing performance, risk, and cost in S&T programs. A more extensive 4-day course is offered for affordability program managers and industry/government teams performing ATDs, ACTDs, and major 6.2/6.3 programs. More information can be found at http://www.affordability.com.

- **Introduction to Acquisition for S&T Managers.** The Office of Naval Research and the Office of the Assistant Secretary of the Army (Acquisition, Logistics, and Technology) have worked collaboratively with the Defense Systems Management College to develop a 3-day course entitled "Technology Insertion in Defense Systems Acquisitions". This session provides a basic overview of the mechanisms used to integrate advanced technologies into future warfighting systems. For more information on course offerings, contact Mr. Bill Lukens at DSMC, e-mail: bill.lukens@dau.mil.

- **Affordability Management Tools.** Additional courses are available that are aimed at the use of IPPD/ IPTs and affordability tools that S&T program managers may use to focus on customer needs and affordability. These include courses in Quality Function Deployment, Design of Experiments, Design for Six-Sigma, Cost as an Independent Variable, and Modeling and Simulation. A more detailed description of course offerings is described in the DoD handbook "Addressing Affordability in Defense S&T".

- **Affordability Modeling and Prediction.** The Office of Naval Research conducts the Affordability Measurement and Prediction (AMPP) program that develops advanced science-based tools to model and predict a system's affordability. These software tools enable the technologist to not only consider the performance benefits of developing a potential technology, but also to factor in life cycle cost impacts and the return-on-investment for a particular technology insertion. The eventual goal is to provide a web-based affordability toolkit for application by government and industry scientists and engineers to predict the overall affordability of a system. For more information, visit the program at http://www.onr.navy.mil/sci_tech/industrial/afford.htm.



Best Practices / Lessons Learned

- **S&T Affordability Conference.** This annual conference is held with senior laboratory, acquisition, and industry representatives to share best practices, discuss lessons learned, and improve the dialogue for affordability in the research and development community. Proceedings from past conferences are available at the National Center for Advanced Technologies (NCAT) web site, http://www.ncat.com/. Future Affordability Conferences will be announced on the following web site, http://www.affordability.org, and via notification from the Deputy Under Secretary of Defense (Science & Technology).

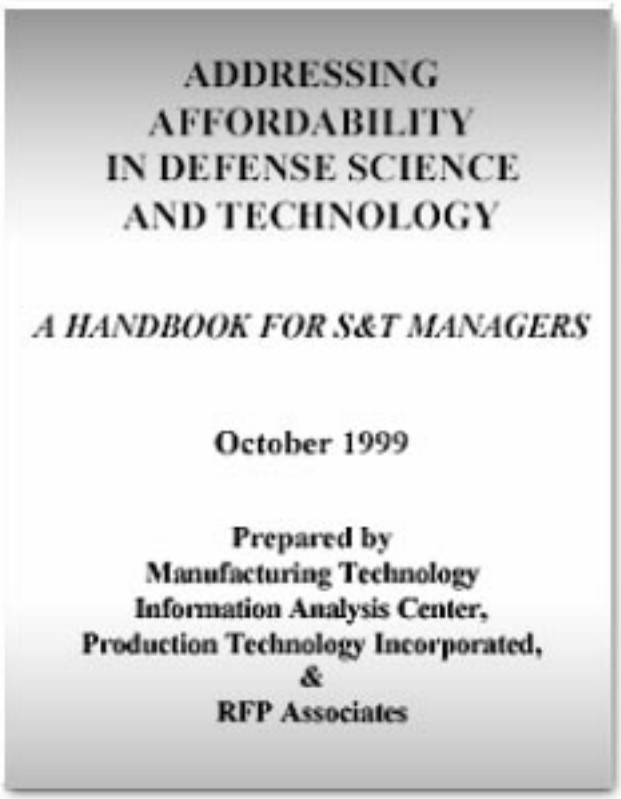
- **Technology Transition Strategy.** A written transition plan or a written commitment between the S&T program manager and the acquisition customer to implement a technology has been shown to improve the likelihood of transition. The transition plan provides clear assignment of responsibilities. Resource mechanisms for rapid acquisition and elements of a good technology transition plan are described in Section 2.2.5 of the DoD handbook, "Addressing Affordability in Defense S&T".

- **Virtual Technology Exposition (VTE).** Via the development of the VTE, the DUSD(S&T) has established a means for increasing the weapon system acquisition community's awareness of technology available to the warfighter via development of the VTE. The Web Site currently contains descriptions of more than 500 research efforts, which can be easily located by selecting subject areas associated with the Defense Technology Areas or the Joint Warfighting Capability Objectives. Work is ongoing to populate, update, and garner customer feedback on the database. Registered users of the Defense Technical Information Center (DTIC) and persons with a government or military email address may visit the Web site at https://vte.dtic.mil/.

- **Technology Readiness Levels (TRLs).** The Government Accounting Office report titled, "Better Management of Technology Development Can Improve Weapon System Outcomes", addresses how best practices offer improvements to the way the DoD incorporates new technology into weapon system programs. The report concluded that demonstrating a high level of maturity before incorporating new technologies into product development programs puts programs in a better position to succeed. The S&T manager should use TRLs as a guide to determine when a technology is ready to transition. It is crucial to approach TRLs together with the system program office targeted for transition and to apply TRLs as appropriate to the specific technology and application. A summary of the TRL levels follows:

Technology Readiness Level	*Description*
1. Basic principles observed and reported.	**Lowest level of technology readiness. Scientific research begins** to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.
2. Technology concept and/or application formulated.	**Invention begins.** Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
3. Analytical and experimental critical function and/or characteristic proof of concept.	**Active research and development is initiated. This includes analytical studies and laboratory studies** to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Component and/or breadboard validation in laboratory environment.	**Basic technological components are integrated to establish that the pieces will work together.** This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.
5. Component and/or breadboard validation in relevant environment.	**Fidelity of breadboard technology increases significantly.** The basic technological components are integrated with reasonable realistic supporting elements so that the technology can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.
6. System/subsystem model or prototype demonstration in a relevant environment.	**Representative model or prototype system**, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated operational environment.
7. System prototype demonstration in an operational environment.	**Prototype near or at planned operational system.** Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
8. Actual system completed and "flight qualified" through test and demonstration.	**Technology has been proven to work in its final form and under expected conditions.** In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9. Actual system "flight proven" through successful mission operations.	**Actual application of the technology in its final form and under mission conditions**, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.

[17] Addressing Affordability in Defense Science & Technology



ADDRESSING
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A HANDBOOK FOR S&T MANAGERS

October 1999

Prepared by
Manufacturing Technology
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EXECUTIVE SUMMARY

Affordability is receiving special attention within both the public and the private sectors. Within the public sector, particularly the DoD, diminished resources require greater emphasis to be given to affordability. The DoD affordability goal is to provide effective weapon and support systems - in the quantity and quality needed by the warfighter to carry out assigned missions - at a reduced cost. Affordability in the "cradle to grave" defense acquisition system needs to begin at the early stages of science and technology development and extend into acquisition and transition of the technology in order to obtain reduced acquisition and life cycle costs.

Dr. Paul G. Kaminski, former Undersecretary of Defense for Acquisition and Technology, defined affordability concisely in his remarks to the Acquisition and Technology Subcommittee of the Senate Armed Services Committee, as, "reducing development, production and ownership cost." He also stated that "Each technology effort must buy its way into our programs in terms of reducing life-cycle cost and program risk." The Honorable Jaques S. Gansler continued the affordability challenge in January, 1999, with publication of "Into the 21st Century: A Strategy for Affordability". He stated, "For this next phase of acquisition reform, we must further adapt the best world class business and technical practices to our needs, rationalize our infrastructure, restructure our support systems, and reduce cycle time and ownership costs while simultaneously improving readiness."

The requirement that each technology effort 'buy its way' into programs with 'reduced cycle time and ownership costs' has motivated the Science & Technology (S&T) community to attack the issue of affordability. As indicated in the Defense Science and Technology Strategy, the first of the four Strategic Investment Priorities is affordability. "Diminished resources require greater emphasis to be given to affordability throughout the S&T program. DoD acquisitions will not meet the warfighters' needs within current budgets unless we consider reduced costs of development, procurement and life-cycle operation in the S&T program." It is also recognized that technological innovations can result in reduced system costs but only if they can be affordably incorporated into systems. Hence, the S&T community has recognized the need to more closely align its activities to the needs of the system acquisition and logistics communities.

The S&T community must not forgo the legacy of providing the 'seed-corn' for future systems, but it must also incorporate the lessons of commercial industry. In every technological endeavor, the researcher makes 'choices' that eventually affect the utility and supportability of the final product. Commercial success has focused on developing an understanding of the effect of such choices. Stifling creativity is not the goal; providing an understanding of the long-range impact of 'choices' is.

The Manufacturing Technology Information Analysis Center (MTIAC) has worked with the DoD S&T Affordability Task Force (ATF), Production Technology Incorporated, and RFP Associates to develop a handbook for S&T program managers that captures the ideas, concepts, and best practices in implementing affordability practices in S&T. This handbook provides guidelines on how to address affordability in an S&T program. The earlier we consider affordability, the more effectively we influence the life cycle costs and the affordability of products for insertion into military systems.

Affordability best practices are outlined in examples of S&T program case studies that focus on customer involvement in the development and transition of technology. The customer – that is the DoD program office or systems integrator – should be involved early on in planning the transition of technology across one or more military systems. The technology transition process is reviewed – program office needs should be identified, program office management support should be formalized, affordability metrics established against which to measure progress, and producibility and manufacturing issues addressed throughout the program. Education and training modules are detailed to promote application of integrated process and product development principles in S&T development. Also selected affordability management tools are discussed – for example, integrated product and process development (IPPD), quality function deployment, design of experiments, and six sigma manufacturing.

ADDRESSING AFFORDABILITY IN DEFENSE SCIENCE AND TECHNOLOGY (S&T)

1.0 INTRODUCTION

Affordability is receiving special attention within both the public and the private sectors. Within the public sector - particularly the DoD - diminished resources require a greater affordability emphasis. The DoD affordability goal is to provide effective weapon and support systems, in the quantity and quality needed by the warfighter to carry out assigned missions, at a reduced cost. As shown in Figure 1-1, affordability not only addresses the issue of being able to afford to purchase the necessary quantity of weapons, but also being able to afford the support of these systems over very long periods of time. Affordability in the "cradle to grave" defense acquisition system needs to begin at the early stages of science and technology development and extend into acquisition and transition of the technology in order to obtain reduced acquisition and life cycle costs.

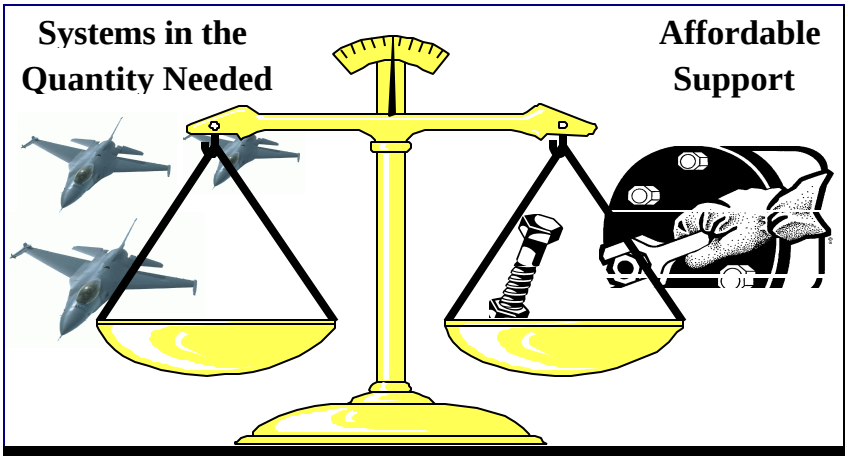

Figure 1-1. DoD Affordability Goal.

1.1 Definition of Affordability in Defense S&T. With respect to this handbook, "affordability" in S&T has dual definitions. On the one hand, affordability concerns the DoD's ability to acquire and maintain sufficient quantities of military equipment to achieve the department's strategy and objectives. Affordability addresses the notion of *best value* in terms of performance, producibility, life-cycle cost and risk. Hence, affordability efforts are directed at the cost-effective acquisition of high-performance systems and equipment and the cost-effective sustainment of those systems to accomplish the mission. Affordability may be achieved by reducing the life cycle cost of a given system and purchasing and maintaining the same number of systems. But it can also be achieved by devising new ways to achieve the mission that require fewer systems. While individual units or systems might be more costly to acquire and maintain, the net life cycle to achieve the mission may be reduced through significant improvements in performance and effectiveness. Affordability can also be achieved by developing new manufacturing processes that enable the low cost production and/or repairs of new weapons systems. Advances in manufacturing may significantly reduce non-recurring costs, such as hard tooling for

composites, thus reducing the acquisition cost for items produced in volumes insufficient to amortize the high up-front costs typical of defense products.

Dr. Paul G. Kaminski, former Undersecretary of Defense for Acquisition and Technology, defined affordability concisely in his remarks to the Acquisition and Technology Subcommittee of the Senate Armed Services Committee, as, "reducing development, production and ownership cost." He also stated that "Each technology effort must buy its way into our programs in terms of reducing life-cycle cost and program risk." The Honorable Jaques S. Gansler enforced this in January, 1999, with publication of "Into the 21st Century: A Strategy for Affordability". He stated, "For this next phase of acquisition reform, we must further adapt the best world class business and technical practices to our needs, rationalize our infrastructure, restructure our support systems, and reduce cycle time and ownership costs while simultaneously improving readiness." The concern for life cycle cost is obvious. However, the bulk of life cycle cost is fixed long before it is spent. An example of how life cycle cost is fixed early in the life cycle is given by Boeing data on ballistic missile systems as summarized in Table 1-1.

TABLE 1-1: When Costs Become Fixed (Unchangeable).

By the end of:	**% of LCC spent is:**	**% of LCC rendered unchangeable is:**
Concept development	1.0	70
Advanced development	7.0	85
Full scale development	18	95
Production	50	97
Operations and support	100	100

As indicated, seventy percent of the total life cycle costs of the system are rendered unchangeable after only about one percent of the total costs are expended; eighty-five percent are unchangeable after only about seven percent are expended. Accordingly, affordability is largely determined during early development in the S&T stage.

That then brings us to our second definition of "affordability", which is as a code word or shorthand for a philosophy of program management and set of program management objectives and tools. In our view, a necessary but not sufficient condition of an affordability program is that it be concerned with cost, as elaborated above. But, it must also adopt an appropriate management philosophy, as described below.

1.2. Affordability Considerations in Science and Technology. Affordability is one of the strategic investment priorities of the Defense Science and Technology Strategy, which states "The S&T program provides options to enable modernization of our forces with smaller budgets." These options are provided in two ways:

First, technological innovations are produced that reduce system cost. An example is the development of embedded sensors that will alert maintenance personnel to the need for maintenance of structures such as airplane wings. This technology will eliminate unnecessary preventive maintenance inspections and more effectively prevent costly (and perhaps catastrophic) fatigue failures. Second, the proper development of S&T products assures that they can be affordably incorporated into systems. "Proper development" includes the near-term transition, when appropriate, of S&T innovations that may reduce system cost and meet system needs "in-time", and the routine use of S&T development processes that treat life cycle system costs as a parameter equal in importance to system performance.

The DoD has been challenged to make weapons systems more producible and affordable with good planning from technology to acquisition to product manufacture. For systems already in the "pipeline", that is, mature in the design process, affordability can be achieved via upgrades to existing designs. For systems with designs not yet finalized, affordability may be achieved by addressing producibility and manufacturability as part of the S&T design process. A concerted S&T affordability effort is important to achieve reasonable acquisition and life-cycle costs.

The S&T community must not forgo the legacy of providing the 'seed-corn' for future systems but must incorporate the lessons of commercial industry. In every technological endeavor, the researcher makes 'choices' that eventually affect the utility and supportability of the final product. Commercial success has focused on developing an understanding of the effect of such choices. Stifling creativity is not the goal; providing an understanding of the long-range impact of 'choices' is.

1.3 Scope of the Handbook. This handbook provides guidelines on how to make an S&T program more affordable. The earlier we address affordability in a technology development program, the more effectively we influence the life cycle costs, and hence the affordability of products for insertion into military systems. This handbook is aimed at those S&T managers who are developing advanced technology (6.3) that may be transitioned in the near term; however, it describes how 6.1/6.2 managers may also consider affordability and be aware of systems needs in a way that does not inhibit innovation or research. This handbook is a guide for all S&T managers and focuses on the ideas, best practices, and tools in considering affordability in S&T programs. S&T affordability best practices are outlined that focus on technology transition as the way to achieve affordability. Examples of S&T affordability program case studies are provided that show how the customer – the DoD system program office or systems integrator – is involved in the development and transition of technology across one or more military systems.

1.4 Structure of the Handbook.

- **Section 2** provides guidance for S&T program managers in addressing affordability in their programs.
- **Section 3** describes some S&T affordability program case studies that are good examples of affordability "best practices".
- **Section 4** provides an overview of selected tools that can be used by program managers and their staffs in addressing affordability.

- **Section 5** lists references for additional information.
- **Appendix A** is a glossary of terms and definitions of affordability.
- **Appendix B** provides more detailed information on the tools presented in Section 4.
- **Appendix C** discusses and lists the affordability programs.
- **Appendix D** lists some of the training and educational courses that will help program staff members successfully address affordability during S&T.

2.0 GUIDELINES FOR IMPLEMENTING AFFORDABILITY PRACTICES IN R&D AND MANUFACTURING

2.1 Introduction. Historically, the focus of the DoD S&T program was to develop technology to meet future threats. The technology did not necessarily meet a warfighter requirement or get incorporated into a weapon system. However, over the past ten years, the DoD, with Congressional support, has chosen a budget strategy in which S&T funding has remained essentially unchanged while acquisition funding has decreased about 50%. With these declining DoD budgets, the trend of S&T development for the sake of purely establishing a large technology base is changing. Increasingly, S&T programs (especially 6.3 advanced technology) are developing technology with a view toward meeting nearer term warfighter requirements. It is now clear that S&T projects, especially those involving the maturation of technology for transition to existing and future systems, must clearly embrace affordability principles early in development.

Affordability must now be a consideration in the formulation of every S&T project. It is a fundamental requirement for all 6.3 projects expected to transition to demonstration/validation or engineering and manufacturing development. As stated by the Under Secretary of Defense (Acquisition & Technology) in an August 7, 1996 policy memorandum:

> Basic Research (6.1) and Applied Research (6.2) programs explore the boundaries of technology relatively unfettered by the demands of near term application, but program managers should still be aware of downstream affordability issues. Advanced Technology Development (6.3) programs must, however, address affordability issues to the maximum extent practicable to facilitate their successful and cost effective transition to the appropriate phase of acquisition.

In managing any S&T program there are a set of best practices and procedures for program management to ensure that affordability is implemented in the program. These principles are particularly pertinent to those S&T managers who are developing advanced technology (6.3) that may be transitioned in the near term. However, 6.1/6.2 managers should also be aware of these principles when managing their S&T program. These best practices and procedures are summarized below.

2.2 Affordability Best Practices and Procedures. The following affordability elements are Best Practices and Procedures captured in the form of criteria for S&T managers to address affordability in their S&T efforts. While aimed at 6.3 S&T managers, these practices and procedures are intended to help all S&T managers – including 6.1/6.2 managers – to focus on affordability in their programs without stifling creativity or innovation. These criteria are endorsed by the Deputy Under Secretary of Defense for Acquisition & Technology (DUSD/S&T) Affordability Task Force that was chartered by the Director for Defense Research & Engineering (DDR&E) in May 1995 to develop solutions on how to strengthen the affordability focus of DoD S&T programs.

2.2.1 Obtain Management Support to Meet Affordability Goals. It is the goal of the DoD to implement Integrated Product and Process Development (IPPD) methods throughout all 6.3 S&T

programs. IPPD is a management process that integrates all activities from product concept through production/field support, using multi-functional teams, to simultaneously optimize the product and its manufacturing and sustainment processes to meet cost and performance objectives. IPPD requires a fundamental shift from traditional sequential technology development to a concurrent process. Traditionally, separate groups operating independently, designed a product, then gave it to the manufacturing department. The manufacturing engineers decided that it could not be manufactured without design modifications, so they gave it back to design, and so on. Once produced, the product moved into the logistics cycle where engineers determined that it could not be supported. The goal of IPPD is to anticipate and address these manufacturing and support issues from the outset, during early design. The purpose is to ensure that "customer" requirements are addressed during the technology development process.

Management commitment to IPPD begins with understanding the IPPD process and providing funding (i.e., training/travel) to implement affordability goals by using IPPD. The commitment continues with management empowerment of Integrated Product Teams (IPTs)—cross-functional, multidisciplinary teams that facilitate transition – and possible leveraging of other related S&T programs, acquisition investments and commercial technology programs. The criteria for a successful IPPD approach are to:

a) Understand and encourage the need for a shift from a performance-only development focus to an integrated view that addresses producibility, life-cycle cost, and implementation risk along with performance.

b) Adjust the funding profile to implement affordability goals by addressing issues such as producibility, life-cycle cost, implementation risk, application of open systems, and interoperability.

c) Establish leverage with other S&T programs, acquisition investments, and/or commercial technology programs.

d) Hold technical program reviews with senior management to routinely address affordability issues.

Effective top-level management should motivate managers and workers at every level to perform as desired by clearly identifying objectives and by fostering a positive "can-do" attitude from top to bottom. Promotion policies, awards, and other formal recognition are important in providing feedback that jobs have indeed been done well. The best incentive for government managers is an environment that promotes goal setting, teamwork, and recognition of accomplishments from the management chain.

2.2.2 Implement the IPPD Methodology. More affordable technology will be achieved when IPPD methods are applied during S&T. An S&T IPT – or multidisciplinary team that includes the "warfighter" customer – is a critical component of IPPD in that life cycle and support issues are considered early in the design process. If the IPT is successful, the result will be a more mature technology that requires fewer costly changes later in the product development process. A successful

IPT achieves the benefit of reduced cost and schedule while maintaining and often increasing the quality of a technology. As industry experience has demonstrated, quality tends to cost less in the long run although the initial cost of high quality technology may be high. The same is true in S&T. IPT activities during 6.3 and advanced technology demonstrations should focus principally on the warfighter customer and meeting that customer's need. Laboratory and technology base customer needs should not be neglected, particularly in 6.2 and early 6.3 efforts. Accurately understanding the various levels of user needs and establishing realistic requirements that will enable the technology to transition smoothly into the acquisition cycle is critical to achieving affordable technology.

Criteria for developing a good IPT include:

a) Establish a multi-disciplinary team with common objectives that includes stakeholders from all government and industry elements – research, development, design, test, manufacture, training, logistics, warfighter, financial, and contracts.
b) Create a charter that clearly articulates team objectives, the scope, process approach, and individual team roles and assignments. Note that some members will attend all meetings of the IPT and will form the core team while others will meet intermittently, as required.
c) Empower members of the IPT to make decisions, and have a clear understanding on the extent of their decision-making authority.
d) Organize the team hierarchically as required. Most large projects employ a leadership or system-level IPT and a number of sub-IPTs. Leaders of sub-IPTs are members of the leadership or system-level IPT.
e) Keep IPTs relatively small, generally seven members or fewer, and not more than nine. "Real work" rarely gets accomplished with ten or more individuals present.
f) Assign strong, senior leaders to the IPT and sub-IPTs. IPT and sub-IPT leaders must be able to work well with teams, understand group dynamics, and possess sufficient technical depth to properly track progress and report accurately on activities. The IPT goal is consensus; the IPT leader's task is to facilitate the achievement of this goal.
g) Put in place a mechanism to document and track assignments, action items and workflow among the team members and establish effective communication processes between IPT members. This mechanism and communications can be a simple email-based process or a more sophisticated web-enabled workflow tool.
h) Implement regular sessions and a reporting process, so that work in process is tracked regularly and team members are regularly accountable for their contributions to the team.
i) Use contract incentives and requirements to incentivize affordability.

Successful S&T managers have used industry contract incentives to encourage affordability. Contractually incorporating production and life-cycle cost objectives and providing for a sharing of the savings when costs come in below objectives creates a "win-win" situation for all. Well-structured contracts and well-designed contract incentive clauses are key in focusing contractor attention on cost reduction. Cost plus incentive fee contracts have been shown to be a good method of achieving affordability.

2.2.3 Develop and Execute a Training Plan. IPPD is an excellent method to systematically manage priorities, performance, cost and risk. In particular, when applied to the 6.3 environment, IPPD methods can assist in effectively transitioning technology. However, for IPPDs to be effective, S&T personnel must have the skills, knowledge, motivation and the environment to make it happen. A culture change through education and training in affordability principles is essential to modify the long standing S&T focus on performance.

Proper training for IPTs is an important ingredient for success. The three criteria related to preparing a training plan are to:

a) Conduct training as a team, including training of the industry partners and warfighters.
b) Conduct IPPD tool training, e.g., group dynamics, quality function deployment, six sigma, design of experiments.
c) Identify funding and set aside funding to conduct training.
d) Provide for future training as the needs exist.

Appendix E provides a listing of various training classes that are available to S&T managers.

2.2.4 Establish and Track Affordability Metrics. An S&T program manager needs to establish quantitative metrics by which to track the progress of an S&T program. By applying and tracking performance and programmatic metrics, an S&T manager can identify actions and resources needed to successfully satisfy requirements. The criteria for establishing metrics are the following:

a) Identify quantitative metrics – programmatic and technical – in order to measure affordability.
b) Develop key exit criteria for transition.
c) Demonstrate and validate the cost/benefit of the technology (e.g., through modeling and simulation).
d) Adopt best practices and benchmarking activities.
e) Measure and report metrics periodically.

In general, metrics should be simple, related to the team's or organization's goals, and be meaningful to both the team and the customers. In some cases, technical performance should be measured, in others programmatics. In most cases it is both. Understanding what is important for the team's success, and to the customer is critical. It is imperative that identification of the metrics be done in coordination with the customer.

Examples of programmatic measures are unit cost, operating and support cost, or life cycle cost savings/avoidance and leadtime reduction savings. These may be measured using cost and schedule reporting data such as Schedule and Cost Performance Indexes (SPI and CPI) and Schedule and Cost Variance (SV and CV). Technical reports can be examined to see what measures of the performance and process characteristics may be used as technical metrics. These data should be highlighted and tracked closely. New metrics should be selected only as needed to supplement existing information.

Metrics that do not effectively measure progress should be eliminated in lieu of more meaningful measures. Each IPT needs to establish the set of metrics that is most appropriate to their product.

In addition to programmatic and technical metrics, the IPT needs to establish key exit criteria for affordable transition of the S&T technology to a weapon system(s). It should be noted that most exit criteria include the requirement to deliver the technology according to a specified schedule. S&T program exit criteria for transition to DoD systems may consider the following:

a) Technological performance requirement of system (e.g., lighter, stronger, more resistant to environmental stresses, faster, and smaller).
b) Need for cost effective manufacturing processes to reduce system cost.
c) DoD need for common hardware across multiple systems (e.g., open systems approach).
d) The requirement for technology applications, as defined by the Defense Technology Area Plan or Joint Warfighting S&T Plan.
e) Form-fit-function replacement for block improvement of existing subsystem.
f) Alternative technology approach required to improve producibility/lower project cost (e.g., less expensive, more durable composite part to replace an aluminum part) while system design is still flexible (i.e., in engineering and manufacturing development or EMD).
g) Meets critical shortfalls in which an unanticipated pre-or-post EMD problem may seriously affect deployment/use of the system after deployment.
h) Weapon system program office wants the technology and is financially supportive of inserting the technology into their system or has executed a Memorandum of Understanding (MOU) with the S&T program office.

2.2.5 Develop a Transition Plan. With the continued consolidation of the Defense industry, and with DoD under continued pressure to acquire and sustain more affordable DoD systems, the successful transition of technology into acquisition and the sustainment of those weapons systems has become a critical issue. All S&T managers should be aware of near term transition opportunities for their technology and 6.3 managers, in particular, must facilitate successful and cost effective transition of their technology to needed systems/subsystems. While it is true that the primary goal of S&T is to develop and demonstrate technology, process maturity of a technology must be understood during S&T so that technical and economic risks associated with technology transition may be reduced. In addition, it is also necessary to be able to know when and how to "market" a technology that is ready for insertion. Some criteria for the successful transition of an S&T program are to:

a) Establish and maintain frequent communication with Warfighter and Acquisition Customer.
b) Work together with the warfighter, acquisition customer and contractor on an Integrated Product/Process Team (IPT)
c) All stakeholders understand and agree to the end product of the S&T program
d) Put in place MOAs, MOUs, or other written agreements to demonstrate a commitment by all parties to implement the technology results
e) Establish a Transition Team at the beginning of the S&T program

f) Develop a formal Transition Plan
g) Understand the Warfighter and Acquisition Customer requirements
h) Put a funding strategy in place to effect transition

One of the most important aspects in transitioning the results of an S&T program is to prepare a written transition plan or commitment between the S&T program manager and the customer to implement the technology results of an S&T program. Elements of a good transition plan are the following:

- Technology development outline
- Expected outcomes of S&T project
- S&T funding strategy
- Schedule/milestones/when technology is ready to be handed over
- Identification of customer
- Acquisition strategy/integration plan
- S&T issues/risks – technical, production or logistics
- Signed "customer" and S&T manager commitment
- "Customer" funding strategy to implement technology
- Leveraging/linkage/related technologies (i.e., DTAP/JWSTP)

Overall, the elements of a successful S&T transition include early identification of customer needs, formal program office support (with MOU, IPPD, and transition plan), development of affordability metrics against which to track progress, and addressing producibility and sustainability throughout the S&T program.

An S&T transition model (see Figure 2-1) has been developed that addresses two specific aspects of the overall issue in transitioning the result of 6.3 S&T programs: (1) identification of best practices and actions that can be taken by S&T program managers under current policy and procedures; and (2) identification of management issues that are at a policy level requiring action by management above S&T.

The implicit message in the model above is that a disciplined process is needed that is clearly driven by requirements. The intent is to ensure that funding priorities are appropriately based on these requirements and that senior management reviews project funding if requirements are unlikely to be met. The model illustrates the desired multi-community team approach and includes the need for metrics on all aspects of transition. Key to the successful implementation of this model is the need to provide incentives to S&T personnel to achieve transition.

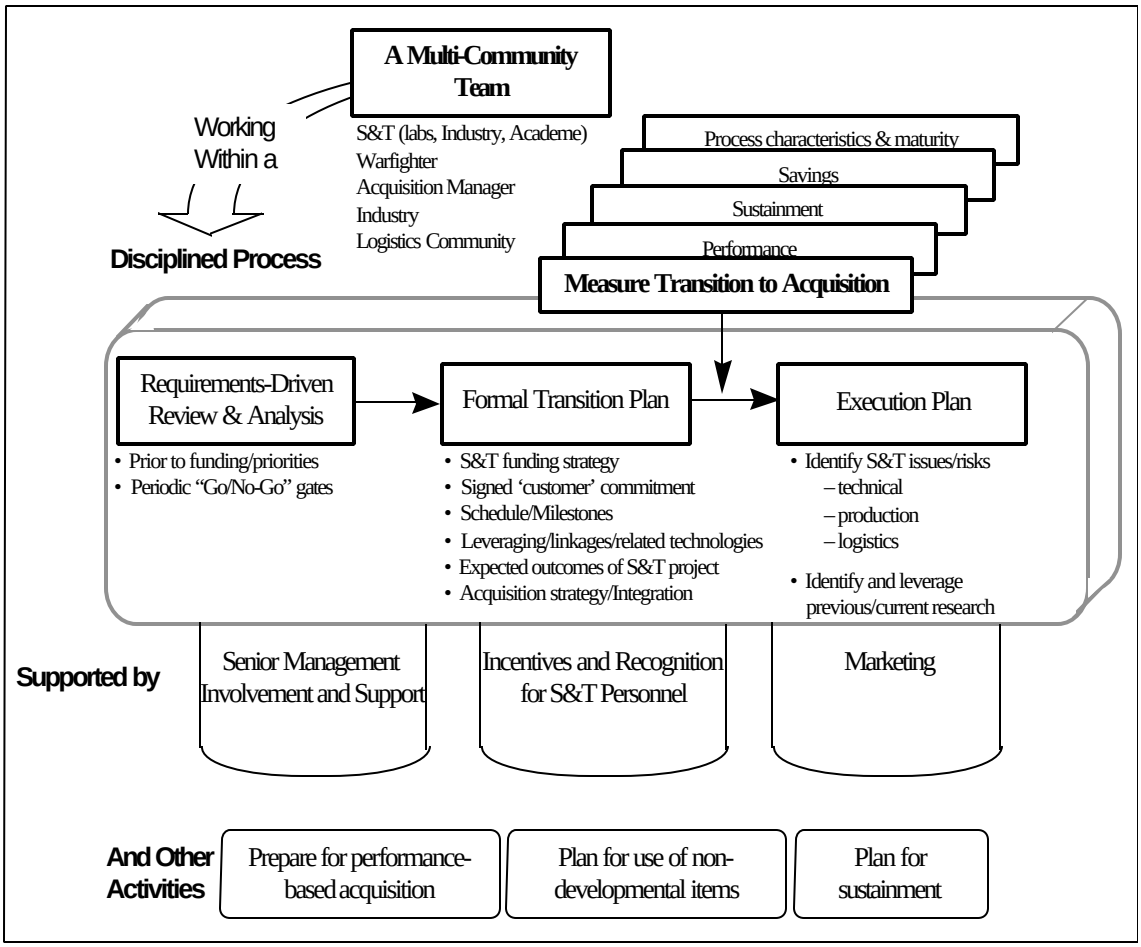

Figure 2-1. Model for transitioning the results of 6.3 S&T programs.

There are four key considerations in implementing the transition model:

1. The assessment of S&T personnel should be based on transition and affordability in addition to technical achievements, papers, etc.
2. S&T personnel must take the initiative to be more customer-oriented. They must clearly understand the customer's needs with the requirement that 6.3 efforts be 'pulled' by those needs. Communication and marketing of the S&T project effort and results is essential.
3. S&T Program Managers must understand acquisition and requirements communities (and vice-versa). The career path to S&T program management should consider 'exposure' to both communities. For example, S&T Program Managers should have knowledge of available technologies and 'marketing' skills; should periodically "participate" in field activities; and should be periodically co-located with the acquisition program.
4. Acquisition management should be involved in S&T (6.3) funding decisions. A real commitment should be obtained from acquisition managers to transition the technology.

2.2.6 S&T Affordability Task Force Reviews. The S&T Affordability Task Force annually reviews select "affordability programs" that are submitted by tri-Service/DARPA members of the task force. These affordability programs are evaluated by their compliance with the affordability criteria listed in Sections 2.2.1 – 2.2.5 above. Some affordability programs receive very high scores because the programs notably emphasize near term (within 3-4 years) technology transition. This near term transition is evidenced by specific transition plans, POM funding that is budgeted by the user (i.e., system to which technology is to be transitioned), or active user involvement in the planning of the technology program. Some notable examples of highly rated projects are summarized below as case studies.

3.0 SCIENCE AND TECHNOLOGY AFFORDABILITY CASE STUDIES

In 1995, the Director for Defense Research and Engineering tasked the S&T Affordability Task Force (ATF) to screen S&T programs for affordability content and to develop a methodology to address process maturity earlier in acquisition programs – namely at the S&T development stage. On an annual basis, fifteen to twenty affordability programs are identified by the military departments and DARPA and evaluated on how well they meet the defined affordability criteria (described in Section 2). The Affordability Programs represent S&T projects from many different technology areas as identified in the annual Defense Technology Area Plan. The results of the ATF review are summarized to the Defense Science & Technology Advisory Group (DSTAG). A listing and brief description of S&T Affordability Programs reviewed through 1999 is found in Appendix D.

This section outlines some of the highest rated affordability programs that serve as examples of S&T case studies on affordability best practices in that they focus on customer involvement and on transition of the technology into a system. The customer – that is, the DoD program office or systems integrator – is involved early-on in planning the transition of technology across one or more military systems. Elements of the technology transition process described in Section 2.2.5 are prevalent throughout these examples – customer needs are identified early, customer management support is formalized with transition plans, affordability metrics are established against which program progress is measured, and producibility and manufacturing issues are addressed throughout the program. A number of these affordability programs have been presented at various affordability workshops and conference as "best practice" examples of affordability.

3.1 Composite Armored Vehicle Advanced Technology Demonstration (CAV ATD). The CAV ATD was one of several S&T programs that may provide opportunities for more deployable combat systems. The CAV ATD program was a key element of the Army's effort to develop lighter, more deployable and survivable ground combat vehicles. It focused on demonstrating the technical feasibility and operational potential of composite materials for vehicle hull structure and armor. The program addressed such issues as resistance to high and low velocity impact, damage tolerance, repairability, affordability, structural integrity (durability), non-destructive inspection, structural integration of signature and armor, scalability, and manufacturing methods and technology which must be solved before composites can transition to ground combat systems. The program's 22-ton demonstrator was durability tested for 6,000 miles and tested with a 105-mm cannon to evaluate the high gun firing forces imposed by a heavy, direct fire weapon on its composite hull.

CAV ATD was designed to support the development of future lighter weight vehicles with at least a 33 percent reduction in hull structure and armor weight and with reduced development time, costs and risks. The program supported potential options for multiple future systems such as the Future Scout Vehicle or Future Tank and follow-on upgrades to fielded systems.

The Army awarded the CAV ATD contract to the United Defense LP in December 1993 to design and fabricate a technology demonstrator and modeling and simulation validation. The technology

demonstration concluded in fiscal year 1997.

The CAV ATD contract did not require Integrated Product Process Development (IPPD) implementation at the time of its award, however, it did require a management system that would utilize the concept of concurrent engineering. It also required the application of Six Sigma methodologies at a level suitable for an ATD throughout duration of the program. Shortly thereafter, it became clear to the Army management that a more comprehensive IPPD approach was needed for the CAV ATD program to become a model for IPPD implementation in other future Army programs. Through a benchmarking process, a tailored Texas Instruments IPPD methodology and the Motorola Six Sigma approach to quality were adopted, licensed and implemented by formal training of both Government and Industry team members. The CAV ATD was one of the first S&T programs to implement the IPPD process to assure that concurrent engineering and Government/Industry teaming were incorporated early on in program to maximize influence on design cost, quality and producibility. Based on direction by senior Army S&T leadership, the United Defense LP and the Army's Tank-Automotive Research, Development & Engineering Center (TARDEC) embraced the IPPD process and are now using it on other Army ground combat development programs.

Technology developed for CAV has transitioned to the Crusader acquisition program. One of the virtues of CAV as a vehicle demonstrator was that it addressed a range or variety of ballistic threats and produced a virtual menu of proven solutions for future vehicle designers. The CAV aft upper hull most nearly matched the Crusader SPH turret shell and RSV mission equipment structure ballistic requirements, and therefore was readily applied with only slight modification.
CAV's emphasis on affordability resulted in ceramic armor selections that transitioned directly to Crusader. This affordability-based approach was critical to successful transition in that the technology did not exceed Crusaders' unit-cost premium for weight-reduction technologies. CAV's emphasis on the Automated Fiber Placement (AFP) process will not likely transition to Crusader. Yet lower cost, less capitol intensive, high thru-put processing technology such as Vacuum-Assisted Resin Transfer Molding (VARTM) will most likely be the process of choice for ground vehicle production.

A focused manufacturing technology program is now bridging the gap between the ATD and Crusader production with a goal of cost-equivalence with the aluminum baseline in rate production for composite ballistic structures.

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3.2 Generation II Soldier (Next Generation Soldier ATD). The GEN II ATD was the cornerstone program of the 21st Century Land Warrior (21 CLW) Integrated Technology Program (ITP). It addressed future dismounted soldiers as a system and as a weapons platform, with the purpose of enhancing the individual soldier's survivability, lethality, mobility, and situational awareness. The GEN II ATD accomplished these tasks by improving upon current dismounted soldier capabilities, while reducing the size, weight, bulk and power requirements relative to current equipment, as well as by providing new capabilities previously unavailable to dismounted soldiers. The GEN II program met these goals through a fully integrated systems development approach that stressed modularity,

interoperability, and soldier compatibility.

The program consisted of five subsystems: 1) the Integrated Headgear Subsystem (IHS) with a helmet mounted display, head orientation sensor, helmet mounted mobility sensor and improved ballistic protection; 2) the Individual Soldier Computer/Radio (ISCR), a 2.5 pound Power PC based computer radio with 1.3 to 5 km range, integrated GPS and POSNAV navigation systems and expansion/interface capabilities to accommodate other 21 CLW components; 3) the Protective Subsystem (PS), an enhanced lightweight body armor, totally new load carrying equipment with embedded ISCR and IPS components, and enhanced uniform components; 4) the Weapons Interface Subsystem (WIS), which provides the link between the ISCR and the various future weapons being developed for dismounted soldiers, such as the Javelin and OICW, and 5) the Interface and Power Subsystem (IPS), which is responsible for managing the power budget, locating connectors and wiring, and determining battery requirements and trade-offs.

The GEN II system was awarded in August 1994 with Motorola as the prime contractor and Hughes, Gentex, Battelle, Honeywell, and Arthur D. Little as contractor team members. The GEN II office of Natick RD&E Center, Soldier Systems Command led the development effort and worked in conjunction with US Army CECOM, ARDEC, DARPA, ARL and other government agencies.

The GEN II ATD was structured with IPPD as a primary characteristic of the program. The use of IPPD and IPTs was a key evaluation factor during the source selection for the program and insured that IPPD is inherent in all management and technical aspects of the program. The GEN II team had a strong customer focus and worked in conjunction with the Army's Dismounted Battlespace Battle Lab and the USMC to ensure user participation. The program was notable for its military members' involvement in the planning from the beginning of the design process to the system integration through the User Systems Engineering Requirements (USER) Panel. The panel members were involved in frequent system and component assessments and were on hand to provide immediate feedback to engineers and designers. The GEN II program further facilitated customer/contractor interaction by sponsoring a USER representative and government technical representative at the contractor's facilities. IPPD was further implemented on the GEN II program through formal IPPD/IPT training with Motorola University for all government and civilian personnel. IPPD concepts were fully embraced by senior Army leadership across all organizations, and the philosophy of investing in affordability and producibility issues early on in product development was proliferated throughout the program. Metrics were used to track
affordability and producibility issues, i.e. Design to Unit Production Cost (DTUPC), Six Sigma, and to track program progress so that problems could be seen on the horizon, allowing for their timely management.

The GEN II ATD, and the associated technology applications, transitioned from the S&T community to the Land Warrior acquisition program beginning in 1996. The IPPD/IPT approach enabled many technologies from the GEN II ATD to be rapidly incorporated into the Land Warrior program. A Technology Insertion IPT was chartered with participation from government and contractor personnel from both the GEN II ATD and the Land Warrior acquisition program to enhance the transition

process. Contract modifications were required for both prime contracts to execute these transitions. Examples of successful transitions include an integrated helmet suspension, liner and communications headset assembly, active matrix electro-luminescent (AMEL) head mounted display, low power display driver electronics, integrated GPS module,. dead reckoning module, selected Graphic User Interface (GUI) software, and system voice control. Each technology was measured against performance exit criteria and USER Panel ratings before being considered for transition. Once the technology passed through those "gates", then the technology designs, prototypes, technical reports, test reports, and any lessons learned were provided to the Land Warrior IPTs through a series of technical interchange meetings. In some cases the same contractor personnel who worked on the GEN II ATD team "transitioned" with the technology and became members of the appropriate Land Warrior IPTs.

POC for this program is Mr. John Munroe, (508) 233-5813

3.3 Advanced Enclosed Mast/Sensor (AEM/S) System. The U.S. Navy, through the Office of Naval Research (ONR), is the primary sponsor of the AEM/S System, a DoD Affordability Program. The U.S. Navy's first-ever advanced hybrid composite structure has been installed aboard the Spruance Class multi-mission destroyer USS ARTHUR W. RADFORD (DD 968) at Norfolk Naval Shipyard, Portsmouth, Virginia. The ship will be the platform for extensive testing of the new mast by the Navy. The AEM/S System mast was installed aboard the RADFORD to replace her conventional main (aft) mast. The RADFORD, currently undergoing regular overhaul, will return to normal fleet service in Fiscal Year '98 with a fully operational AEM/S System. The AEM/S System will remain aboard the RADFORD for at least a year of tests and at-sea trials.

The AEM/S System is a 93 foot high, hexagonal structure, 35 feet in diameter, enclosing existing radars and providing important signature and other operational benefits. By enclosing major antennas and other sensitive equipment, the AEM/S System protects them from the weather. This reduces maintenance, as well as providing significantly reduced radar signature. The new, advanced composite mast, which the Navy describes as "revolutionary and spectacular," was built and designed by an Integrated Product Team (IPT) -- known as "The AE MIS System Masters" -- made up of technical experts drawn from diverse Navy and industry activities nationwide.

As an Affordability Program, the AEM/S System ATD has developed a revolutionary mast that is affordable, solves problems associated with current masts, enables new technology required for the Navy's next generation of stealthy ships, reduces life-cycle costs, enhances sustainability, and most importantly, enhances war-fighting capabilities. Successful completion of this ATD is a key element in the incorporation of advanced technology into the topside design for the next generation of surface combatants.

Participating in the development, design, and construction of the AEM/S System were representatives of the Office of Naval Research, Naval Sea Systems Command, Naval Research Laboratory, Carderock and Dahlgren Divisions of the Naval Surface Warfare Center, Naval Command and Control and Ocean Surveillance Center, and Norfolk Naval Shipyard. Industry participants were Ingalls Shipbuilding, Seemann Composites, Mission Research Corporation, Material Sciences Corporation,

Ohio State University, and Analysis & Technology.

The AEM/S System is a high-risk, high-payoff ATD. Benefits and payoffs include:

- Enhanced Performance. The AEM/S System is fabricated with an advanced composite hybrid Frequency Selective Surface (FSS), designed to allow passage of own-ship sensor frequencies while reflecting other frequencies. Improved sensor performance results from reduction of blockage, false targets and sensor downtime, thereby dramatically enhancing the ship's war-fighting capability.

- Affordable Low-Cost Manufacturing. AEM/S utilizes unique materials, creative structures and innovative manufacturing techniques, yet the mast can be produced in a shipyard.

- Affordable Reduced Life-Cycle Costs. The AEM/S System's enclosed structure protects radars and communication antennas from weather exposure and provides all-weather access for repair, thus greatly reducing the need for repair, maintenance costs, replacement costs and risk of failure.

- Enhanced sustainability. The AEM/S System concept will enable rapid and seamless transition to the next generation of technology. Features such as embedded sensors, planar arrays, integrated antennas, low observable signatures, reduced topside weight -- all contribute to the Navy's objectives for future warships. Accelerated transition of AEM/S System technology to the LPD 17 is already underway, along with evaluation of its applicability to the SC 21 and CV(X).

- The upper half of the AEM/S System is designed to allow passage of own-ship sensor frequencies with very low loss while reflecting other frequencies. It is divided into two radome-like compartments; the upper compartment houses the MK 23 TAS antenna, and the lower encloses the SPSAO air search radar antenna.

The whole system is a free-standing, fully integrated composite structure. Structural design requirements for strength and stiffness meet Fleet requirements for vibration, shock and fatigue.
Signature and electromagnetic design requirements are based on criteria associated with sensor and antenna performance, electromagnetic interference, lighting protection electromagnetic shielding, electrical bonding and grounding. As noted by the S&T Program Manager, “the objective of this team effort was to develop an affordable mast by fully integrating sensor technology, electromagnetics, signature reduction, advanced materials structures and manufacturing technologies. The AEM/S System will result in significant new design options for both future surface ships and major upgrades. This program is a necessary step in the development and deployment of next generation radar and communication systems."

POC for this program is Jeffrey L. Benson, NSWC, White Oak, 301-227-1087.

3.4 Miniature Air Launched Decoy (MALD) Program. The goal of the MALD Advanced Concept Technology Demonstration (ACTD) is to develop and demonstrate a small, very inexpensive

air-launched decoy system for the Suppression of Enemy Air Defenses (SEAD) mission. Current decoys are large and expensive, and most lack the range, maneuverability, and speed needed to accurately simulate combat aircraft. MALD will greatly enhance the survivability of friendly aircraft and aid in establishing air superiority by stimulating, diluting, and confusing enemy integrated air defense systems. The MALD is a small, affordable, jet-powered Unmanned Air Vehicle (UAV) that will appear electronically to be a larger aircraft. When launched from platforms such as the F-15, F-16, and US Navy F/A-18, the MALD will confuse enemy air defenses by simulating aircraft attacks against early warning radars. It will also cause missile fire control systems to target the decoys rather than friendly aircraft and, by saturating enemy air space with sufficient multiple simulated targets, significantly degrade the enemy's ability to find and track actual aircraft.

As an affordability program reviewed by the ATF in 1997 and 1998, notable affordability best practices include the following:

- Performance and cost tradeoffs have been carefully considered (using the CAIV process) throughout the program. For example, a MIL STD that required -95° operation on 3% of the days in a year was canceled by the user because the design to reach this standard would have been very expensive at a temperature that is rarely encountered; and the payload antenna was reduced.
- Commercial processes: Use of COTS parts, with a reliability factor of 95%. The composite fuselage is to be built at the Ford pickup truck production facility, with the commercial manufacturing processes only slightly altered to mold the part.
- Strong use of teaming/IPTs: Teledyne Ryan leads the transition IPT that includes the warfighter, industry, DARPA, AF ASC, user, and the Air National Guard.
- Transition of the development and acquisition of MALD from DARPA to the Air Force will be facilitated by the ACTD. ACC is the designated user and is responsible for assessing military utility and developing the employment tactics for the MALD system. The Air National Guard, the Operational Test Agency for the ACTD, will provide all support necessary to conduct and evaluate flight testing. When the ACTD ends, 32 residual MALD systems will be turned over to ACC for further testing, tactics development, or possible limited operational use. If ACC determines that MALD offers sufficient operational utility to warrant procurement, the Air Force may elect to start low rate production with an inventory objective of 1500 units. The U.S. Navy is also a potential user of MALD.
- Incentives: Use of award fee to motivate contractor to meet unit price objectives.

The MALD is being developed in response to an Air Force Air Combat Command (ACC) requirement for an aerial radar decoy. The affordability objective is to build a miniature air vehicle that mimics aircraft or weapons with a $30K average unit fly away cost goal at unit 3,000. The Air Force F16 is the vehicle in which the technology is to be demonstrated. DARPA is presently working with the Air Force Aeronautical Systems Center (ASC) as its agent, to conduct an ACTD of an inexpensive miniature air-launched decoy. Teledyne-Ryan, the prime contractor, will design, build and test complete MALD systems, including the signature-enhancement payload package; conduct producibility analysis and planning; and develop concepts of operations and tactics refinement.

POC for this program is Walt Price, DARPA/TTO, (703) 696-7500.

4.0 OVERVIEW OF SELECTED AFFORDABILITY MANAGEMENT TOOLS

This section provides general information on some of the more significant tools and techniques available to support managers in meeting affordability goals. These tools and techniques are:

- Integrated Product and Process Development (IPPD)
- Integrated Product Teams (IPTs)
- Quality Function Deployment (QFD)
- Design of Experiments (DOE)
- Design for Six-Sigma
- Cost as an Independent Variable (CAIV)
- Modeling and Simulation

A more detailed discussion of each of these tools is provided in Appendix B and in the designated references in Section 5. These are not the only tools available for program implementation, but do reflect the techniques most often applied in acquisition and best practice affordability programs.

4.1 Integrated Product and Process Development (IPPD). IPPD is a management technique that simultaneously integrates all essential acquisition activities through the use of multi-disciplinary teams to optimize the design, manufacturing, business, and supportability processes. IPPD has its roots in integrated design and production practices, concurrent engineering, and total quality management. In the early 1980s, U.S. industry used the concept of integrated design as a way to improve global competitiveness.

DoD defines IPPD as, "A management process that integrates all activities from product concept through production/field support, using a multi-functional team, to simultaneously optimize the product and its manufacturing and sustainment processes to meet cost and performance objectives." (See DoD IPPD Web Site. http://www.acq.osd.mil/sa/se/index.htm).
IPPD evolved from concurrent engineering, and is sometimes called integrated product development (IPD). It is a systems engineering process integrated with sound business practices and common sense decision making. Organizations may undergo profound changes in culture and processes to successfully implement IPPD.

IPPD activities focus on the customer and meeting the customer's need. In DoD, the customer is the user. Accurately understanding the various levels of users' needs and establishing realistic requirements early in the acquisition cycle is now more important than ever. Trade-off analyses are made among design, performance, production, support, cost, and operational needs to optimize the system (product or service) over its life cycle. In order to afford sufficient numbers of technologically up-to-date systems, cost is a critical component of DoD system optimization. Cost should not simply be an outcome as has often been the case in the past. Thus, cost should become an independent rather than dependent variable in meeting the user's needs.

4.1.1 An S&T IPPD Process

Over the past two years, the Air Force Research Laboratory has conducted pioneering work in how to implement IPPD in an S&T environment. While many of the IPPD practices implemented in the weapons systems acquisition environment apply to S&T programs, it became clear to senior Air Force S&T executives these practices needed to be tailored for design and development programs. This section describes the Air Force process for applying IPPD on S&T programs. The basic functions associated with implementing IPPD principles are the following:

(1) Determine requirements;
(2) Establish S&T exit criteria;
(3) Develop technology alternatives;
(4) Perform value analysis;
(5) Develop and demonstrate technology; and
(6) Analyze and deliver project results.

This process illustrated in Figure 4.1 was developed by the U.S. Air Force in conjunction with approximately 30 companies in the defense aerospace industry. While the process is displayed horizontally to make it easy to read, it is *not* a serial process, as the large elliptical background

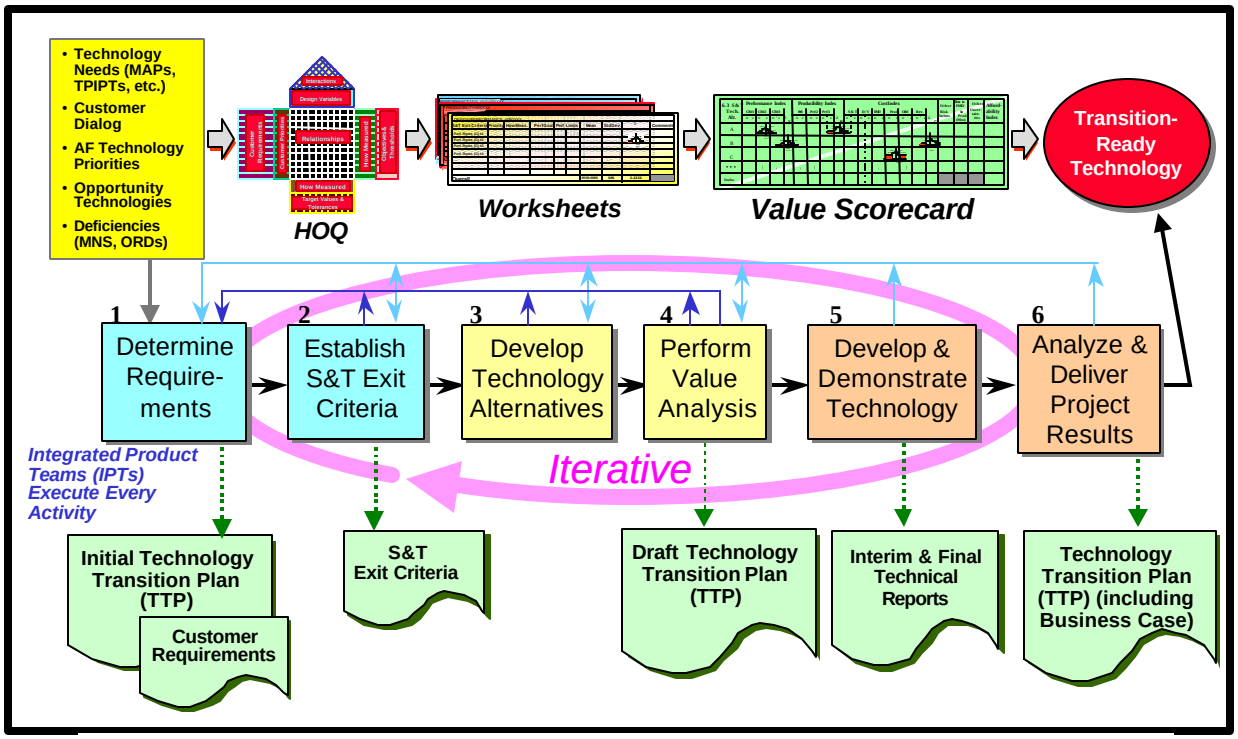

Figure 4.1. An S&T IPPD Process

arrow suggests. The key activities associated with the process are represented by the central six blocks. The document symbols along the bottom represent important outputs from the process. The artifacts along the top of the diagram represent various methods and tools that can be employed to implement

the process.

During a workshop in 1994, when this process was first contemplated, it became apparent to everyone present that IPPD is not something that can be layered on top of an S&T development effort. Rather, *one either develops technology in an integration fashion, or one does not*. As that workshop, industry experience, and subsequent experience with S&T IPPD Pilot projects have all demonstrated, IPPD is *not something you do in addition to S&T*. It is a fundamental way of thinking about and executing technology development. There is not one set of program goals and another set of IPPD goals. They must be one and the same. They must address the critical issues associated with technology maturation and transition (viz. producibility, life-cycle cost and risk). It should be noted that if transition issues to the next phase of development are not addressed as explicit program requirements, the program is *not* addressing IPPD issues, regardless of the use of a team approach. The process in Figure 4.1 provides a structured approach for addressing those critical issues, namely, the balance of performance, producibility, cost and risk, and making those elements integral to an S&T effort.

The six activities outlined in the integrated technology development process are described in detail in Appendix B (Section B.9). Also, additional information on how specific methods and tools are used, as represented in the artifacts along the top of the process, are detailed in the appendix.

4.2 Integrated Product Teams (IPTs). Integrated Product Teams are cross-functional teams that are formed for the specific purpose of delivering a product for an external or internal customer. IPT members should have complementary skills and be committed to a common purpose, performance objectives, and approach for which they hold themselves mutually accountable. Members of an integrated product team represent technical, manufacturing, business, and support functions and organizations that are critical to developing, procuring and supporting the product. Having these functions represented concurrently permits teams to consider more and broader alternatives quickly, and in a broader context, enables faster and better decisions. A critical element of successful IPTs is effective communications between team members who work together to achieve the team's objectives. Additional information concerning conduct and formation of IPTs can be found at the DoD Systems Engineering website: http://www.acq.osd.mil/sa/se/index.htm).

4.3 Quality Function Deployment (QFD). Quantitative S&T development goals should be derived using the same process used to derive product requirements for specific programs. This process consists of performing a needs-analysis and uses tools such as Quality Function Deployment (QFD). QFD is a tool for translating defined customer requirements into appropriate design requirements at each stage of design and development. The method uses a matrix known as the House of Quality. This "house" encompasses several elements: *Whats, Hows, Importance, Weighted Importance, Relationships*. The following provides a definition of these terms:

Whats	The product characteristics, functions, or levels of performance wanted by the customer. These are the customer needs or requirements. The *Whats* are sometimes divided into Primary, Secondary, and Tertiary requirements. Examples of each for a fighter aircraft are, respectively, Operating Characteristics, Sorties, and 4 Sorties per Day.
Hows	The ways in which the *Whats* can possibly be met. Also called design requirements. A *How* for the fighter sortie requirement might be a product availability of 0.92
Importance	The value or importance placed by the customer on each *What*. Typically stated as Greatest, Average, or Least.
Hows to *Whats* Relationships	The relative strength of the relationship between a *What* (a requirement) and a specific How. Typically stated as Very Strong, Strong, or Weak or a corresponding numerical value.
Weighted Importance	The importance of each *How* based on either its *How* to *What* relationship value and number of tertiary *Whats* (absolute weighting) or the relationship value, risk, and number of tertiary *Whats* (relative).
How Correlation	The strength of the technical interrelationships between the *Hows*. Typically stated as Very Strong, Strong, or Weak. Often, positive and negative relationships are indicated using separate symbols.
Risk	The degree of technical and cost risk associated with each *How*. Typically stated as Greatest Average, or Least.
N	The total number of requirements (Whats).

By using successive QFD "Houses of Quality", with the *Hows* from one used as the *Whats* of the next, increasingly more detailed (lower level) requirements can be derived.

4.4 Design of Experiments (DOE). Design of Experiments (DOE) is a statistical approach to identify and improve factors that impact product performance. It consists of seven steps:

- Select the factors to be tested and parameters to be measured
- Determine the factor values to be used as test settings
- Set up the test array
- Run the tests
- Analyze the results
- Calculate optimum values for the factors
- Run confirmation tests

DOE is often used in production to determine the optimum settings for production processes. In S&T development, it can be used to optimize performance parameters and to select optimum processes for new products.

4.5 Design for Six Sigma. "Six Sigma" is the title used by Motorola for their initiative to improve their products by reducing variability. Using measures, such as the standard deviation, one can determine the proportion of the product for which the measured parameter will be between the upper and lower specified limits, and thus is acceptable. For example, if a parameter is distributed normally, 66.3% of the product will have a parameter value within plus and minus one sigma of the mean value of the parameter, 95.5% between plus and minus two sigma, and 99.7% between plus and minus three sigma. The goal of the "Six Sigma" program formulated by Motorola is for such low variability in the process that a variability of six sigma in the value of the parameter of interest will fit between the specification limits. By way of comparison, the average business process is a "four sigma" process, which translates to 6,200 items per million "out of spec." Achieving a "six sigma" process requires the control of critical process parameters, which can be identified by the statistical design of experiments, the previous topic.

Many S&T managers ask the question as to how six sigma can be applied to prototype models produced in the laboratory environment, given that historical data and trends point to application for measuring variability of systems/components in a production environment. One of the original "model" programs for affordability, the Next Generation Soldier System, provides a good example of how this tool might be applied to 6.3 ATDs:

- A sigma approach was used to estimate the sigma for production units, not developmental units. These estimates were based on historical data and/or extrapolations from historical data, for like or similar components. Utilizing the sigma approach, each unit was broken down to the smallest piece (e.g. PC board, wiring harness, etc.), an estimate of the sigma value was made on each item, and then rolled up for all components to get an overall sigma estimate for the subsystem or system. Since the NGS used historical estimates, the values had to be reviewed frequently to ascertain whether the assumptions and data used changed over time. If they did, a new sigma must be calculated. In the developmental program, the key emphasis should not be on the precise sigma value, but rather, it should be on identifying potential show stoppers, or components, which because of their complexity or manufacturing immaturity, will not allow one to achieve reasonably high sigmas in the future. When these problem components are identified, one must either try to find replacement components or develop better manufacturing processes.

4.6 Cost as an Independent Variable. DoD has adopted a new acquisition strategy to meet the future needs of our forces with highly capable systems at affordable costs and possibly shorter schedules. This strategy entails setting *aggressive*, realistic cost objectives for acquiring defense systems, and managing risks to obtain those objectives. Cost objectives must balance mission needs with projected out-year resources, taking into account existing technology as well as high-confidence maturation of new technologies. This concept has become known as "cost as an independent variable" (CAIV), meaning that once the system performance and objective cost are decided (on the basis of cost-performance tradeoffs), the acquisition process will make cost more of a constraint and less of a variable, while nonetheless obtaining the needed military capability of the system.

A major topic upon approval of a Mission Need Statement should be the approach and inputs used to set and refine cost objectives. At each milestone review, cost objectives and progress in achieving them should be assessed. There must be flexibility for adjustments and/or refinement in cost objectives. To assist in establishing program cost objectives and to facilitate cost-performance tradeoffs, the Overarching IPT (OIPT) for each Major Defense Acquisition Program is required to establish a Cost-Performance Integrated Product Team (CP-IPT). It is critical that the user community has representation on the CP-IPT. Industry representation, at the appropriate time, is also expected.

4.7 Modeling and Simulation. In recent years, advances in information technology have offered new opportunities for tools to aid the analytic and design communities. These new opportunities come from computers and communications that are much faster and affordable. Finer granularity models can be used that execute in the same elapsed time as did less precise, older models.

The new 5000-series acquisition regulations strongly encourage the use of models and simulations to improve quality and to reduce acquisition time, resources, and risks. They also encourage embedding virtual prototypes in synthetic environments to support requirements definition, concept exploration, and manufacturing and testing of new systems.

Simulation Based Acquisition (SBA) is an acquisition process supported by the robust, collaborative use of simulation technology that is integrated across acquisition phases and programs. Simulation Based Acquisition is comprised of three principal components. The first is an *advanced systems engineering environment* that uses formal methods and automation to support efficient design synthesis, capture, and assessment, as well as other complex life-cycle activities. The second component is a *refined system acquisition process* that takes advantage of the SBA systems engineering environment capabilities. The third component is a culture that has evolved to a point where *enterprise-wide cooperation* is the rule, and individual technical contributions and innovations are encouraged and managed efficiently.

The objectives of SBA are to:

(1) Reduce the time, resources, and risk associated with the acquisition process
(2) Increase the quality, military utility, and supportability of systems developed and fielded
(3) Enable integrated product and process development from requirements definition and initial concept development through testing, manufacturing, and fielding

Simulation Based Acquisition *is not an incremental step* beyond current system engineering methods and tools. Instead, it represents *a major paradigm shift* toward a comprehensive, integrated environment that addresses the entire system development life cycle and the spectrum of engineering and management domains.

Modeling and simulation can be effectively used on S&T programs to evaluate the affordability of the technologies under study. Simulations can be used to evaluate the producibility of the technology. Models and simulations can be used to assess risk and to project costs.

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Department of Defense (DoD)

ACQWEB **http://www.acq.osd.mil/**

The Office of the Under Secretary of Defense for Acquisition and Technology (USD(A&T)), providing access to information on unclassified activities, documents, and projects.

Defense Acquisition Deskbook **http://www.deskbook.osd.mil/**

A Department of Defense entry point for acquisition information, a place to receive up-to-date policy and procedure and to receive answers to acquisition questions, and a way to communicate with the acquisition community.

Integrated Product and Process Development

http://www.acq.osd.mil/te/programs/se/ippd/index.htm

Provides information of DoD policies and procedures, training courses available, related publications and speeches concerning the topic of IPPD.

Defense LINK **http://www.defenselink.mil/**
A Department of Defense World-Wide Web Information Service, providing access to DoD news, events, speeches, and other information.

Defense Research and Engineering (DDR&E) **http://www.dtic.mil/ddre/**
Provides assistance and advisory services to the Under Secretary of Defense for Acquisition and Technology (USD (A&T)) for DoD scientific and technical matters, basic and applied research, and advanced technology development.

Deputy Under Secretary of Defense (Science and Technology) **http://www.dtic/mil/dusdst/**
Web site of DUSD(S&T), Dr. Dolores Etter.

Director, Test, Systems Engineering & Evaluation
http://www.acq.osd.mil/te/programs/se/ippd/index.htm
Provides policies and procedures for IPPD, including a handbook and guide for IPPD practices.

Defense Technical Information Web (DTIW) **http://www.dtic.mil/dtiw/**
A resource for accessing DoD scientific, technical, and acquisition information.

Defense Science and Technology Planning **http://www.dtic.mil/dstp/**
Provides a single location for 1998, 1997, and 1996 science and technology planning documents and selected related documents of the Department of Defense.

DOD Affordability Programs (Partial Listing)

Miniature Air Launched Decoy **http://www.darpa.mil/tto/mald.html**
DARPA program to develop a small, low cost, expendable air-launched decoy to enhance the survivability of friendly aircraft and to aid in establishing air superiority by diluting and confusing surface-based and airborne enemy air defense systems.

Composites Affordability Initiative
http://mantech_nt.bmpcoe.org/book/archive/M0881.html
Cooperative effort between industry and (Navy/AF) intended to address the inhibitors, problems, and issues associated with reducing the cost of aircraft constructed with composite materials.

Nanoscale Coatings **http://www.onr.navy.mil/onr/newsrel/nr971001.html**
Use of these coatings that exhibit an extraordinary combination of hardness, toughness, abrasion-resistance, and adherence on ships and aircraft in order to reduce the cost of fleet maintenance.

Advanced Enclosed Mast/Sensor (AEM/S) System
http://www.spear.navy.mil/ships/dd968/aemspr.htm

Description of ONR-sponsored affordability program to build a composite AEM/S System that is a 93' high, hexagonal structure, 35' in diameter, enclosing existing radars and providing important signature and other operational benefits.

DARPA Programs

Defense Advanced Research Projects Agency (DARPA) **http://www.darpa.mil/**
DARPA manages and directs selected basic and applied research and development projects for DoD, and pursues research and technology where risk and payoff are both very high and where success may provide dramatic advances for traditional military roles and missions.

Affordable Multi-Missile Manufacturing (AM3) **http://www.darpa.mil/tto/am3.html**
A program established to demonstrate advance missile design and manufacturing concepts and manufacturing enterprise systems that reduce the cost of DoD's portfolio of tactical missiles and smart munitions.

Rapid Design Exploration and Optimization
http://www.arpa.mil/DSO/rd/Manufact/Radeo/radeo.html
ATD which is creating a highly flexible and responsive design environment that can be used to evaluate an order of magnitude more design alternatives than is possible today in an attempt to optimize product characteristics (such as performance, manufacturability, assemblability, quality, reliability, and maintainability), and quickly prototype complex products and processes.

Simulation-Based Design (SBD) **http://sbdhost.parl.com/**
This DARPA program is applying virtual prototyping to the acquisition and life cycle support of complex military and commercial systems. It holds the promise of substantially reducing their cost, risk and time to market while resulting in a superior product meeting all customer requirements and expectations.

Military Services

Air Force Manufacturing Technology (ManTech) Program
http://www.ml.wpafb.af.mil/divisions/mlm/mlm.html
Information on Wright Laboratory's manufacturing divisions and programs offices in addition to access to reports and publications.

Army Manufacturing Technology (ManTech) Program
http://ippd.redstone.army.mil/mst_army/mantech_97/
Supports the development and implementation of advanced manufacturing technologies for the production of Army Materiel throughout the product life cycle.

Army Aviation & Missile Command's Manufacturing Technology Division
http://ippd.redstone.army.mil/mt_div/
Executes and manages a program of manufacturing activities for specific weapon systems that insure adequate consideration of factory-floor requirements are incorporated into product designs during the weapon system's development and transition to production.

Best Manufacturing Practices (BMP) Program **http://www.bmpcoe.org**
Seeks to identify the best practices in the areas of design, test, production, facilities, logistics, and management, and to encourage industry and government to share information about these practices.

Joint Strike Fighter (JSF) Program **http://www.jast.mil/**
A joint services team creating the building blocks for affordable, successful development of next generation strike weapon systems.

Navy Affordability Modeling **http://www.onr.navy.mil/sci_tech/industrial/afford.htm**
The objective in modeling affordability is to provide Navy planners and decision makers with: a structure to measure and predict system affordability, select the most affordable concepts and designs, enhance affordability of systems currently being acquired and improve the affordability of operational systems.

Navy Manufacturing Technology (ManTech) Program **http://mantech.bmpcoe.org/**
Through this web site you can access Navy ManTech program information, including the annual Project Books, as well as submit manufacturing issues for consideration during the Program's annual planning process.

Selected Education Sources

Defense Acquisition University (DAU) **http://www.acq.osd.mil/dau/**
DAU was established by Congress in 1990 to consolidate and integrate education and training for more than 110,000 people in the Defense Acquisition Workforce. Consortium member schools provide more than 85 acquisition courses to entry, intermediate, and senior level civilian and uniformed personnel to allow them to attain certification in one or more of the 11 defense acquisition career fields.

James Gregory Associates, Inc. **http://www.JamesGregory.com/FramesIndex.html**
Specializes in managing information technology, offering industry and government training to better manage their information assets, aligning them with their strategic business processes. The site provides information about the Air Force IPPD S&T process and tools available to assist S&T managers in conducting affordablity programs.

National Center for Advanced Technologies (NCAT) **http://www.ncat.com/**
NCAT was founded as a non-profit research and education foundation to provide a bridge between government, industry, and academia, and to encourage cooperative efforts on technology development. The site provides information about affordability conferences and NCAT's IPPD courses.

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY OF TERMS

A.1 DEFINITIONS (Note: definitions are written from the perspective of S&T affordability)

Acquisition Costs. The costs associated with acquiring a new product. R&D or S&T, although usually attributed to specific product development programs, are part of acquisition costs.

Affordability. (1) The demonstration of *best value* in terms of performance, producibility, life-cycle cost and risk. Affordability efforts are directed at the cost-effective acquisition of high-performance systems and equipment and the cost-effective sustainment of those systems to accomplish a mission. (2) A philosophy of program management and a set of program management objectives and tools to build affordable system are able to be procured when needed and within budget, operated at the desired performance level, and maintained and supported within the life cycle budget allocated. (3) Reduced development, production and ownership cost (Dr. Paul G. Kaminski, former USDA&T).

Collateral Costs. Costs incurred in the use of a product, outside of the direct operating and maintenance costs. May include loss of customers dissatisfied with product, loss of lives due to product failure, or environmental cleanup when product pollutes.

Cost. The expenditure of resources (usually expressed in monetary units) necessary to develop, acquire, or use a product over some defined period of time.

Cost As an Independent Variable (CAIV). A strategy for setting *aggressive*, realistic cost objectives for acquiring defense systems, and managing risks to obtain those objectives. Cost objectives must balance mission needs with projected out-year resources, taking into account existing technology as well as high-confidence maturation of new technologies. Once the system performance and objective cost are decided (on the basis of cost-performance tradeoffs), cost becomes a constraint on the acquisition process.

Defense Science and Technology (S&T). DoD research and development efforts that lead to the development of technology for insertion into military systems. Defense S&T programs are divided into three budget categories -- Basic Research (6.1 account), Applied Research (6.2 account), and Advanced Technology Development (6.3 account).

Design of Experiments (DOE). A statistical approach for identifying and improving those factors that impact product performance.

Discretionary O&S Cost. The O&S costs dictated by laws (FAR), policies (National Priorities), management procedures (Acquisition Reform) and other product-independent factors.

Equivalent Cost. A cost not readily measured in terms of dollars. For example, the inability of a failed program to meet mission performance requirements is an equivalent cost.

Intrinsic Cost. Cost dictated by product characteristics such as technology required, performance, design and process manufacturing.

Life Cycle Costs. Life cycle costs (LCC) are the total costs associated with acquiring (purchasing), operating and supporting, and eventually disposing of a product. LCC includes acquisition costs and operating and support costs. *Affordability is a function of these two basic categories of costs - Acquisition and O&S.* A critical characteristic of life cycle costs, as shown in Figure A-1, is that 90% is determined prior to full scale development, even though at that point, only 10% of the total LCC has been spent.

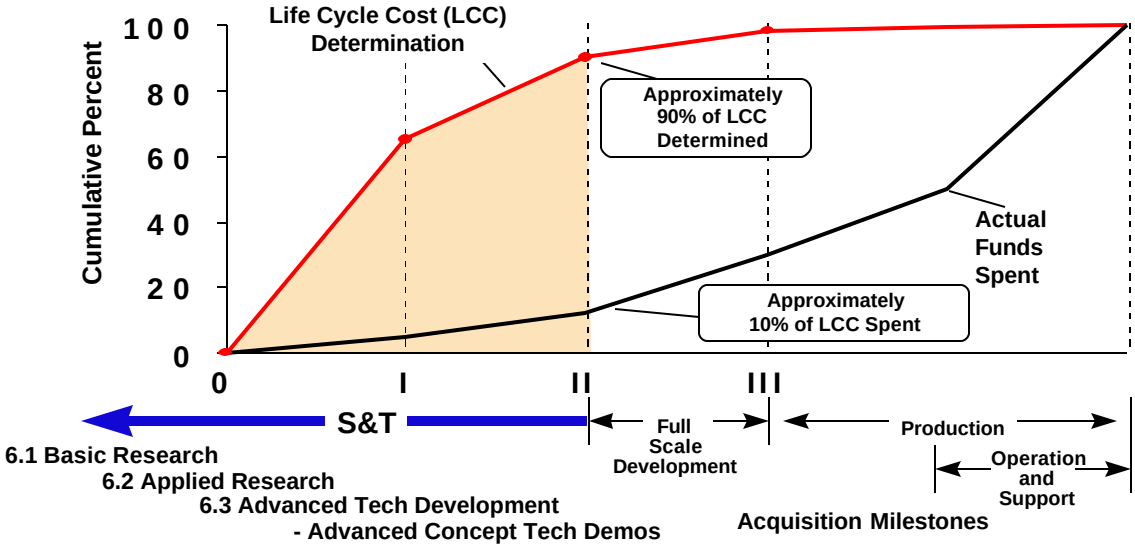

Figure A-1. Life cycle costs are determined very early in a product's life cycle.

Operating and Support (O&S) Costs. Those costs associated with operating and supporting (i.e., using) a product after it is purchased or fielded. These may include collateral, opportunity, and equivalent costs. OS& costs may be intrinsic or discretionary.

Opportunity Cost. The loss of revenue or cost associated with a lost opportunity to invest in a desired manner or to earn income. For example, diverting funds from other programs to allow a failing program to meet its mission performance requirements is an opportunity cost.

Producibility. The inherent ease and economy with which a product may be manufactured. Producibility is a direct function of design (of both the product and the manufacturing processes), the choice of materials, and the technologies incorporated in the design.

Quality Function Deployment (QFD). A tool for translating defined customer requirements into appropriate design requirements at each stage of design and development.

Six-Sigma. The title originally coined and used by Motorola for their initiative to improve their products by reducing variability. Now universally used to describe efforts to control variability so that 99.9% of the products from a manufacturing process will have a parameter value(s) within plus and minus three sigma of the mean value of the parameter. The parameter(s) is the one of most value to the customer and the mean value is usually the specified or desired value of the parameter(s).

Value. Value is a function of the product's characteristics, performance, and the function it is to perform. The customer's perception of the value of the product determines the willingness to buy a product.

A.2 ACRONYMS

Acronym	Definition
ACAT	Acquisition Category
ACTD	Advanced Concept Technology Demonstration
ATD	Advanced Technology Demonstration
ADM	Acquisition Decision Memorandum
CAD	Computer-Aided Design
CAE	Component Acquisition Executive
CAE	Computer-Aided Engineering
CAIV	Cost as an Independent Variable
CAM	Computer-Aided Manufacturing
CTP	Critical Technical Parameters
DAB	Defense Acquisition Board
DAE	Defense Acquisition Executive
DDR&E	Director, Defense Research & Engineering
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOT&E	Director, Operational Test and Evaluation
DTC	Design to Cost
DTSE&E	Director, Test, Systems Engineering and Evaluation
DUSD(S&T)	Deputy Under Secretary of Defense (Science & Technology)
ECP	Engineering Change Proposal
EMD	Engineering Manufacturing Development
ILS	Integrated Logistics Support
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
IPPD	Integrated Product and Process Development
IPS	Integrated Program Summary
IPT	Integrated Product Team
JROC	Joint Requirements Oversight Council

LRIP	Low-Rate Initial Production
MANTECH	Manufacturing Technology
MDA	Milestone Decision Authority
MNS	Mission Need Statement
MOU	Memorandum of Understanding
NDI	Non Developmental Item
OIPT	Overarching Integrated Product Team
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
POM	Program Objective Memorandum
PPBS	Planning, Programming, and Budgeting System
PRDA	Program Research and Development Agreement
QFD	Quality Function Deployment
RFI	Request for Information
RFP	Request for Proposals
S&T	Science and Technology
SETA	Systems Engineering and Technical Agent
SOW	Statement of Work
SSEB	Source Selection Evaluation Board
SSP	Source Selection Plan
TEMP	Test and Evaluation Master Plan
TPM	Technical Performance Measures
UAV	Unmanned Air Vehicle
USD(A&T)	Under Secretary of Defense for Acquisition and Technology
WBS	Work Breakdown Structure

APPENDIX B

DETAILED DISCUSSION OF SELECTED AFFORDABILITY MANAGEMENT TOOLS

AFFORDABILITY MANAGEMENT TOOLS

B.1 Introduction. This section provides information on some of the more significant tools available to support managers in meeting affordability goals. These tools are:

- Integrated Product and Process Development (IPPD)
- Integrated Product Teams (IPTs)
- Quality Function Deployment (QFD)
- Design of Experiments (DOE)
- Design for Six-Sigma
- Cost as an Independent Variable (CAIV)

B.2 Integrated Product and Process Development (IPPD)

B.2.1 Introduction. The ultimate goal of DoD acquisition is to provide the warfighters with world-class equipment and systems at an affordable cost and on a schedule that is responsive to the need. Accordingly, William J. Perry, then Secretary of Defense, directed on May 10, 1995, the "immediate implementation" of a management process called Integrated Product and Process Development (IPPD) throughout the acquisition process to the maximum extent practicable.

As a result of the changes made by Secretary Perry, DoD is shifting from an environment of regulation and enforcement to one of incentivized performance. The objective is to be receptive to ideas from the field, thereby obtaining buy-in and lasting change. IPPD is part of the change in the DoD environment.

B.2.2 Background. IPPD has been successfully used by the private sector and by the Services on selected programs to reduce product cost and to field products sooner. It is a management technique that simultaneously integrates all essential acquisition activities through the use of multi-disciplinary teams to optimize the design, manufacturing, business, and supportability processes. IPPD has its roots in integrated design and production practices, concurrent engineering, and total quality management. In the early 1980s, U.S. industry used the concept of integrated design as a way to improve global competitiveness.

Industry's implementation of IPPD expanded concurrent engineering concepts to include all disciplines, not just technical, associated with the design, development, manufacture, distribution, support, and management of products and services. Diverse segments of U.S. industry have successfully implemented this concept to become recognized leaders in IPPD practices, most notably in the auto and electronics industry. Many corporations have institutionalized the IPPD process and associated training programs.

B.2.3 Definition. DoD defines IPPD as, "A management process that integrates all activities from product concept through production/field support, using a multi-functional team, to simultaneously optimize the product and its manufacturing and sustainment processes to meet cost and performance objectives." IPPD evolved from concurrent engineering, and is sometimes called integrated product development (IPD). It is a systems engineering process integrated with sound business practices and

common sense decision making. Organizations may need to undergo profound changes in culture and processes to successfully implement IPPD.

IPPD activities focus on the customer and meeting the customer's need. In DoD, the customer is the user. Accurately understanding the various levels of users' needs and establishing realistic requirements early in the acquisition cycle is now more important than ever. Trade-off analyses are made among design, performance, production, support, cost, and operational needs to optimize the system (product or service) over its life cycle. In order to afford sufficient numbers of technologically up-to-date systems, cost is a critical component of DoD system optimization. Cost should not simply be an outcome as has often been the case in the past. Thus, cost should become an independent rather than dependent variable in meeting the user's needs.

B.2.4 Implementation. Although there are common factors in all known successful IPPD implementations, IPPD has no single solution or implementation strategy. Its implementation is product and process dependent. A generic IPPD iterative process is shown in Figure B-1.

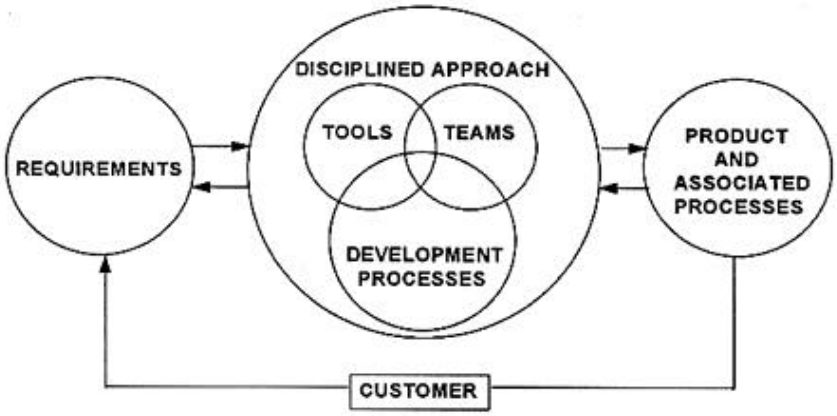

Figure B-1. A Generic IPPD Iterative Process

Resources applied include people, processes, money, tools, and facilities. The IPPD process reorders decision making, brings downstream and global issues to bear earlier and in concert with conceptual and detailed planning, and relies on applying functional expertise in a team-oriented manner on a global-optimization basis. It is necessary to understand early the processes needed to develop, produce, operate and support the product. Equally important are these processes' impacts on product design and development. Basic elements of the iterative process are:

Requirements, a first step in the iterative process above, are generated by the customer in a negotiation among many parties, each with serious and important concerns. Knowing and understanding the customers (command structure, doctrine, tactics, operating environment, etc.) and their needs is essential. Integrating the user's requirements, logistical requirements, and the acquirer's budgetary and scheduling constraints is a fundamental challenge in DoD acquisition.

Disciplined approach includes five general activities: understanding the requirements, outlining the approach, planning the effort, allocating resources, and executing and tracking the plan. Decisions made using this approach should be re-evaluated as a system matures and circumstances (budgetary, threat, technology) change. A disciplined approach provides a framework for utilizing tools, teams, and processes in a structured manner that is responsive to systematic improvement efforts.

- Tools in this IPPD process include documents, information systems, methods, and technologies that can be fit into a generic shared framework that focuses on planning, executing and tracking. Tools help define the product(s) being developed, delivered or acted upon, and relate the elements of work to be accomplished to each other and to the end product. Examples of tools used include integrated master plans, 3-D design tools and their associated databases, cost models linked to process simulations/activity-based costing, metrics, development process control methods, and earned value management.

- Teams are central to the IPPD process. Teams are made up of everyone who has a stake in the outcome or product of the team, including the customer and suppliers. Collectively, team members should represent the know-how needed and have the ability to control the resources necessary for getting the job done. Teams are organized and behave so as to seek the best value solution to a product acquisition.

Development Processes are those activities that lead to both the end product and its associated processes. To ensure efficient use of resources, it is necessary to understand what activities are necessary and how they affect the product and each other. Examples include requirements-analysis, configuration management, and detailed design drawings.

Product and Associated Processes include what is produced and provided to the customer. Customer satisfaction with the product, in terms of mission effectiveness, as well as operating and support aspects and costs, is the ultimate measure of the team's success.

Customer is the user and a team member and also the ultimate authority regarding the product. Any changes to the formal requirements driving the product/process development must come through negotiation with the customer.

The generic IPPD iterative process just described is a systems engineering approach. It differs from the long held view that systems engineering is essentially a partitioning, trade-off, control process that brings the "-ilities" and test functions together. The IPPD process controls the evolution of an integrated and optimally balanced system to satisfy customer needs and to provide data and products required to support acquisition management decisions which, themselves, are part of the IPPD/IPT process. The approach also transforms the stated needs into a balanced set of product and process descriptions. These descriptions are incrementally matured during each acquisition phase and used by DoD and its contractors to plan and implement a solution to the user needs. This process balances cost, system capability, manufacturing processes, test processes, and support processes, as identified in DoD Instruction 5000.2.

The IPPD process is an integrated team effort within DoD and contractor organizations and with each other. DoD crafts the basic acquisition strategy, almost always with industry assistance. Contractors usually play a significant role in development, design, and manufacturing with DoD in a management role. Both participate in each other's major activities through team membership, and the implementation and use of tools and technology.

To implement IPPD effectively, it is important to understand the interrelated tenets inherent in IPPD. These key tenets, outlined by the Secretary of Defense mandate on IPPD and which are consistent with those found in industry, are:

- Customer Focus
- Concurrent Development of Products and Processes
- Early and Continuous Life Cycle Planning
- Maximize Flexibility for Optimization and Use of Commercial Business Approaches
- Encourage Robust Design and Improved Process Capability
- Event-Driven Scheduling
- Multi-disciplinary Teamwork
- Empowerment
- Seamless Management Tools
- Proactive Identification and Management of Risk

Customer Focus. The primary objective of IPPD is to identify and satisfy the customer's needs better, faster, and cheaper. The customer's needs should determine the nature of the product and its associated processes.

Concurrent Development. Processes should be developed concurrently with the products they support. It is critical that during product design and development the processes used to manage, develop, manufacture, verify, test, deploy, operate, support, train people, and eventually dispose of the product be considered. Product and process design and performance should be kept in balance to achieve life-cycle cost and effectiveness objectives. Early integration of design elements can result in lower costs by requiring fewer costly changes late in development.

Life Cycle Planning. Planning for a product and its processes should begin early in the science and technology phase (especially advanced development) and extend throughout every product's life cycle. Early life-cycle planning, which includes customers, functions, and suppliers, lays a solid foundation for the various phases of a product and its processes. Key program activities and events should be defined so that progress toward achievement of cost-effective targets can be tracked, resources can be applied, and the impact of problems, resource constraints and requirements changes can be better understood and managed.

Flexibility. Requests for Proposals (RFPs) and contracts should provide maximum flexibility for employment of IPPD principles and use of contractor processes and commercial specifications,

standards, and practices. They should also accommodate changes in requirements and incentivize contractors to challenge requirements and offer alternative solutions that provide cost-effective solutions.

Robust Design and Process Capability. The use of advanced design and manufacturing techniques that promote (1) achieving quality through design for products with little sensitivity to variations in the manufacturing process (robust design), (2) a focus on process capability, and (3) continuous process improvement. Variability reduction tools such as ultra-low variation process control similar to "Six Sigma" and lean/agile manufacturing concepts should be encouraged.

Event-Driven Scheduling. A scheduling framework should be established which relates program events to their associated accomplishments and accomplishment criteria. An event is considered complete only when the accomplishments associated with that event have reached completion as measured by the accomplishment criteria. This event-driven scheduling reduces risk by ensuring that product and process maturity are incrementally demonstrated prior to beginning follow-on activities.

Teamwork. Multi-disciplinary teamwork is essential to the integrated and concurrent development of a product and its processes. The right people at the right place at the right time are required to make timely decisions. Team decisions, as a result of risk assessments, should be based on the combined input of the entire team (technical, cost, manufacturing and support functions and organizations) including customers and suppliers. Each team member needs to understand his or her role and must support the roles of the other members, as well as understand the constraints under which team members operate. All must operate so as to seek global optima and targets.

Empowerment. Decision making should be driven to the lowest possible level commensurate with risk. Resources should be allocated to levels consistent with risk assessment authority, responsibility and the ability of people. The team should be given the authority, responsibility, and resources to manage its product and its risk commensurate with the team's capabilities. The authority of team members needs to be defined and understood by the individual team members. The team should accept responsibility and be held accountable for the results of its efforts. Management practices within the teams and their organizations must be team-oriented rather than structurally-, functionally-, or individually-oriented.

Management Tools. A framework should be established that relates products and processes at all levels to demonstrate dependencies and interrelationships. A management system should be established that relates requirements, planning, resource allocation, execution and program tracking over the product's life cycle. This integrated or dedicated approach helps ensure teams have all available information thereby enhancing team decision making at all levels. Capabilities should be provided to share technical, industrial, and business information throughout the product development and deployment life cycle through the use of acquisition and support shared information systems and software tools (including models) for accessing, exchanging, validating, and viewing information.

Proactive Risk management. Critical cost, schedule and technical parameters related to system characteristics should be identified from risk analyses and user requirements. Technical and business performance measurement plans, with appropriate metrics, should be developed and compared to best-

in-class government and industry benchmarks to provide continuing verification of the effectiveness and degree of anticipated and actual achievement of technical and business parameters.

Integrated Product Teams (IPTs) are essential to the IPPD process. See B.3 for a discussion of IPTs.

B.2.5 Benefits. Applying the IPPD management philosophy can result in significant benefits to the customer, DoD, and industry. The primary benefits are reduced cost and schedule while maintaining, often increasing, quality. Essentially, a more balanced tradeoff is achieved among cost, schedule and performance. These gains are realized by the early integration of business, contracting, manufacturing, test, training, and support considerations in the design process, resulting in fewer costly changes made later in the process (e.g., during full rate production or operational test). In a traditional approach, the largest number of changes occur late in development, when change costs are high, resulting in higher program costs. In an IPPD process, the bulk of changes occur early in development, when change costs are low, resulting in lower program costs.

The traditional acquisition approach involved each specialist group completing its work in isolation and then passing results on to the next specialist group. This serial approach has resulted in stovepipe competition for organizational rewards. It establishes walls between organizations with resulting inefficiency and ineffectiveness, including a lack of networking and inter-functional communication.

Use of IPPD and IPTs is the antithesis of the traditional approach. The central notion is that product quality and user satisfaction can best be achieved by the integrated concurrent design of the product and its processes. In IPPD, for example, future process requirements are identified and integrated into the evolving product design early in the design phase. However, IPPD does not stop with a one-time identification of process requirements. As product design matures, continued emphasis is placed on the processes, and their attendant costs, required to manufacture, operate, and support the product. This approach greatly reduces the risk associated with design and development. Product and process maturity are achieved earlier, obviating some of the costly late redesign efforts that characterize traditional developments. Moreover, the up-front trade-offs result in more cost-effective designs. Designs can be optimized for cost effectiveness based not exclusively on acquisition cost, but on overall life cycle cost. Such considerations can be critical, since operations and support costs may far exceed acquisition cost. Successful IPPD implementation can result in:

- Reduced overall time to deliver an operational product. Decisions that were formerly made sequentially are now made concurrently and from an integrated perspective. These decisions are based on a life cycle perspective and should minimize the number and magnitude of changes during manufacturing and eventual operational deployment of the product. This in turn reduces late, expensive, test-fix and test-redesign remanufacture cycles that are prime contributors to schedule extensions and overruns.
- Reduced system (product) cost. Increased emphasis on IPPD at the beginning of the development process impacts the product/process funding profile. Specifically, funding profiles based on historical data may not be appropriate. Some additional funds may be

required in the early phases, but the unit costs as well as total life cycle costs should be reduced. This will be primarily due to reduced design or engineering changes, reduced time to deliver the system, and the use of trade-off analyses to define cost-effective solutions.

- Reduced risk. Up-front team planning and understanding of technologies and product processes permits better understanding of risk and how it impacts cost, schedule, and performance. This understanding can result in methods or processes for reducing or mitigating assumed risks and establishing realistic cost, performance and schedule objectives.
- Improved quality. Teamwork coupled with a desire for continuous improvement results in improved quality of the processes and a quality product for the user.

B.2.6 Barriers. IPPD can provide tremendous leverage in managing product development. However, situations can develop throughout the process that can impede IPPD implementation or its effective use. Like most barriers of this nature, careful planning and vigilance can identify these problems and mitigate them as they arise. Some of the more common barriers are:

- Lack of commitment
- Resistance to cultural change
- Incomplete integration of functional organizations
- Lack of planning
- Insufficient education/training
- Poor communications
- "Not invented here" syndrome
- Contractually imposed specifications or standards requiring IPPD
- IPPD implemented by contractor but not by DoD
- No awards for IPPD approach
- Promises exceed capability
- Poor incentives/award fees criteria
- Over-extended reviews

A description of these common barriers follows:

Lack of Commitment. The first principle of successful IPPD implementation is to obtain unequivocal top management commitment. Without total top management commitment many employees may view IPPD as just another fad. Recommendation: Obtain a written commitment from senior management to the principles of IPPD and its application to the program/product/service at issue before embarking on this effort.

Resistance to Cultural Change. Given current approaches, cultural change is required for the IPPD process to work. Because of the hierarchical structure of the military services, adaptation to the IPPD method of doing business may be difficult due to the changing roles of the different staffs. This perception can become more pronounced as differences in rank increase. It is essential that an

atmosphere with freedom to express ideas without repercussion from those conflicting views is created. Do not underestimate the forces of resistance to change. Spend what may seem like an inordinate effort on cultural change management. To the maximum extent possible, use a rewards system to recognize and encourage the desired change.

Incomplete Integration of Functional Organizations. Functional organizations are responsible for technology development, personnel development, process improvement, and administrative functions. These activities cannot be adequately performed if the functional organization and its people are treated as outsiders to the work to be accomplished. For example, process improvement can only occur when teams understand and use the processes developed by the functional organizations. With the implementation of IPPD, the role of the functional organization changes from controlling the work of the program to the care and development of the resources available to the team. These include people, information systems, libraries, models, education and training, public and financial recognition, and often operational processes and capital equipment.

Lack of Planning. Planning can be rushed and incomplete as teams quickly form to start an effort already behind schedule. Up-front planning that includes all functions, customers, and suppliers must be accomplished at the start of any team activity. This allows the program activities and work to be defined and the early identification and management of risk. The integrated master plan must be consistent with the project/organization objectives and it must be constantly reevaluated and modified to meet current team needs and capabilities. Resist the temptation to take short cuts - it will cost more later.

Insufficient Education/Training. Education/training has often been overlooked in the process. Sometimes it is assumed that members have received the required training and, therefore, do not require additional education/training. Include IPPD education/training as an integral part of the comprehensive up-front planning. To optimize the effect of training, it should be done immediately before the particular skill is required.

Poor Communications. There is often a lack of communication across programs/organizations in areas of problem solving, lessons learned, and good practices. A formalized, documented process for exchanging information related to IPPD implementation should be created and used.

"Not Invented Here" Syndrome. There is a natural tendency when things are not going well for a team to focus on its immediate problems to the exclusion of other organizations and their needs. A "Not Invented Here" philosophy can develop, causing teams to exclude ideas/inputs from their internal and external customers and co-workers. The key concept that must be stressed is the idea of teamwork—all individuals working together for a common goal. Publicly acknowledge when good ideas are brought in from outside the team.

Contractually Imposed Specifications or Standards Requiring IPPD. To create the appropriate incentive, it is best practice to include the requirement for IPPD as a contractual item. However, it should not be dictated how IPPD will be implemented because contractors will be hesitant to deviate

from contractually-imposed standards for fear of being found non-responsive. The contractor selected should already have established an IPPD culture and should not need steps for implementation dictated by DoD. If "how-to" details are presently imposed in existing contracts, seek to remove them, if feasible.

IPPD Implemented by Contractor But Not DoD. Problems may arise when DoD expects contractors to use IPPD approaches but does not participate in IPPD tools, teams, or processes. DoD must suppress the tendency to monitor progress along functional lines, to conduct design reviews function by function, and to mandate accounting methods that inhibit IPPD.

No Awards for IPPD Approach. It will not take long for contractors to pick up on the fact that DoD may ask for new and innovative IPPD approaches in the RFP, but still awards contracts based on lowest cost and traditional approaches. If the IPPD approach is to work, DoD's commitment must be real.

Promises Exceed Capability. The possibility of contractors promising more than they can deliver has always been a problem for Source Selection Evaluation Boards (SSEBs). This will be an even greater concern in an IPPD environment because, in the spirit of teamwork, a tendency may develop to make oversight less independent. A related trap is if contractors parrot back the IPPD requirements without making the internal cultural changes needed to operate using IPPD techniques. It is important that the SSEB become familiar with successful IPPD techniques/methods and what can realistically be done, perform a thorough technical evaluation of each proposal, and look closely at contractor past performance in IPPD implementation.

Poor Incentive/Award Fee Criteria. Under the IPPD philosophy, the driving force behind incentive/award fees should be successful product/process development. Concurrent product and process development, full life cycle design considerations, and continuous improvements should be the focuses. Unfortunately, some contract incentive criteria can disincentivize contractors from using IPPD. For example, incentivizing only low development cost can cause the contractor to omit needed design analysis, testing, and alternative examination. Incentivizing meeting scheduled milestone events, such as design reviews, causes contractors to meet those dates whether they are ready or not. Better contract incentives can be based on effectiveness of the contractor's IPPD methods and measures of contractor performance in meeting or exceeding contractual requirements. Beware of including criteria that may preclude optimization of the product.

Over-Extended Reviews. When all members of a multi-functional team are encouraged to participate in a design, many questions and issues will be brought up that result in prolonged discussions. A structured agenda for meetings and reviews should allow for the discussion of issues but not allow the discussion to be dominated by any one specific point. Time limits, however, should only be stressed by the meeting facilitator or chairperson when the discussion becomes repetitive, or a consensus cannot be reached.

B.3 Integrated Product Teams (IPTs)

B.3.1 Introduction. Integrated Product Teams are cross-functional teams that are formed for the specific purpose of delivering a product for an external or internal customer. IPT members should have complementary skills and be committed to a common purpose, performance objectives, and approach for which they hold themselves mutually accountable. IPTs are the means through which IPPD is implemented. Members of an integrated product team represent technical, manufacturing, business, and support functions and organizations that are critical to developing, procuring and supporting the product. Having these functions represented concurrently permits teams to consider more and broader alternatives quickly, and in a broader context, enables faster and better decisions.

Once on a team, the role of an IPT member changes from that of a member of a particular functional organization, who focuses on a given discipline, to that of a team member, who focuses on a product and its associated processes. Each individual should offer his/her expertise to the team as well as understand and respect the expertise available from other members of the team. Team chartering is an excellent way of the team understanding roles and responsibilities of both the team and team members. Team members work together to achieve the team's objectives. A critical element of successful IPTs is effective communications within and between IPTs.

B.3.2 Formational Elements. Critical elements in the formation of a successful IPT are:

1. All functional disciplines influencing the product throughout its lifetime should be represented on the team;
2. Clear understanding of the team's goals, responsibilities, and authority should be established among the business unit manager, program and functional managers, as well as the IPT; and
3. Identification of resource requirements such as staffing, funding, and facilities.

The preceding elements can be defined in a team charter that provides guidance.

B.4 Quality Function Deployment (QFD)

B.4.1 Introduction. Quantitative S&T development goals should be derived using the same process used to derive product requirements for specific programs. This process consists of performing a needs analysis and uses tools such as Quality Function Deployment (QFD). QFD is a tool for translating defined customer requirements into appropriate design requirements at each stage of design and development. The method uses a matrix known as the House of Quality, as depicted in Figure B-2.

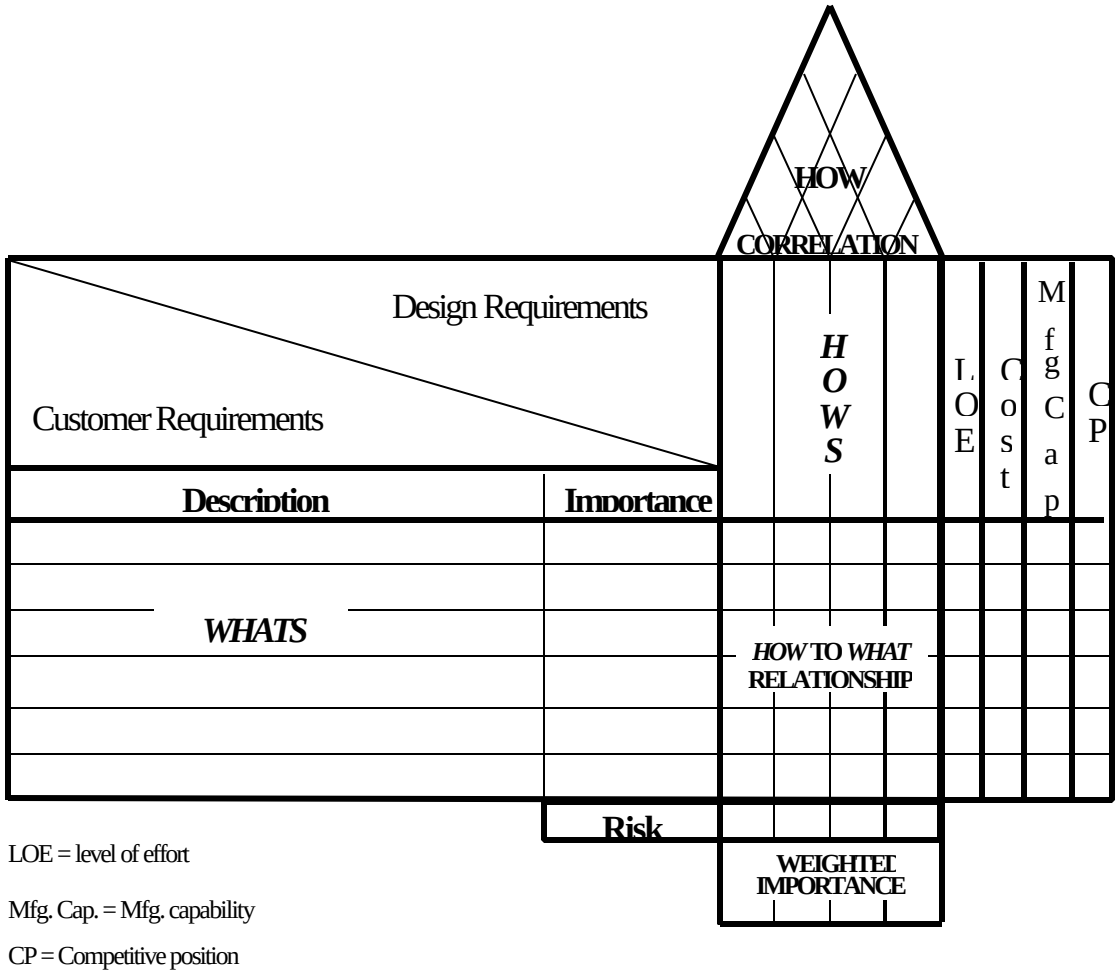

Figure B-2. QFD House of Quality

The following are definitions of the terms used in the House of Quality.

Whats	The product characteristics, functions, or levels of performance wanted by the customer. These are the customer needs or requirements. The *Whats* are sometimes divided into Primary, Secondary, and Tertiary requirements. Examples of each for a fighter aircraft are, respectively, Operating Characteristics, Sorties, and 4 Sorties per Day.
Hows	The ways in which the *Whats* can possibly be met. Also called design requirements. A *How* for the fighter sortie requirement might be a product availability of 0.92
Importance	The value or importance placed by the customer on each *What*. Typically stated as Greatest, Average, or Least.

Hows to *Whats* Relationships	The relative strength of the relationship between a *What* (a requirement) and a specific How. Typically stated as Very Strong, Strong, or Weak or a corresponding numerical value.
Weighted Importance	The importance of each *How* based on either its *How* to *What* relationship value and number of tertiary *Whats* (absolute weighting) or the relationship value, risk, and number of tertiary *Whats* (relative).

Weighted Importance is calculated as follows:

$$\text{Relative weight} = \sum_{\substack{i=1 \\ \text{Rank Ordered}}}^{N} (\text{Relationship value x importance factor})_i$$

$$\text{Absolute weight} = \sum_{\substack{i=1 \\ \text{Rank Ordered}}}^{N} (\text{Relationship values})_i$$

How Correlation - The strength of the technical interrelationships between the *Hows*. Typically stated as Very Strong, Strong, or Weak. Often, positive and negative relationships are indicated using separate symbols.

Risk - The degree of technical and cost risk associated with each *How*. Typically stated as Greatest, Average, or Least.

N - The total number of requirements (Whats).

B.4.2 Implementation Steps. Briefly, the following steps are used in the QFD approach (see example, Figure B-3).

1. Enter the *Whats* already determined. If necessary, further define the *Whats* as Primary, Secondary, and Tertiary requirements.
2. Determine the *Hows*, the design requirements, based on technical experience and knowledge.
3. Develop *What-How* relationships, assigning a numerical value to each (for example, a Very Strong relationship might be assigned a 5, a Strong relationship a 3, and a Weak relationship a 1). Determining relationships is based on experience and technical knowledge. To provide an easily understood graphical display, symbols, as shown in Figure B-3, are used.
4. Define and assign customer importance factor for each of the lowest level (primary, secondary, or tertiary) requirements and the degree of technical and cost risk associated with each *How*. Assign numerical values to the factors and degrees of risk (e.g., Greatest = 5, Average =3, Least =1).

Customer Requirements				Design Requirements		
Primary	**Secondary**	**Tertiary**	**Importance**	DR1	DR2	DR3
Operating Characteristics	A	A-1	○	⦿	—	△
		A-2	△	○	⦿	—
		A-3	⦿	⦿	—	○
		A-4	○	△	○	△
	B	B-1	○	△	○	⦿
		B-2	△	—	⦿	—
		B-3	⦿	○	—	⦿
	C	C-1	○	—	⦿	—
		C-2	△	⦿	—	△
	D	D-1	○	○	—	⦿
		D-2	△	—	⦿	—
		D-3	△	—	△	⦿
		D-4	⦿	⦿	—	—
		D-5	○	—	⦿	△
	E	E-1	△	⦿	○	—
		E-2	○	○	—	⦿
			Risk	△	⦿	○
		Weights	Relative	1	3	2
			Absolute	1	2	3

Symbol	Relationships	Importance/Risk
⦿	Very Strong = 5	Greatest = 5
○	Strong = 3	Average = 3
△	Weak = 1	Least = 1
—	None	N/A

Figure B-3. Example Excerpt of House of Quality.

5. Develop relationships among the *Hows* (not shown in Figure B-3). Use the same definitions for the strength of the relationship and the corresponding numerical value that were used for the *What-How* relationships. Knowing the relationship among *Hows* will be important during trades.
6. Calculate the relative and absolute weights for the *Hows*. For each *How* (DR1, DR2, and DR3), sum the relationship values in that column. The results are 39, 35, and 32, respectively. Ranked ordered, the *Hows* are given absolute weights of 1, 2, and 3. Now multiply the relationship values in each column by the corresponding importance and add the products yielding the following sums: 117, 67, and 100, respectively. Rank ordered, the relative weights are 1, 3, and 2, respectively, for DR1, DR2, and DR3.
7. Multiply the relative weights by the Risk factors of the *Hows*. The products of this multiplication indicate the attention merited by each *How*. DR2 rates the most attention, DR3 the next most, and DR1 the least.

The right-hand side of the complete House of Quality (reference Figure B-2) is used to project the relative level of effort, cost, required manufacturing capability, and the supplier's competitive position regarding each *What*. Projections are usually stated as Greatest, Average, and Least. By using successive QFD "Houses of Quality", with the *Hows* from one used as the *Whats* of the next, increasingly more detailed (lower level) requirements can be derived.

B.5 Design of Experiments (DOE)

B.5.1 Introduction. Design of Experiments (DOE) is a statistical approach to identify and improve factors that impact product performance. It consists of seven steps:

- Select the factors to be tested and parameters to be measured
- Determine the factor values to be used as test settings
- Set up the test array
- Run the tests
- Analyze the results
- Calculate optimum values for the factors
- Run confirmation tests

DOE is often used in production to determine the optimum settings for production processes. In S&T development, it can be used to optimize performance parameters and to select optimum processes for new products.

B.5.2 Selecting Factors and Parameters. The test factors selected are those which are most likely to impact a product parameter that must be controlled. For example, the users of a wave solder process may wish to control(in this case, minimize) the number of solder defects in printed wiring boards going through the process. To determine how best to do this, they must identify the factors most likely to affect the number of defects. This is best done by a team of people familiar with the process. Possible factors of interest might be solder temperature, wave height, and whether or not flux is used. Since each additional factor increases the cost of the experiment, only the factors reasonably likely to be significant are selected. The parameter to be measured must also be defined. In this case, it could be the average number of defects per board, or the percent of boards coming out of the process that contain a solder defect. (In DOE supporting S&T development, the factors could be different joining processes, such as soldering, welding, and wire wrapping, and the output parameter could be cost per acceptable board.)

B.5.3 Determine Factor Values. The experiment will consist of a series of tests, during which each factor must take at least two different values. It is possible to use more than two values (e.g., test at five different temperatures), but each additional value tested will significantly lengthen the experiment and add complexity to the analysis. The two values selected must be far enough apart so that the difference in their impacts can be observed, but close enough so that the difference is approximately linear with the change in value.

Once the values are selected, they are coded. One could be called "high" and the other "low" (even if the "low" value is greater than the "high" value), or one value could be labeled "plus" and the other "minus." Other labels are also used. The label is an arbitrary designation used to organize the data for analysis. For the wave solder process, test factors could be assigned values as shown in Table B-1.

Table B-1: Test Factors Value Settings

Factor	"plus" setting	"minus" setting
(A) Temperature	400 degrees	380 degrees
(B) Wave height	12 mm	10mm
(C) Flux	Present	Absent

B.5.4 Setting Up the Test Array The test array is simply a matrix showing what combinations of settings will be used in the different iterations of the test. One type of test array is the orthogonal array which permits the easy separation of the effects of each factor. A full Factorial Orthogonal Array will require the testing of every possible combination of high and low values for each factor. This is represented by the three columns of Table B-2 labeled "Tested Factors".

Table B-2: Full Factorial Orthogonal Array

	Tested Factors			Inferred Factors				
Test	**A**	**B**	**C**	**AB**	**AC**	**BC**	**ABC**	**Results**
1	+	+	+	+	+	+	+	
2	-	+	+	-	-	+	-	
3	+	-	+	-	+	-	-	
4	-	-	+	+	-	-	+	
5	+	+	-	+	-	-	-	
6	-	+	-	-	+	-	+	
7	+	-	-	-	-	+	+	
8	-	-	-	+	+	+	-	

The columns labeled "Inferred Factors" are not test settings, but represent the effects of interactions between the tested factors, which can be calculated from the test results. The number of tests required by a full factorial test array is:

No. of tests = 2^n , where n = number of factors, each having two values assigned.

A Full Factorial Orthogonal Array for two factors in our example, say temperature and wave height, is shown in Table B-3.

Table B-3: Full Factorial Orthogonal Array for Two Factors.

Test	TEST FACTORS			Results
	A	B	AB	
1	+	+	+	
2	-	+	-	
3	+	-	-	
4	-	-	+	

When there is little possibility of interaction between the factors, a much more economical test may be run by using the columns for the interactions to determine test settings for additional factors. This is called a "saturated" or fractional orthogonal array[1], and Table B-3 could be used to create a saturated array for seven different factors. For the three factors to be tested in the wave solder process experiment, a saturated array is given by Table B-4. This table is derived from the Full Factorial Orthogonal Array for two factors in Table B-3, by substituting the third factor (C) for the column ordinarily held by the interaction (AB). The "+, -" matrix pattern defining the factor combinations for the four runs was developed using Yates' algorithm.

Table B-4: Saturated Array

Test	TEST FACTORS			Results
	A	B	C	
1	+	+	+	
2	-	+	-	
3	+	-	-	
4	-	-	+	

B.5.5 Running the Test Using Table B-4 as a guide, we would run one test with Factor A (Temperature) at its "plus" setting of 400 degrees, factor B (Wave height) at its "plus" setting of 12 mm and Factor C (Flux) at its "plus" setting (Flux present). Another test would be run with Factor A at its "minus" setting, B at its "plus" setting and C at its "minus" setting. Another test would have Factor A at its "plus" setting and the other two factors at "minus." A fourth test would be run with Factors A and B at "minus" settings and C at its "plus" setting. These tests can be run in any order and each can be repeated as often as felt necessary. For each test, the defect rate would be recorded. If a test is run more than once, the average value of the results is determined.

B.5.6 Analyzing the Results. The measured result of each test shows the effect of the particular values chosen for the test settings. The effect of combinations of settings not tested (i.e., those omitted

[1]Fractional factorial designs limit the overall analysis capability. In this case, only the effects of the main factors and some first order interactions can be studied. Fractional factorial design strategies are commonplace and, in fact, form the basis for the majority of Taguchi arrays.

when using a saturated array) and of settings between the "plus" and "minus" values can be determined using linear regression techniques. The average result (test outcome) when a factor is set to its "plus" value is computed from all the tests run with that factor at its "plus" value. From this is subtracted the average result when the factor was set to its "minus" value. The result of this subtraction, called Delta (Δ), is the average difference in the value of the test outcome as the factor varies from "minus' to "plus." Assuming a linear relationship, this result can be used to predict the result of setting the factor at any value between "plus" or "minus." This is illustrated in Table B-5, where some assumed results have been entered, and the regression equations derived.

B.5.7 Calculating Optimal Settings. Since the test results in the example are defect rates, and the lowest defect rate is the desired output, the factors would be set to the value between "plus" and "minus" that result in the smallest value for y. Factor C, the presence or absence of flux, can take on only the values "plus" (present) and "minus" (absent). The other factors can take on any value between "plus" and "minus" representing settings between the high and low values selected for the test. From the equation derived in Table B-5, the optimal settings would be "plus" for Factors A and B and "minus" for Factor C. The expected defect rate at these settings would be 0.1 (y = 1.0 - 0.5 - 0.3 - 0.1 = 0.1). Note that this result is lower than any shown in Table B-5.

Table B-5: Analysis of Test

Test	TEST FACTORS			Results
	A	B	C	
1	+	+	+	0.3
2	-	+	-	1.1
3	+	-	-	0.7
4	-	-	+	1.9
Avg.+	$\frac{0.3 + 0.7}{2}$	$\frac{0.3 + 1.1}{2}$	$\frac{0.3 + 1.9}{2}$	$\bar{y} = \frac{0.3 + 1.1 + 0.7 + 1.9}{4}$
Avg. -	$\frac{1.1 + 1.9}{2}$	$\frac{0.7 + 1.9}{2}$	$\frac{1.1 + 0.7}{2}$	$\bar{y} = 1.0$
Δ	-1.0	-0.6	+0.2	NA
$y = \bar{y} + \frac{\Delta A}{2} A + \frac{\Delta B}{2} B + \frac{\Delta C}{2} C$ y = 1.0 - 0.5A - 0.3B + 0.1C				

B.5.8 Run Confirmation Test(s). There is always a danger that the test results reflect the influence of an unknown factor present during the tests. For this reason, it is always good practice to run a confirmation test at the optimized setting to verify that the expected results are indeed achieved. This is especially important when a saturated array is used under the assumption that interactions between the factors are not significant. If the assumption is wrong, the verification test should not give the expected results, and the analyst will know that more work needs to be done.

B.6 Design for Six Sigma.

B.6.1 Introduction. "Six Sigma" is the title used by Motorola for their initiative to improve their products by reducing variability. The impact of variation in a product can be determined by comparing the distribution of the parameter of interest with the specified limits for that parameter. One measure of variation is the population standard deviation (sigma), which is estimated from samples using equation B-1.

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} \left(x_i - \bar{x}\right)^2}{n-1}} \qquad \text{(Equation B-1)}$$

where: σ = population standard deviation x_i = value of sample (i)

$\bar{x}$ = mean of sample values n = number of samples

Using the standard deviation, one can determine the proportion of the product for which the measured parameter will be between the upper and lower specified limits, and thus is acceptable. For example, if a parameter is distributed normally, 66.3% of the product will have a parameter value within plus and minus one sigma of the mean value of the parameter, 95.5% between plus and minus two sigma, and 99.7% between plus and minus three sigmas. Figure B-4 illustrates the included percentages for varying +/- values of sigma.

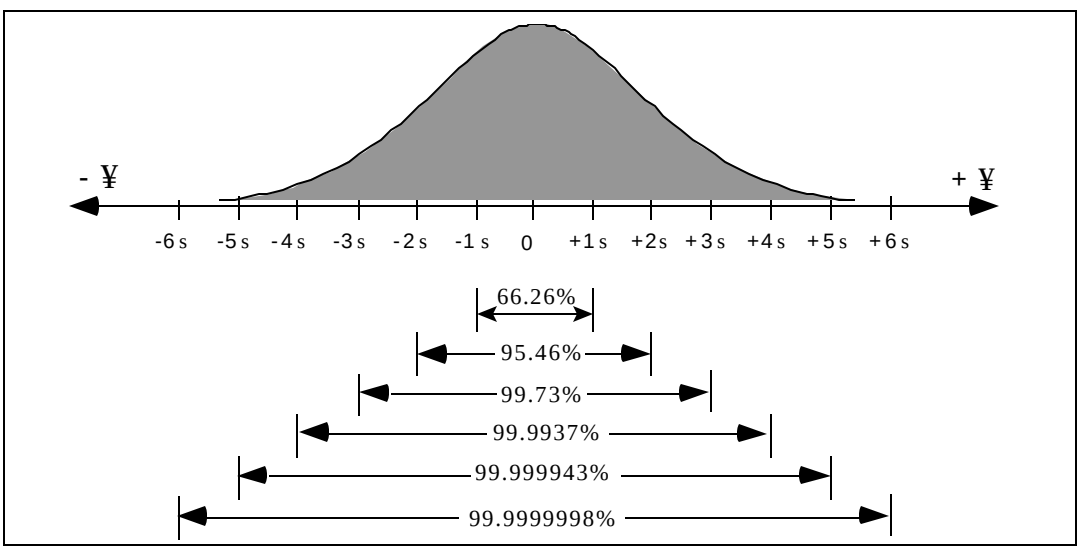

Figure B-4. Percent of population included in +/- sigma ranges.

B.6.2 Process Capability. Comparing the specified limits to the actual variation yields a measure of robustness. One of these measures is Process Capability, which is calculated using Equation B-2. A Process Capability of 1.0 means that 99.7% of the product will be "in-spec." Anything lower is generally considered bad, and quality oriented companies aim at higher values.

$$Cp = \frac{USL - LSL}{6\sigma} \qquad \text{(Equation. B-2)}$$

where: USL = Upper specification limit
LSL = Lower specification limit
σ = Standard deviation

One shortcoming of the Process Capability measure is that it presumes that the mean of the process is the target value for the parameter of interest, as illustrated in Figure B-5.

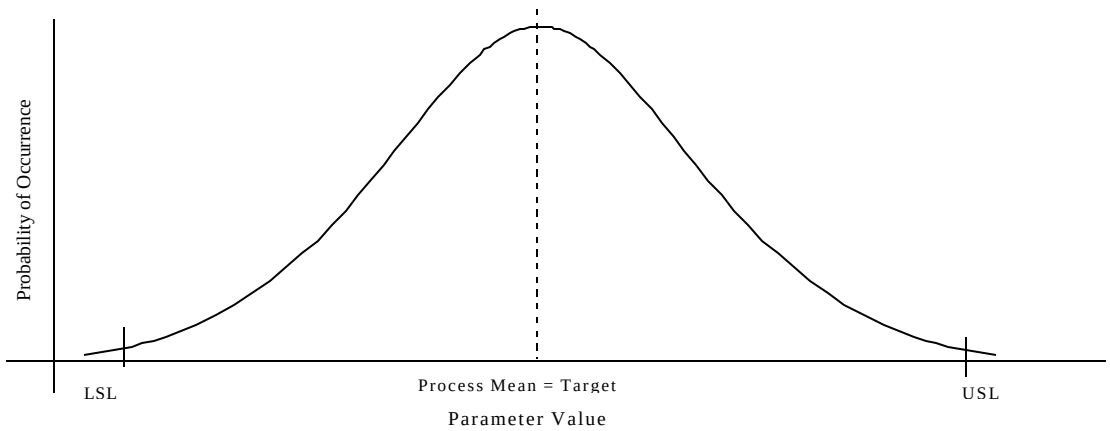

Figure B-5. Process Capability: A Measure of Process Capability with Process Mean Equal to Target Value.

However, "real world" distributions are more likely to resemble Figure B-6, where the process mean value is displaced from the target. For this reason, another measure of process capability called Process Performance, Equation B-3, is often preferred.

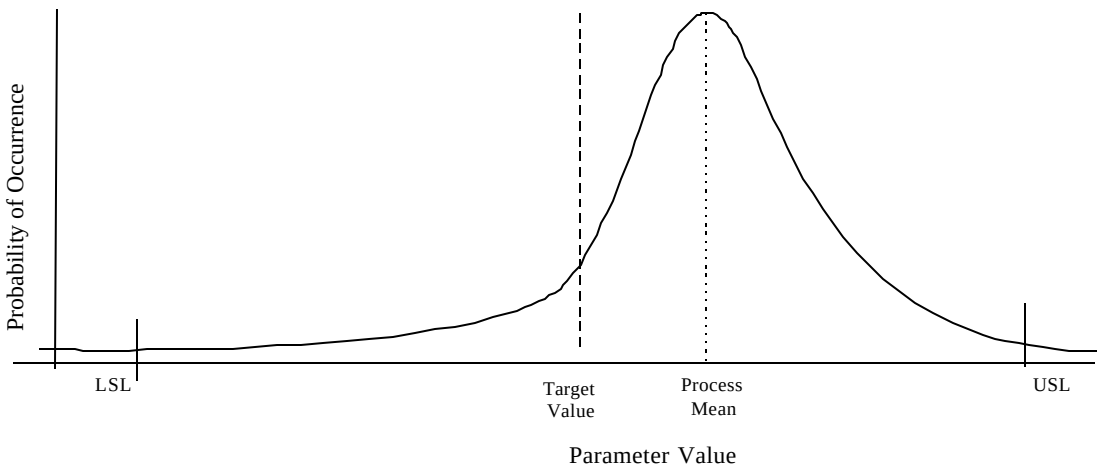

Figure B-6. Process Performance: Measure of Process Capability with Process Mean Shifted from Target.

$$C_{pk} = \frac{\{\text{Min (USL - } m\text{); } (m \text{ - LSL})\}}{3s} \qquad \text{(Equation B-3)}$$

where:

Min{(USL - μ); (μ - LSL)}	=	Smaller of the two values expressed in units of σ
USL, LSL, σ	=	As for equation B-2
μ	=	Process mean

B.6.3 Process Goals. The goal of the "Six Sigma" program formulated by Motorola is for such low variability in the process that a variability of six sigmas in the value of the parameter of interest will fit between the specification limits (i.e., a Process Capability of 2.0). Presuming the mean of the process is 1.5 sigmas off target (i.e., a Process Performance of 1.5), this level of variability translates to 3.4 items per million out of specified limits. By way of comparison, the average business process is a "four sigma" process, which translates to 6,200 items per million "out of spec." Achieving a "six sigma" process requires the control of critical process parameters, which can be identified by the statistical design of experiments, the previous topic.

The need for high levels of process capability can be illustrated by the following example:
The probability of an assembly of n parts having no defects is the part yield raised to the nth power. A "three sigma" process with mean on target produces 99.73% good product. Thus, an assembly of "three sigma" parts would have a probability of no defects (i.e., no parts "out of spec") of .9973 raised to the nth power. For an assembly of ten parts, this is .9733, which may be acceptable. For an assembly of 100 parts, the probability of being defect free is .7631, which is rarely acceptable. For an assembly of 1000 parts, the probability of being defect free is only .06696. Thus, any sizable aggregate of parts cannot be economically produced unless the part variation is controlled to very low levels.

B.6.4 S&T Influence on Six Sigma Production. The achievement of six sigma processes depends on the processes being inherently capable of producing uniform product. Hence, its achievement depends on the selection of the production process. This selection should be done as part of IPPD during S&T development. S&T should include the selection of the optimum processes, which may require some DOE testing or benchmarking of possibly useful processes. Transition to production should not occur before the processes suitable for producing a product are identified and the product is designed to be produced by a sufficiently capable process.

B.7 Cost as an Independent Variable

B.7.1 Introduction. DoD has adopted a new acquisition strategy to meet the future needs of our forces with highly capable systems at affordable costs and possibly shorter schedules. This strategy entails setting *aggressive*, realistic cost objectives for acquiring defense systems, and managing risks to obtain those objectives. Cost objectives must balance mission needs with projected out-year resources, taking into account existing technology as well as high-confidence maturation of new technologies. This concept has become known as "cost as an independent variable" (CAIV), meaning that, once the system performance and objective cost are decided (on the basis of cost-performance tradeoffs), the acquisition process will make cost more of a constraint, and less of a variable, while nonetheless obtaining the needed military capability of the system.

B.7.2 Achieving the CAIV Objectives. A key tenet of the CAIV approach is a far stronger *user* role in the process through participation in setting and adjusting program goals throughout the program, particularly in the cost performance tradeoff process. Working within that context, a process toward achieving the objectives of cost as an independent variable, will include:

- Setting realistic but aggressive cost objectives early in each acquisition program
- Managing risks to achieve cost, schedule and performance objectives
- Devising appropriate metrics for tracking progress in setting and achieving cost objectives
- Motivating government and industry managers to achieve program objectives
- Putting in place for fielded systems additional incentives to reduce operating and support costs.

Several current and past programs, including the Joint Air Strike Technology System (JAST) and the New Attack Submarine, have employed CAIV principles. However, until very recently, goal-setting processes have been largely driven by available technology and generally have not emphasized cost-performance tradeoffs in setting program goals. Furthermore, goals have been set on the basis of near-term budgetary needs--a reality--but not always in balance with life-cycle cost mitigation. By better connecting the user, supporter and developer, the proposed CAIV approach facilitates the process of making tradeoffs among performance, schedule, and costs. Establishing tradeoffs empowers the user to make choices that provide the best performance for the money for each system, thereby helping to ensure maximum benefit from all systems across the force within the resources available.

The best time to reduce life-cycle costs is early in the acquisition process, and cost performance tradeoff analyses must be conducted before an acquisition approach is finalized. However, because external parameters change and program realities evolve, cost-performance tradeoffs must occur throughout the acquisition process. Life-cycle cost objectives should be incorporated in program requirements documents, RFPs, contract provisions, and the source selection process.

Maximizing Program Managers' and contractors' flexibility to make cost/performance tradeoffs without unnecessary higher-level permission is essential to achieving cost objectives. Therefore, the number of threshold items in requirements documents and the Acquisition Program Baselines should be strictly limited and the threshold values should represent true minimums, and requirements should be stated in terms of capabilities, vice technical solutions and specifications. RFPs should include a strict minimum number of critical performance criteria that will allow industry maximum flexibility to meet overall program objectives. Stating requirements in terms of overall military capability needed rather than as detailed design specifications is crucial in providing the necessary trade space and flexibility to implement CAIV successfully.

A major topic upon approval of a Mission Need Statement should be the approach and inputs used to set and refine cost objectives. At each milestone review, cost objectives and progress in achieving them should be assessed. There must be flexibility for adjustments and/or refinement in cost objectives. To assist in establishing program cost objectives and to facilitate cost-performance tradeoffs, the Overarching IPT (OIPT) for each Major Defense Acquisition Program will establish a Cost-Performance Integrated Product Team (CP-IPT). It is critical that the user community have representation on the CP-IPT. Industry representation, at the appropriate time, is also expected.

B.7.2.1 Aggressive Cost Objectives. This means costs objectives that are the "DoD-equivalent" of sound commercial business practices. They should be much lower than would be projected for a system using past ways of doing business in DoD. Reducing life-cycle costs (see Figure B-7) means focusing early on setting and managing to the production cost objective and assessing the impact of basic system parameters and early design decisions on O&S costs. Achieving aggressive cost objectives for the production and operating phases of a system's life may, in fact, occasionally require greater up-front investment during Program Definition and Risk Reduction, and Engineering and Manufacturing Development (EMD) phases. Although lower up-front costs usually indicate simpler designs, and therefore correspondingly lower support costs, there may be cases where certain elements of early program costs may be higher than historical experience because of increased emphasis on product maturity exiting EMD and up-front investments to reduce O&S costs.

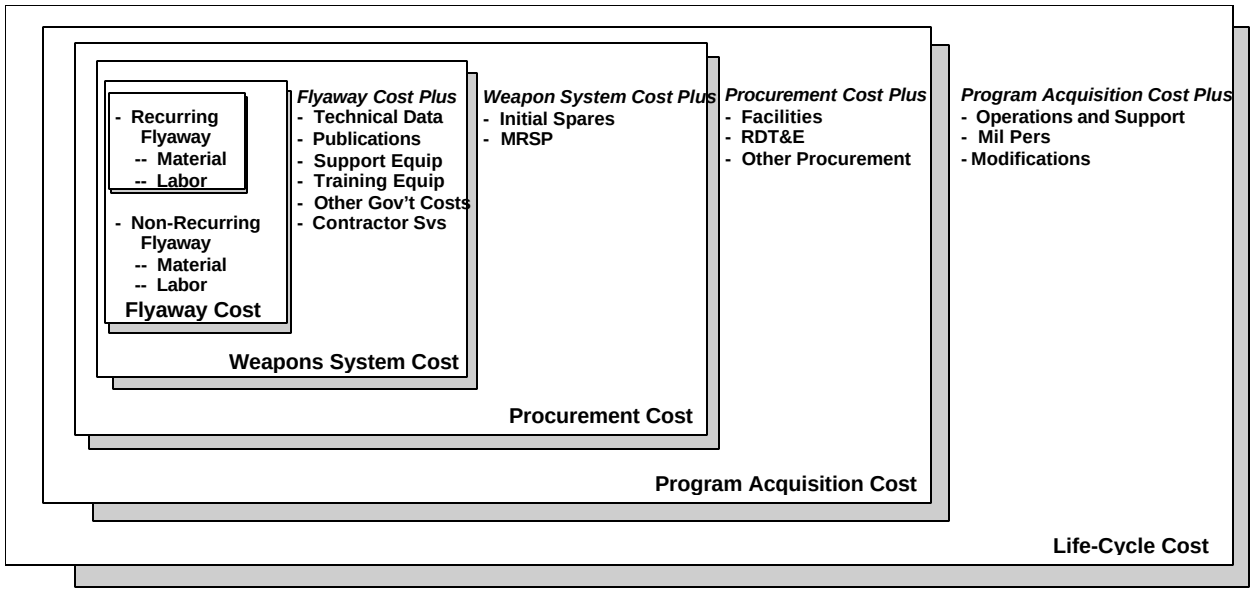

Figure B-7. Definition of Life-Cycle Costs

Life cycle cost objectives (R&D, production, and O&S costs) should reflect consideration of: available near-term and out-year resources; recent unit costs of comparable or fielded systems; parametric estimates; mission effectiveness analysis and trades; technology trends; and use of innovative manufacturing techniques and commercial business practices. Early cost objectives should be challenging but realistic and should be defined as ranges. Aggressive cost objectives will typically entail risks; however, process maturity, aggressive management (under a more failure-tolerant philosophy), and other initiatives should result in lower overall risk.

Production cost objectives should be expressed in terms of some reasonably stable measure, such as an early fixed production quantity (e.g., the first production lot), to eliminate variations due to future changes in the quantities planned or actually produced. (For some programs, it may be appropriate to specify the objective in terms of "first production unit cost.")

Both commercial and defense industries are adopting new design, manufacturing and management processes that offer the potential to reduce development and production times and costs substantially over previous processes. We are stressing increased reliance on commercial business and technical practices and benchmarking commercial processes to define equivalent cost-saving processes for military systems. If given the right incentives and room to make design tradeoffs, industry management and engineers working in IPTs can institute process improvements and system designs that produce products with inherently lower production and operating and support costs and which might be fielded sooner.

B.7.2.2 Managing Risk. Risks in achieving both performance and aggressive costs goals must be clearly recognized and actively managed through continuing iteration of cost/performance/ schedule/risk tradeoffs, identifying key performance and manufacturing process uncertainties and demonstrating

solutions prior to production. Risk reduction through use of mature processes should be a significant factor in source selection, since the production cost objective can only be achieved by demonstrating and bringing key manufacturing processes to maturity. Whereas DoD has traditionally managed performance risk, there must be an equal emphasis on managing toward cost and supportability goals. Cost and risk management involves constructing a plan and schedule of events and demonstrations to verify solutions to cost/risk problems. It further involves unit procurement and O&S cost tracking models that will update cost predictions based on observed events and metrics as program progress. Table B-6 contains examples of illustrative cost factors and indicators that can contribute to assessing cost objective achievement.

Table B-6: Illustrative Factors and Indicators in Reducing Cost Risks

Factor	*Indicators*
• Design Simplification (Mission/Complexity)	- Mission simulation complete - 80% solution analysis complete
• Mature Manufacturing Processes (Cost/Yield)	- Scaleable process demonstrated - Statistical process controls in place
• Technology (cost trends, cost/performance)	- Product available - Market prices established
• Effective Integration (Errors/Redesign)	- 100% 3-D product model exists - Test articles available - Software available
• Commercial Processes and Components (Cost/Performance)	- Environmental suitability established
• DoD Prototype	- Integration verified
• Elimination of (unnecessary) DoD Unique Business Practices	- Low-cost business processes employed

B.7.2.3 Appropriate Metrics. It is critical to CAIV that the process of setting cost objectives begins as early as possible. The ability to set and achieve aggressive cost objectives depends significantly on early tradeoffs in performance versus costs. Metrics and observables are needed for an overall assessment of progress in applying CAIV to a collection of programs; to Defense Acquisition Executive (DAE) or Component Acquisition Executive (CAE) oversight of CAIV implementation; and to execution of the program. Illustrative metrics and observables are shown in Table B-7. In general, these identify important and observable steps that should be implemented in setting aggressive production and O&S cost objectives and then managing for their achievement. In some cases, quantitative metrics may be applied, indicated by the parentheses at the end of a process step. Specific risk reduction steps for manufacturing, performance, manpower utilization, etc., should be addressed by other metrics and observables. Implementation should be tailored for specific programs.

Table B-7: Illustrative CAIV Metrics and Observables

• Are cost objectives defined & consistent with programmed reqmts & projected fiscal resources?	- Out-year resources identified? ($) - Production and O&S cost objectives included in the RFP? - Key tradeoff issues addressed? (e.g., in COEA)
• Is DoD managing to achieve cost objectives?	- RFP contains a strict minimum number of performance specifications? (#) - CP-IPT functioning; tradeoff space identified in program baseline and RFP? - Risks to achieve cost objectives identified and program steps to address these defined? (risk plan) - Incentives for achieving cost objectives included in the RFP and contract? (% relative to total contract $'s) - Mechanism for contractor suggestions to reduce production and O&S costs in place and operating? - Robust contractor incentives plan in place?
• Are contractors managing to achieve cost objectives?	- Appropriate tools for cost-performance tradeoffs (including incentives for corporate management) and participates in cost-performance tradeoff process? - Identifying (and when appropriate implements) new technologies and manufacturing processes that can reduce costs? - Identifying procedural/process impediments to cost reduction measures? - Establishing strong relationship with vendor base, including sound incentives structure?

B.7.2.4 Motivating Management. Higher-level managers, program managers and industry must be motivated to innovate and accept increasing risks, and then be rewarded for achieving their objectives. Most importantly, they must not be penalized if failures occur, despite best management efforts. DoD must promote Congressional acceptance of this new way of doing business, even though open identification of risks might be used by those opposed to a program. Descriptions of two new incentives follow.

B.7.2.4.1 Motivating Government Managers. In the past, guidance to program managers have frequently not stressed up-front investments to minimize production and O&S costs. In the early phases, the program manager needs the encouragement of the users, CAEs, and the DAE to accept risks associated with aggressive cost objectives, and promotion policies must recognize and reward good tries as well as successes. Headquarters must accept risk taking (while promoting risk management) when the potential payoffs are high. In the later phases, the Defense Acquisition Board (DAB) and Component reviewers should enforce all aspects of life-cycle cost reduction, with increasingly specific exit criteria (identified in Acquisition Decision Memoranda) as the program evolves.

Effective top-level management should motivate managers and workers at every level to perform as desired by clearly identifying objectives and by fostering a positive "can-do" attitude from top to bottom. Promotion policies, awards and other formal recognition are important in providing feedback that jobs have indeed been done well. However, by far the best incentive for government managers is an environment that promotes goal setting, teamwork, and recognition of accomplishments from the management chain.

B.7.2.4.2 Motivating Industry. Motivating and incentivizing industry must center primarily on ensuring competition to win business along with attendant business profit in all phases of a program's life cycle.

Current practices frequently provide little or no industry incentive to reduce long-term costs to the government. Source selections all too frequently emphasize (near-term) performance, with less attention given to life-cycle costs. However, contractually incorporating production and life-cycle cost objectives and providing for a sharing of the savings when costs come in below objectives creates a "win-win" situation for all. The following tools and techniques are available to motivate contractors to reduce costs:

Competition: At both prime and sub-tier levels, the government should use competition for as long as reasonably possible. The government has maximum cost leverage when there are competing concepts or producers. In many cases, this means continuing competition as far into the acquisition cycle as practical and affordable, keeping open the option of re-starting competition in the production phase. (This must be planned for early in the acquisition process.) Therefore, cost objectives should be included in all RFPs, and the government should apply the results of cost/performance tradeoffs in contracts early in the process, preferably before final source selection. For industry, the early incentive is to win the business through the most credible solutions to the RFP problem statement that appear capable with acceptable risks of achieving specified cost objectives. Thus, contractors should be encouraged by program managers to incentivize sub-tier vendors to assist in cost reduction efforts, both through competition and other incentives.

Maximum use of open systems concepts at all levels can greatly facilitate having opportunities for continuing competition throughout program lifetime. When it is no longer practicable to maintain real competition for a system, some of the benefits of competition can still be obtained through competition among acquisition programs within the same mission area for available funds in the Planning, Programming, Budgeting System (PPBS) process.

Shared Savings Incentives: Value Engineering provides rebates of substantial percentages of savings to the contractor. Current obstacles to the use of value engineering include long administrative approval times and concerns over the possibility of product gaming. Judicious setting of objectives and thresholds under CAIV are needed to overcome these obstacles.

Contract Incentives: Well-structured contracts and well-designed contract incentive clauses are key in focusing contractor attention on cost reduction. The following considerations apply in the different stages of acquisition:

Development: In early design with multiple concepts, competition is the government's strongest tool. The design and development contracts should include cost objectives for production and life cycle costs and require the accomplishment of cost/performance tradeoffs. The source selection criteria communicated to industry should reflect the importance of developing a system

that can achieve stated production and life cycle cost thresholds. We need credible models to track projected unit production cost and O&S costs through development and into production.

Production: A focus on first production lot quantities removes the effect of later quantity changes and can emphasize initial quality. When appropriate, an arrangement should be included in the contract that provides the contractor with a share of the cost savings for bringing the program in at or below objective price. Care must be taken not to sub-optimize the first production lot cost at the expense of O&S costs. For later production lots, the objective is to incentivize continued cost reduction throughout the production phase. When practicable, as discussed above, competition can be introduced if unwarranted price increases occur. Other tools that would further reduce costs during production include multi-year procurement contracts, component breakout, and value engineering-type clauses.

O&S: Incentives during early production and follow-on could be in the form of repair warranties with the contractor, or alternatively (possibly deferred payment) incentive fees could be tied to the R&D or production contracts. Since O&S costs are not easily measurable in the early stages of the acquisition process, incentives to reduce O&S costs may require a (validated) model that relates specific design parameters to measurable and predictable O&S costs. Reliability and maintainability characteristics, which are more readily measured and projected, might serve as early indicators of progress towards meeting O&S cost objectives. In any event, DoD needs better cost models for the O&S phase of our programs. We face the challenge that CAIV may involve incentivizing savings and cost avoidances that will only be realized in the more distant future.

B.7.2.5 Incentives for Fielded Systems. Two new programs have been recommended in this area. The first is to institute an *awards program* to recognize valuable suggestions toward reducing life-cycle costs. A board would be established to review nominations for the awards, which should be made at least annually. A second new incentive program would be established to encourage Component (Service) funding of high-leverage proposals for investments to reduce future life-cycle costs. Annually, the proposals would be ranked by projected, validated return-on-investment, risk, and other considerations. Participants from both Government and industry would be encouraged to compete for these resources. A suitable mechanism to fund as many worthy proposals as possible would be implemented.

B.8 Modeling and Simulation

B.8.1 Introduction. Modeling and simulation (M&S) tools have been in use for quite some time. In recent years, advances in information technology offer new opportunities for tools to aid the analytic and design communities. These new opportunities come from computers and communications that are much faster and affordable. Finer granularity models can be used that execute in the same elapsed time as did less precise, older models. Models and simulation are now used in every phase of a product, as shown in Figure B-8.

Simulations are becoming ubiquitous. They will be embedded in every phase of support tools for acquisition. The notion of interoperability has already taken hold; simulations built by different projects are engineered so that they can later be connected in federations with each simulation delivering a complementary capability. Because M&S applications span multiple functional areas, they should help achieve improved cooperation across DoD, foster an emerging consensus, and support a roughly common vision.

The conceptual model of the computer model mission space, or CMMS, is a complex database which provides a shared authoritative understanding of the real world. It is multi-dimensional and depicts the entities, actions, and interactions that occur in the real-world. Such a resource will provide an evolvable and accessible framework of information to support the front-end analysis that must be done as part of any simulation design process.

Common data standards include the development of common data interchange formats, identification of authoritative data sources, and guidance for verifying, validating and certifying data; thereby facilitating access to required data and ensuring database quality.

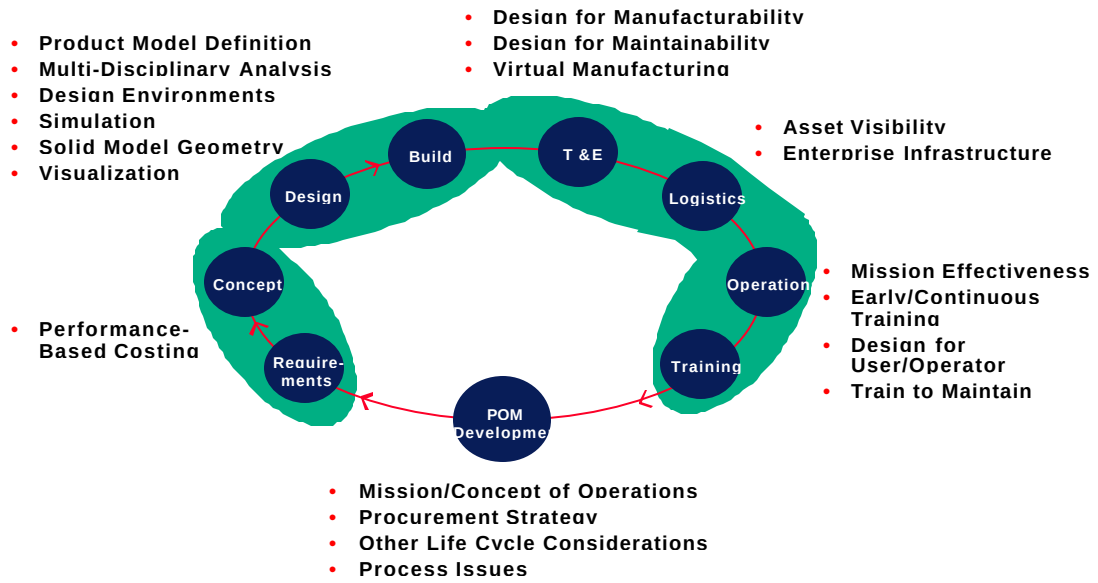

Figure B-8. Use of Models and Simulations in Various Life-Cycle Phases.

The benefits of using the new capabilities of simulations are:

- For developers - adaptable architectures with a full range of scale and complexity saving cost, schedule, and risk for the same level of requirements.
- For users - new federations to answer different questions with greater granularity.
- For resource sponsors - no need to fund as many upgrades to meet new requirements.
- For DoD leadership - development of fewer simulations and more capable and adaptable existing simulations.

The Defense Modeling and Simulation Office (http://www.dmso.mil/) has made great strides in developing a consensus-building forum within the DoD modeling and simulation community. For example, the creation of three functional area councils, under the Executive Council for Modeling and Simulation, provide stakeholder representation within the functional communities of analysis, acquisition, and training. The initial task for the three councils is to build annexes for their respective functional areas for the DoD Modeling and Simulation Master Plan that spell out that community's priorities. The Analysis Council is available to the analytic community to influence and develop priorities and statements of what is important to the analytic community. Representatives of the Office of the Secretary of Defense / Program, Analysis and Evaluation (OSD/PA&E), and the Joint Staff jointly chair the Analysis Council.

B.8.2 Simulation Based Acquisition. The new 5000-series acquisition regulations strongly encourage the use of models and simulations to improve quality and to reduce acquisition time, resources, and risks. They also encourage embedding virtual prototypes in synthetic environments to support requirements definition, concept exploration, and manufacturing and testing of new systems.

The Defense Department envisions an acquisition process supported by the robust, collaborative use of simulation technology that is integrated across acquisition phases and programs, as shown in Figure B-9. This vision is called Simulation Based Acquisition (SBA). The objectives of SBA are to:

(1) Reduce the time, resources, and risk associated with the acquisition process
(2) Increase the quality, military utility, and supportability of systems developed and fielded
(3) Enable integrated product and process development from requirements definition and initial concept development through testing, manufacturing, and fielding

Substantial evidence has already accumulated regarding the value of a simulation-based approach to acquisition. Both commercial and military programs provide pervasive evidence of tangible results that can be measured in terms of improvements in *cost, schedule, productivity,* and *quality/performance*.

Simulation Based Acquisition is comprised of three principal components. The first is an *advanced systems engineering environment* that uses formal methods and automation to support efficient design synthesis, capture, and assessment, as well as other complex life-cycle activities.

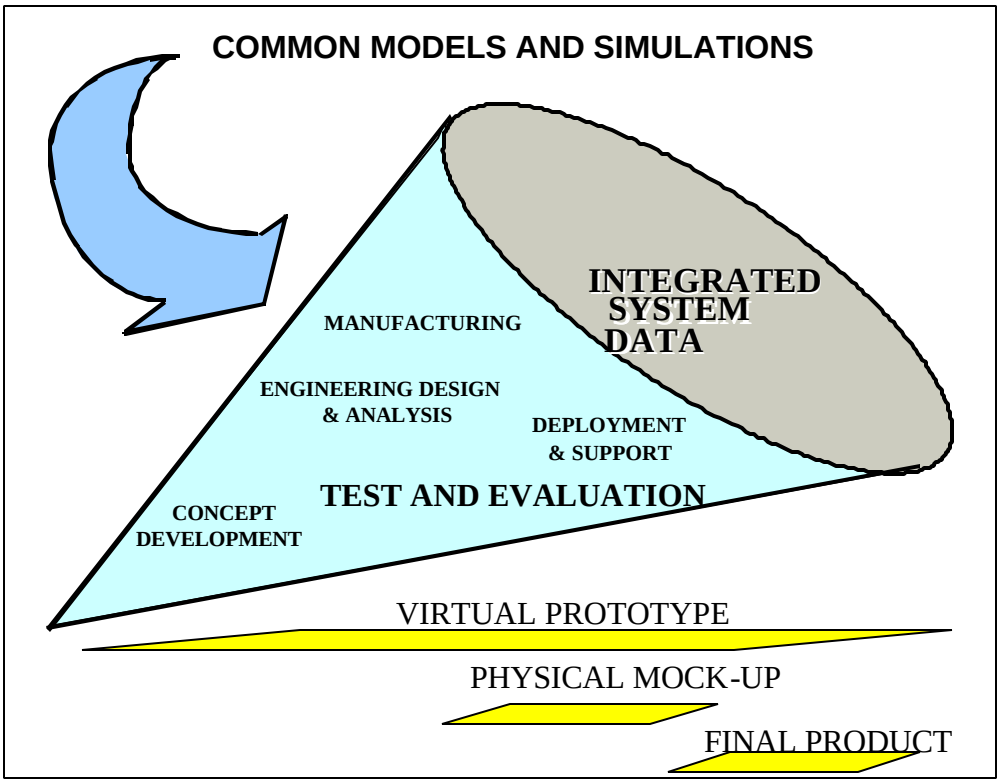

Figure B-9. Integrating Models and Simulation Within and Across Programs.

The SBA engineering environment provides a means for executing a process that can be extended, tailored, and repeated. The process results in the creation of reusable design repositories and products that can be reengineered. The potential gains from the use of such an advanced SBA environment will not be realized until the engineering process, as well as its people and organizations, also evolve.

The second component is a *refined system acquisition process* that takes advantage of the SBA systems engineering environment capabilities. The third component is a culture that has evolved to a point where *enterprise-wide cooperation* is the rule, and individual technical contributions and innovations are encouraged and managed efficiently.

Simulation Based Acquisition *is not an incremental step* beyond current system engineering methods and tools. Instead, it represents *a major paradigm shift* toward a comprehensive, integrated environment that addresses the entire system development life cycle and the spectrum of engineering and management domains.

B.8.2.1 M&S as a Decision and Management Tool. Decision cycle times are improved when program managers and functional staffs have access to modeling and simulation results. Models and simulations also allow the program manager to measure and track performance against milestone decision criteria. A virtual factory can be developed to evaluate the producibility of a design and initiate tooling design at an early stage of the program. By identifying the maintenance and supply requirements

associated with a design, a program manager can exert positive front end control over the system's logistics "footprint" and life cycle cost.

The ability to develop digital master product models with Computer-Aided Design/ Computer-Aided Manufacturing/Computer-Aided Engineering (CAD/CAM/CAE) software technology has made it possible to more fully understand products from a manufacturing standpoint during the early design stage. The depth and richness of the product information contained in a digital master model makes it easier to more fully communicate detailed information to everyone involved in the product development process.

B.8.2.2 M&S in Design. Digital master models help to develop and evaluate multiple design concepts so that the material solution most efficiently meets user needs. Quality becomes part of the design process itself and can be built-in instead of added-on. Digital master models provide details about the product's shape, behavior, and cost before the fabrication of costly physical prototypes, and help minimize scrap, reduce downtime, and eliminate wasted or redundant operations. This approach allows teams to work concurrently by providing common ground for interrelated product development tasks. Instead of individuals creating one piece of information at a time, the digital master model enables various disciplines to work together much earlier in the product development process.

B.8.2.3 M&S in Manufacturing. Use of standard, relatively inexpensive computer equipment, virtual prototypes and simulations helps to bring together a shared vision of the system and provides a means for understanding the complex interactions among the configuration items in the system design. Some studies indicate that the use of computer aided design/manufacturing (CAD/CAM) tools and common databases can result in significant manufacturing cost avoidance, including:

- 20-60% reductions in set up time
- 15-25% reductions in planned labor and tooling
- 15-75% reductions in rework and scrap
- 20-50% reductions in work-in-progress carrying cost

The primary contribution of emerging M&S tools is not in improved manufacturing technologies, but rather in bringing manufacturing expertise to the design processes so that the final design is more manufacturable. Improved manufacturability offers significant potential payoff.

In addition, M&S tools can assist the manufacturing team in designing the manufacturing process for a new system just as the design team is developing the design. The equipment, work flow, and overall process for manufacturing can now be developed and analyzed in a virtual environment with high confidence in the results.

B.8.2.4 M&S in Test and Evaluation. At a minimum, the early involvement of the T&E engineer in the concept development stage, to ensure that functional requirements are formulated in a testable manner, is facilitated and aided by M&S tools. Similar tools are now widely used to plan, rehearse, extend, and evaluate live T&E activities. To a significant extent, assessment of a system is now possible

using M&S long before a physical prototype is actually constructed. Physics-based dynamic models using CAD descriptions of the system in a test-validated environment now provide critical feedback to system designers, as well as users, as the design matures.

For example, the first flight of a new aircraft is preceded by years and hundreds of millions of dollars of mathematical modeling, flight simulations, hardware-in-the-loop (HWIL), software-in-the-loop (SWIL), and other simulations.

As in previous phases, the significant change made possible by the use of M&S tools is to integrate these O&S functions into the total system development process. That primarily means considering the implications of these functions on the concept which is selected and the design which is developed to satisfy operational requirements. Not only can operational use be evaluated during the design stages to minimize the subsequent necessity for modifications to the fielded systems, but the support requirements for those systems can be better analyzed during the design stage to lessen the support burden and thus the total life cycle costs of the system.

The real power of a computer based modeling and simulation system lies in the connection and coordination between the tools and functional users. Systems that provide a seamless environment for geographically distributed teams and a diverse set of functional users will tend to lead to cost avoidance on the higher end of the reduction ranges just described. In addition to increasing the effectiveness of the design and manufacturing functional specialists, the product support members (testers, logisticians and maintainers) of the team will benefit as well.

The bottom line is that integrated product and process development, backed by a strong commitment to computer based modeling and simulation tools, provides a dominant competitive edge in the commercial marketplace and a clear warfighting edge on the battlefield. It provides a path for getting to market first and at a lower cost.

B.9 An S&T IPPD Process

B.9.1 Implementing the IPPD Process

The basic functions associated with implementing IPPD principles are shown in the process diagram in Figure B.10. This process was originally developed by the U.S. Air Force in conjunction with approximately 30 companies in the defense aerospace industry. While the process is displayed horizontally to make it easy to read, it is *not* a serial process, as the large elliptical background arrow suggests. The main activities associated with the process are represented by the central six blocks. The document symbols along the bottom represent important outputs from the process. The artifacts along the top of the diagram represent various methods and tools which can be employed to implement the process.

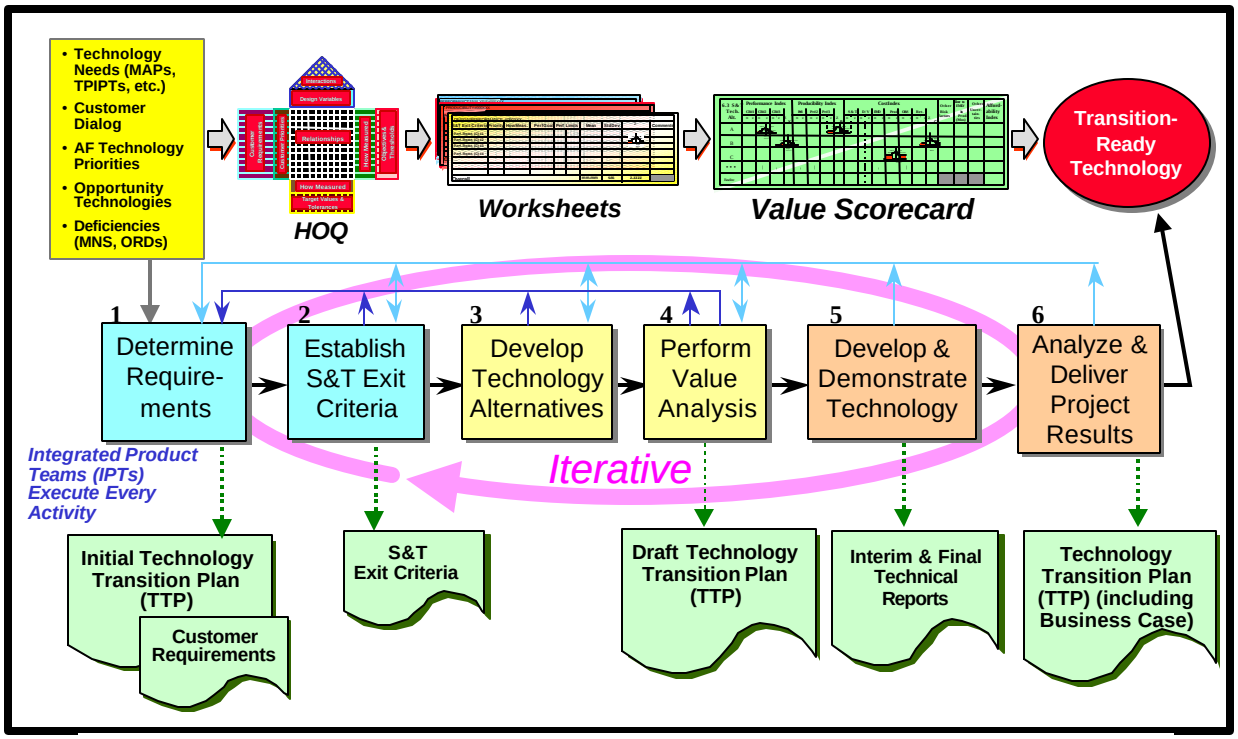

Figure B.10. An S&T IPPD Process

During a workshop in 1994, when this process was first contemplated, it became apparent to everyone present that IPPD is not something that can be layered on top of an S&T development effort. Rather, *one either develops technology in an integration fashion, or one does not*. As that workshop, industry experience, and subsequent experience with S&T IPPD Pilot projects have demonstrated IPPD is *not something you do in addition to S&T*. It is a fundamental way of thinking about and executing technology development. There is not one set of program goals and another set of IPPD goals. They must be one and the same. They must address the critical issues associated with technology maturation and transition (viz. producibility, life-cycle cost and risk). It should be noted that if transition issues to the next phase of development are not addressed as explicit program requirements, the program is *not* addressing IPPD issues, regardless of the use of a team approach. The process in Figure B.10 provides a structured approach for addressing those critical issues, namely, the balance of performance, producibility, cost and risk, and making those elements integral to an S&T effort.

The six activities outlined in the integrated technology development process in Figure B.10 are each briefly described below.

B.9.1.1 Define Requirements

The process begins with defining the requirements. The activity of defining requirements requires (i) one or more customers, explicitly identified and participating in the process, and (ii) the participation of *all* stakeholders, from S&T personnel and customers to designers, production and manufacturing, logistics,

financial and others. Hence, it is imperative to form an integrated product team (IPT).

IPTs are critically important if life cycle and support issues are to be considered early in the design process. If the IPT is successful, the result will be a more mature technology that requires fewer costly changes later in the product development process. A successful IPT achieves the benefit of reduced cost and schedule while maintaining and often increasing the quality of a technology. As industry experience has demonstrated, quality tends to cost less, not more. The same is true in S&T. IPT activities during 6.3 and advanced technology demonstrations should focus principally on the warfighter customer and meeting that customer's need, although laboratory and technology base needs should not be neglected, particularly in 6.2 and early 6.3 efforts. Accurately understanding the various levels of user needs and establishing realistic requirements that will enable the technology to transition smoothly into the acquisition cycle is critical to achieving affordable technology. The criteria for developing a good IPT that focuses on strong customer involvement are discussed in detail under Section 2.2.2 .

Defining requirements involves looking at a problem from multiple perspectives. Different requirements are often associated with different customers. For example, end-users generally specify performance and life-cycle cost requirements. Industry team members, who will be focused on manufacturing the system or sub-system, might be equally concerned with producibility issues. The logistics people, who will need to support the system or sub-system once it is fielded, will be concerned with supportability requirements. The laboratory itself may have requirements for longer term technology development to meet emerging threats that are not yet on end-users' radar screens.

Requirements can be documented in a matrix as shown in Figure B.11, which is a partial "snapshot" of a spreadsheet based tool for capturing S&T requirements. We focus initially on the first five columns (through "How Measured"). Indeed, it is the "How Measured" column that is perhaps most important.

In order to accurately describe where we are and where we are going, a metric (or a set of metrics) is needed. The purpose of establishing specific, quantifiable measures for each requirement is two-fold. Measures enable:

a. Assessment of when, and to what extent, we have satisfied the requirements

b. Predictive comparisons among competing technologies

HOME

Advanced Laser Eye Protection

Top-Level Requirements Matrix

Updated: 26 Aug 98

d	Customer	Requirement	Pri	How Measured	Objective	Lower Threshold	Upper Threshold	Type
Protection, Source Confguration 1								
1	HSC/YA	Daytime Disability Glare, Source Config 1	High	Corneal Illum, ANSI MPE [CW, $\mu W/cm^2$ @ 530nm]	0.1	N/A	0.15	A(perf)
2	HSC/YA	Nighttime Disability Glare, Source Config 1	High	Corneal Illum, CW, $\mu W/cm^2$ @ 530nm (photopic)	10	8	12	A(perf)
3	HSC/YA	Daytime Flash Blindness, Source Config 1	High	Log Troland Seconds, not to exceed daytime equiv bkgnd	1.5	N/A	3	A(perf)
4	HSC/YA	Nighttime Flash Blindness,Source Config 1	High	Log Troland Seconds, not to exceed nighttime equiv bkgnd	1	N/A	3	A(perf)
5	HSC/YA	Permanent Eye Damage, Source Config 1	High	ANSI MPE	0.5	N/A	1	A(perf)

Figure B.11. Example S&T Requirements Matrix (Partial, courtesy USAF AFRL)

Readers familiar with techniques such as *Quality Function Deployment* (QFD) will notice certain differences between the matrix in Figure B.11 and traditional QFD *House of Quality* approach. The matrix above has been tailored to meet the needs of S&T. Each requirement is associated with one or more specific measures. The level of requirements detail shown above should not be confused with that of a typical Operational Requirements Document (ORD) or even with a statement of work (SOW). This approach can be used to address almost any level of requirements, from strategic down to detail design. The requirements in Figure B.11 reflect the level of detail needed to assess affordability, in terms of best value across performance, producibility, life-cycle cost and risk, for one or more specific laser eyewear technologies. Although not shown, these requirements are mapped to the ORD/end-user level requirements.

Experience reveals that the real work begins with defining the measures. In actual S&T Affordability Pilot programs, defining the measures has resulted in several important benefits:

a. Measures clarify the requirements. Quite often the ensuing discussion about the metric causes IPT members to clarify the definition of the requirement, thus eliminating ambiguity. *You can't measure what you can't clearly define*.

b. Measures provoke an *exploration* of the requirements. Often a requirement is more complex than we first imagine. It may require several parameters to properly measure it. Figure B.11 provides an excellent example. The five requirements shown in Figure B.11 began as a single requirement: "Provide protection against Source Configuration 1." ("Source configuration 1" is of course clearly defined elsewhere.) In the ensuing discussion, what was originally thought to be a single, well-understood requirement for laser eye protection evolved into *five* requirements, each with its specific measure.

c. Measures drive IPT consensus. In the example in Figure B.11, the IPT consisted of SPO customers, engineers, optical filter (thin film) scientists, end-user representatives, fabricators and human systems scientists. Initially, opinions varied widely in terms of how to measure optical protection against laser threats. The first cut at protection metrics resulted in a simple optical density (OD) measure. However, ensuing discussion soon revealed that OD was not a good measure because it is too ambiguous and does not reflect potential eye damage levels. Issues such as laser pulse rate also confound the problem. At first, there were clear divisions of opinion between the optical filter experts and the human factors scientists who actually study biological effects and eye damage. Through facilitated discussion and over the course of several meetings, the differences were resolved. A new, far more meaningful set of metrics was established that satisfied all of the disciplines. The ability to measure progress and results became far more robust than in the past.

d. Measures sometimes drive the science. For example, in the laser eye protection area, everyone on the team recognized the value of objective metrics that can be assessed quickly and cost-effectively, in a laboratory bench setting, as opposed to more subjective measures based on human or bioeffects sampling. However, when objective measures address human factors issues, they must be correlated with actual bioeffect and/or perceptual data. The measures may therefore require correlation studies and in that sense, they can influence the science investment.

e. Measures enable affordability assessment. Throughout the laboratories and industry, there has been a growing call to be able to assess the affordability of a new technologies (i) with respect to performance, producibility, cost and risk, (ii) in a way that is *objective* and *quantifiable* in addition to capturing relevant subjective information, and (iii) in a way that engenders *confidence* on the part of technology recipients (S&T customers) so that laboratory claims are *credible*. Credibility is engendered by the exercise of a *process* and by achieving *measurable results* that are *traceable* from the final affordability assessment right back to the original driving requirements.

B.9.1.2 S&T Exit Criteria

S&T Exit Criteria are the *objectives and thresholds* associated with quantifiable metrics (the *measures)*. They are used to estimate future affordability, track technical progress and ultimately to characterize the affordability of new technologies. We begin to establish "exit criteria" when we establish specific objectives and thresholds for all high priority requirements. Notice in Figure B.11 that requirement #1, Daytime Disability Glare, Source Config 1, is measured in terms of ANSI MPE (Maximum Permissible Exposure). The objective is to achieve 0.10 or one tenth ANSI MPE (a specific, published value). There is no lower threshold, indicating that "less is better." The upper threshold, that is, the value beyond which the protection fails to meet the requirement, is 0.15 ANSI MPE.

To help establish objectives and thresholds, as well as support subsequent affordability analysis, *Desirability Curves* can be developed in consultation with the IPT. An example of the desirability curve for Daytime Disability Glare is shown in Figure B.12, (another example of a worksheet based tool to support S&T). The desirability chart plots desirability (d) on the y-axis as a function of the parameter of interest (x-axis). The *objective* for the requirement is represented by the left end of the curve, while the threshold (in this case, an *upper threshold*) is represented by the right side of the chart. The desirability number ranges from 0 to 1 on the y-axis.

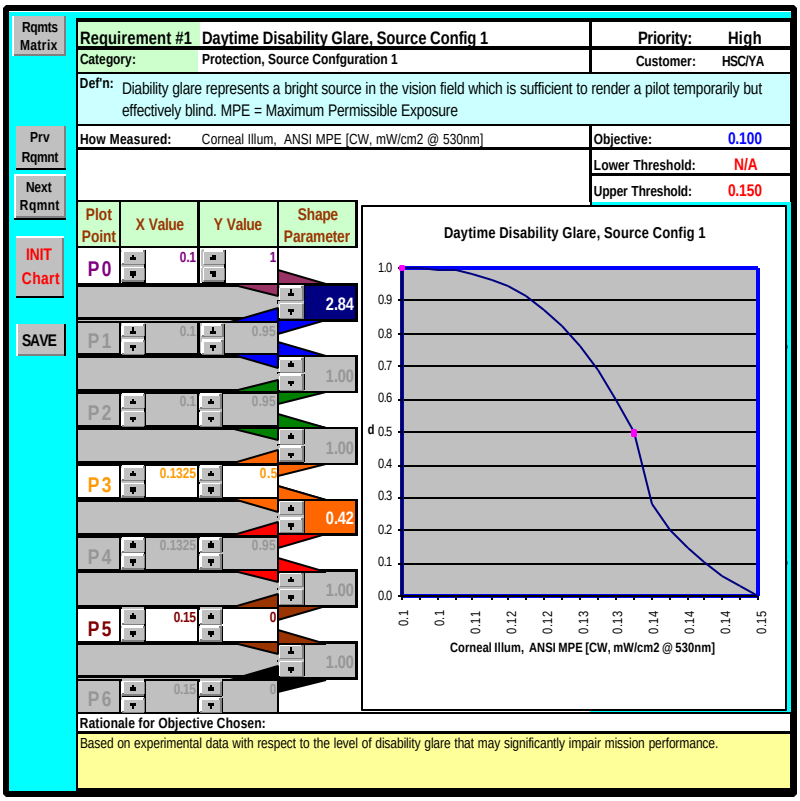

Figure B.12. Establishing Desirability Curves

One of the important benefits of thinking about requirements in terms of desirabilities is that it promotes discussion with the customer concerning threshold negotiation. Thus, it helps the team reach consensus on the *real* requirement, the *must have* rather than the *nice to have*. It also provides considerable insight with respect to the customer's perspective on each requirement, based on the shape of the associated curve. Experience shows that in many cases, customers (end users) do not know what is *feasible*. They do not know what the technology is capable of doing. The discussions that arise from a consideration of desirabilities often help customers and technologists reach consensus on what the real requirement *should* be, based in part on what the technologists believe is the technology potential.

Once established, the *thresholds* of all high priority requirements represent the S&T Exit Criteria for the program. If those requirements have been negotiated with S&T customers, the thresholds collectively reflect the level of technology maturity, in terms of performance, producibility and life-cycle cost and risk, required by the S&T customer to deem the technology ready for transition. If desirability curves have been established for all key performance, producibility and life-cycle cost requirements, the desirability values for each requirement, along with their associated weights, can be combined using a weighted geometric mean to provide an overall customer satisfaction index (CSI). The CSI is a useful metric that reflects the collective extent to which a given technology will (predictive) or has (measured) satisfied the Exit Criteria and is therefore a useful approach for estimating (predictive or measured) overall technology maturity.

B.9.1.3 Technology Alternatives

The third activity associated with the IPPD-driven technology development process (Figure B.10) addresses the issue of defining technology alternatives. Technology alternatives represent various technology configurations, solutions, systems and/or sub-systems that can be developed and combined in an effort to satisfy the Exit Criteria. Technology Alternatives are addressed at three distinctly different levels:

a. Strategic: Addresses issues among competing mission scenarios at the system level (e.g. piloted or uninhabited vehicle? Smart skin or low-cost expendable?).

b. Tactical: Addresses issues among competing technology alternatives at the sub-system or fabrication process level, generally based on expert analysis and consensus (e.g. the strategic decision might be to develop infrared countermeasures, the program level addresses trades between competing laser technologies, or, it might be to assess the affordability impact of various processing technologies for advanced composites)

c. Detailed: Addresses issues among competing designs or fabrication processes to enable improved design optimization and a better search of the *design space*. It is based on detailed analytic, response surface and multi-variable design optimization techniques (e.g. specific competing designs are optimized within their individual design spaces using techniques such as response surface analysis [Figure B.13], and then evaluated with respect to expected performance, producibility, life-cycle cost and risk)

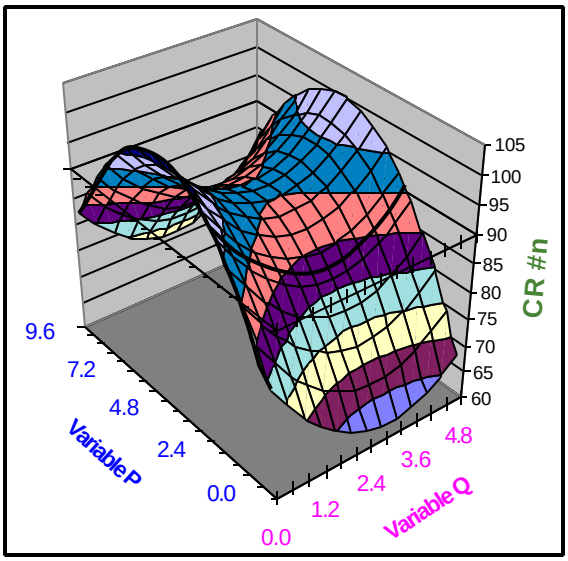

Figure B.13. Example of *design space, response surface* analysis, 2 variables vs response.

Many of the methods discussed in this document that support the process shown in Figure B.10 can be applied at the strategic assessment level. However, our focus here is on the 6.3 project level, on the tactical and detailed technology development scenarios. These levels are not completely independent. Strategic system affordability cannot at times be adequately assessed without some roll-up from a lower level analysis at the sub-system, *tactical* level. Likewise, affordability assessments at the tactical level lack the fidelity of more detailed analyses unless those detailed design space analyses are performed and rolled up to the tactical level.

The depth and fidelity of the analysis at any level depends in part on time and budget, and in part on the design expertise of the team. Industry experience has shown, for example, that a detailed, multi-variable, concurrent design space and design optimization approach, while it may at first *appear* to require more work than a traditional serial design approach, can be far more efficient, because it can sidestep the

costly and time-consuming pursuit of dead-end paths. Indeed, the gains have been so great, that this approach has become *de rigueur* at several leading companies.

It was stated earlier that development decisions made very early in the design process have a major impact on future system cost. It follows that we can maximize the payoff in terms of future system affordability at this phase, *if* we can cost-effectively improve the quality and fidelity of our technology assessments. Better assessments lead to better investment decisions. When we *know* what the transition cost and risk drivers are, then we can address them. In order to make the right decisions early, however, we need to be able to *predict* how the various technology alternatives will likely perform against a given set of Exit Criteria.

When we are considering technology alternatives relatively early in the process, the analysis should be conducted to the maximum level of detail and fidelity that we can reasonably tackle. If detailed design information, design variables, and/or high-fidelity models and simulations exist (and they often do in late 6.3), then a detailed design-space analysis and technology assessment can yield big dividends. If, however, it is necessary to assess a number of very different technology solutions (e.g. gas vs. semiconductor vs. fiber lasers), where we do not have adequate simulations or access to the design variables associated with the different technologies, then other approaches such as expert estimation and consensus techniques are in order (Figure B.14). While these techniques are not as rigorous or high fidelity as detailed design or simulation-based analyses, they are nevertheless extremely valuable in guiding technology investment decisions.

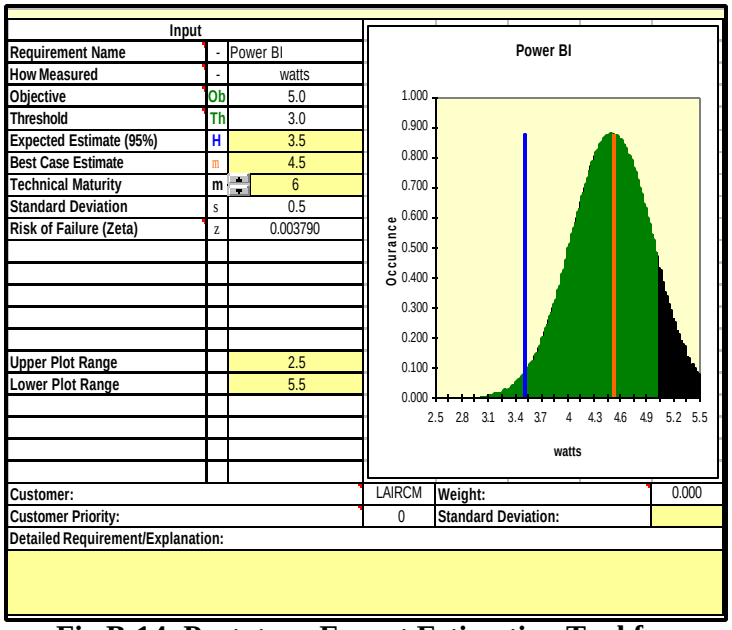

Fig B.14. Prototype Expert Estimation Tool for Affordability Assessment

Technology affordability can be assessed using one or more teams of experts supported by appropriate methods and tools to develop a consensus with respect to how each technology will likely perform against each of the Exit Criteria. Deciding *which* technology solutions or alternatives to assess in the first place is an inexact science. It requires that laboratory and industry personnel be aware of the possibilities. It often requires threat assessments and technology capability assessments to determine what is feasible within given time frames (e.g. 3, 5 and 10 years).

Tools and methods which are analogous to the Desirability Function tool shown in Figure B.12, but which address issues such as "probability of success" versus performance against a given criterion at a given point in the future, can be used to facilitate the estimates. Methods such as the Analytic Hierarchy Process (AHP) and Successive Proportional Additive Numeration (SPAN) can be used to achieve expert consensus even where there may be dissension within the team.

B.9.1.4 Value Analysis

The fourth activity shown in the process represented in Figure B.13 is Value Analysis. The decision to invest in a given technology is based on the extent to which we expect it will be able to meet or exceed a set of Exit Criteria within a certain time frame. The *risk* associated with those estimates can be characterized in terms of a *probability of failure* which, if the analysis is done properly, can be estimated using best practice techniques (viz. six sigma quality methods) borrowed from industry. In that case, the industry metric for new products, called First Time Yield (based on the probability of defects) is analogous to a First Time Success estimate for technology prototypes which is based on the probability of failure.

The results of a Value Analysis can be captured in a Value Scorecard (Figure B.15).

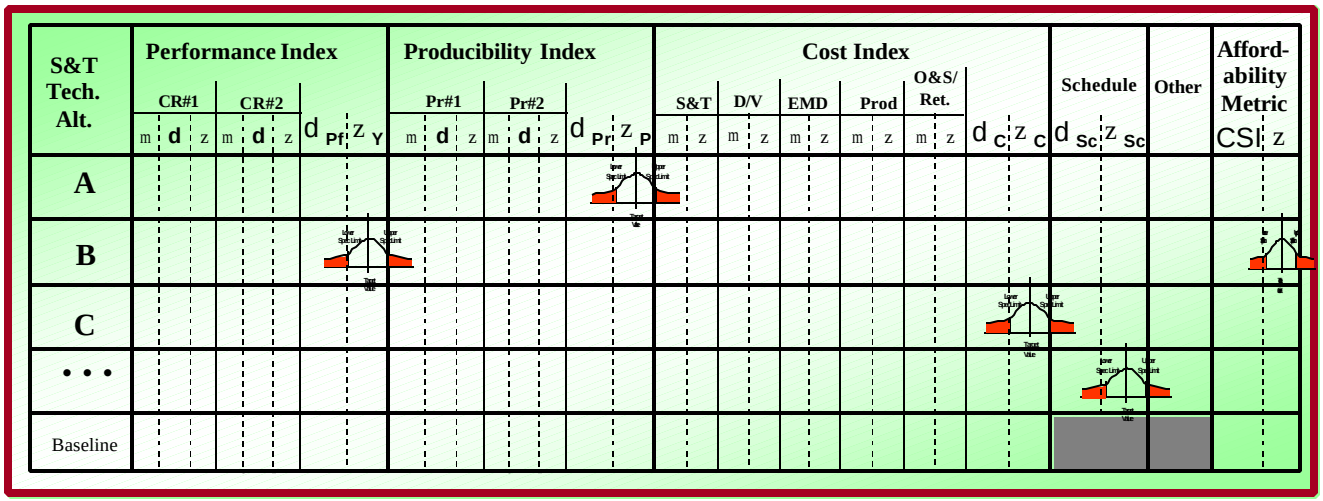

Figure B.15. Value Scorecard

The S&T Value Scorecard shown here is divided into five general areas, Performance, Producibility Cost, Schedule and Other. The two rightmost columns contain two affordability metrics, a Customer Satisfaction Index and an overall risk of failure (zeta). Within each of the general areas, such as Performance, there are columns associated with customer requirements (CR#1, CR#2, which correspond to exit criteria). Note that in the producibility area, the requirements have to do with producibility requirements (PR#1, PR#2, etc.). Within each requirement column there are three sub-columns designated as "mu" (μ), "d" (d), and "zeta" (ζ). The technologies of interest are designated on the left and each technology alternative, A, B, or C, corresponds to a scorecard row. As discussed earlier, mu represents the value that experts and designers think they can achieve with a given technology. This expected value may be an expert estimate, or it may be based on a design analysis.

These estimates are firmed up as much as possible as the technology proceeds through its development cycle.

The desirability and risk metrics were explained earlier. On the right end of each of the general areas, there are two columns that correspond to the area *index* (viz. the *Performance Index*, the *Producibility Index*, and the *Cost Index)*. Each of these indices consists, again, of two metrics, a composite desirability (d) and risk (ζ). It is important to note that cost issues can be addressed in the same way, and on the same terms, as performance and producibility issues. Experience suggests that schedule risk should be handled in the traditional manner and is related to the overlap of the S&T deliverables with the transition window. Other, less tangible but important risks, such as issues in foreign sourcing, are addressed in the *Other* column.

In the case of performance, producibility and cost, the actual numbers that populate the scorecard are derived from underlying documents. The approach in industry, and in the tools that are under development to support this process, has been to develop the supporting data in performance, producibility and cost worksheets. The worksheets are supported by underlying design, producibility and cost analyses. A number of different methods may be employed to perform these analyses, including desirability analysis, designed experiments, response surface analysis, models and simulations, process capability analysis, cost models and expert consensus.

Often, several scorecards are developed during the course of a program. A preliminary scorecard, based principally on expert consensus, might be used to perform a higher level technology assessment. A detailed scorecard, based on actual design variables, models, simulations, statistically designed experiments and response surface analysis might be developed to support investment decisions for a specific technology or critical sub-system component. It is important to observe that the scorecard can be a powerful and effective affordability tool regardless of the level of abstraction or detail available to the analysis. It can be developed fairly quickly and inexpensively to provide credible but rough order-of-magnitude estimates, or more time and effort can be devoted to a higher fidelity, more substantial analysis.

There are many benefits that result from using these metrics in S&T, and there are additional benefits that result from developing and populating a value scorecard. Some of those benefits include:

a. The desirability (d) and risk (ζ) metrics transcend very different areas (performance, producibility and cost). Hence, they provide a capability to assess *overall value* as a function of those areas.

b. By using two metrics, an *affordability vector* is developed. What results from the desirability metric is a sense of how a technology stacks up in the customer's eyes, when all of the customer requirements and the importance (weights) associated with those requirements, are factored in. The risk indices and the overall risk provide a quantified roll-up of the accumulated risk, building it up from individual requirements level.

c. Because of the process, cost and risk drivers are fully traceable right down to the original requirements, design parameters, analytical assumptions, and other factors. The scorecard itself enables project managers to quickly identify cost drivers and locate their origins. And, because the indices associated with each area are built up from the underlying worksheets, which contain *all* of the requirements, rather than the limited set selected for display in the scorecard, any serious discrepancy between the displayed requirements and the indices points to the fact that one must dig deeper (into the worksheets) to understand the issue.

d. The Value Scorecard enables better, more defendable technology investment decisions. Without exception, every pilot project that has engaged in this process has benefitted from the outset, beginning with a requirements analysis that includes identifying the measures, objectives and thresholds. The scorecard represents the denouement of that process, a bottom line assessment of how each technology stacks up against the S&T Exit Criteria. The scorecard *does not make the decision*, however. Rather, it provides the information required to make the decision. That information can support the use of other tools, where methods such as the eigenvector (analytic hierarchy process) can support a formal decision-making process.

B.9.1.5 Technology Development.

The fifth activity in the process shown in Figure B.10 is the technology development effort itself. During technology development, the methods and estimates that were used in the preliminary value analysis are revisited. Scorecard estimates are refined as more data become available and confidence in those estimates improves. As the program proceeds, it may become obvious that certain exit criteria will or will not be met. One of the strengths of using a scorecard approach is that exit criterion is traceable back to a specific customer requirement. If the program is being managed using an IPPD approach, *the customer is still involved during technology development*.

Because the path from requirement to scorecard metrics is fully traceable through underlying worksheets, it is possible to rapidly and cost-effectively perform various impact analyses. Impact analyses reveal the overall impact on system performance, producibility and cost that may result from changing the objectives and thresholds associated with individual requirements. Hence, thresholds and desirability curves can, at any point, be revisited with the customer, and, given access to appropriate software tools, the impact of changing thresholds on scorecard performance, producibility and life-cycle cost parameters can be seen immediately in the scorecard, and in the affordability roll-up metrics (customer satisfaction and overall risk).

B.9.1.6 Technology Delivery

The final activity in the process shown in Figure B.10 addresses the final analysis and delivery of the project results. The analysis is captured in the *business case* portion of the Technology Transition Plan (TTP). In the context of this process, the TTP is viewed as a *living document*. It evolves over the course of the project, and includes the results of the value analysis, including the scorecard. Once the project is complete, the TTP serves as a transition document, detailing the performance, producibility

and life-cycle cost issues, and discussing the overall affordability of the technology in terms of the extent to which it satisfies the exit criteria. The results of the program are cast in terms of the customer's language and perspective. All claims regarding performance, producibility and life-cycle cost are supported by the underlying analysis.

B.9.2 Summary

The IPPD process and methods outlined here provide a structured, measurement-driven approach to technology development. They can be employed at a high level of abstraction, or at a detailed design level. They can drive technology development. For example, even early in the technology development process, knowing the type and fidelity of the information that will be needed down the road in a value analysis can drive the input and output requirements for a modeling and simulation effort. Often, in order to measure a given requirement, correlation studies must be performed to establish the relationship between objective laboratory measurement and human perception.

IPPD is not an add-on. It must be comprehensive and intrinsic to the effort, *a way of doing business*. The process and methods described here help substantially in providing a framework in which to proceed with an IPPD-driven technology development effort.

APPENDIX C

DoD S&T AFFORDABILITY PROGRAMS
(1997 - 1999)

1997 - 1999 S&T Affordability Programs

On an annual basis, fifteen to twenty tri-Service/DARPA affordability programs are identified and evaluated on how well they meet the defined affordability criteria (described in Section 2). These 6.2/6.3 programs represent S&T projects from many different technology areas as identified in the Defense Technology Area Plan. The results of the S&T Affordability Task Force review are presented during to the Defense S&T Advisory Group (DSTAG), the senior service/agency body that develops S&T policies and priorities. A listing and brief description of how these programs addressed affordability issues follows.

AIR PLATFORMS DEFENSE TECHNOLOGY AREA	
Advanced Motor Drive (1997)	Four year, $3.8M Air Force CRDA (with $4.0M cost share by Sunstrand) to design, fabricate and test a 270 VDC electromechanical actuator (EMA) for a spoiler surface of a transport aircraft. It is to achieve double (1 kW/lb) the power density of present day systems with 81% efficiency. Notable affordability practices: • IPT established (with participation from Boeing, Sunstrand, C-17, C-5, B1B & ManTech). • Cost sharing of program developmental expenses by contractor. • QFD and HOQ being used.
Tier II+ High Altitude Endurance Unmanned Air Vehicle (1997)	DARPA-sponsored ACTD initiated in 1990 to respond to a JROC request to develop a high altitude, long endurance, reconnaissance, survivable, target acquisition (RSTA) systems for theater area defense. Users are USACOM, ACC and ASC. Notable affordability practices: • IPT key driver of program management approach. • Maximum use of COTS (very few mil-specs). • $10M unit flyaway cost driving performance tradeoffs (CAIV). • As ACTD, DARPA has applied section 845 “other agreements” authority, which avoids the DoD 5000.1 acquisition & contractual requirements. This motivates contractor to provide more affordable product that maximizes performance. • Extensive user involvement with 24-month user operational field demo requirement. • Parallel affordability program exists in agile logistics to address reduction of life cycle cost and part count. • Transition team in place with a plan to be established in FY98.

AIR PLATFORMS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Miniature Air Launched Decoy (1997/1998)	DARPA ACTD ($26M) with Teledyne Ryan to develop a launch vehicle decoy. The objective of the program is to build a miniature air vehicle that mimics aircraft or weapons with a $30K average unit fly away cost goal at unit 3,000. The F16 is the vehicle in which the technology is to be demonstrated. Details on this program are found in Section 3.4.
Rotary Wing Structures Tech Demo (1997/1998)	The Army's Comanche is the combat demonstration vehicle for transition of this new composites technology that focuses on reducing weight and strengthening military vehicles while developing more efficient manufacturing processes. Notable affordability practices: • Strong connectivity shown between the program's technology development and cost reduction goals. • Tools in place for process control, manufacturing, and simulation. • Good "up-front" use of modeling and simulation to define the ManTech process needs for both the military and commercial application – there is cost sharing to reduce the cost. • Specific plans for affordability metrics such as teaming, IPT training, use of IPPD tools, and a transition plan.
Next Generation Transparency (1997/1998)	Air Force ($5.7M) program to develop affordable transparency systems with 80% reduced production costs, 20% lower weight, 90% fewer parts, and reduced change-out time. The first efforts demonstrated the feasibility to design (with CAD) and manufacture transparencies, while the Phase 2 contracts, presently underway, are to adapt the technology to meet future requirements of the Joint Strike Fighter (JSF) and the F-22. Notable affordability practices: • Good customer ties (i.e., JSF, F-15, and F-22). • Contractual requirements to practice affordability using the AF S&T IPPD Process Model. • Leveraged funds from various sources such as Wright labs (AFMC), industry and the Navy. • Programmed funds into the contract for extensive training in IPPD, six sigma, CAIV and design of experiments. • JSF Transition Plan required as part of this program plan. • Exit criteria and quantitative goals defined and tracked.

AIR PLATFORMS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Unmanned Combat Air Vehicle (1999)	Joint DARPA/Air Force, Advanced Technology Demonstration with funding of $110Mover 3 ½ years. Objective to design, fabricate and flight test a revolutionary tactical airpower system that augments the manned force, enables preemptive and reactive suppression of enemy air defense and provides persistent all-weather capability for high-risk and high-payoff missions. Goal is to provide this capability at an O&S cost that is less than 25% of current aircraft O&S costs and at an acquisition cost that is less than one-third of new manned aircraft. Notable affordability practices: • Competing contractor teams have implemented IPPD principles during first phase. All team members have attended IPPD training. Multidisciplinary IPTs are aligned with work breakdown structure. • Affordability figures of merit are key elements of the program. All technologies must "buy their way onto the program." • System maturation plan in preparation for low risk transition into EMD. • The government management team includes all of the key stakeholders – warfighters, acquisition, S&T. • After completion of competitive Phase I, both government and industry will be represented on all key IPTs. • Contract incentive plan established to encourage affordability best practices.
Joint Expendable Turbine Engine Concept (1999)	Four-year, $9.8M joint Air Force, Navy and DARPA program in which the objective is to provide a propulsion technology base of proven, high-payoff, components aimed at both new and engine upgrades/derivatives for subsonic/supersonic missiles/unmanned air vehicles (UAVs) for both tactical and strategic missions. Notable affordability practices: • IPPD supported and encouraged by management. The management IPT includes all stakeholders (government, industry, S&T and acquisition). • Contractor is using Six-Sigma tools in its decision analysis. • Program is leveraging activities including other 6.2 and 6.3 S&T, IR&D, Dual Use S&T. Cost sharing by Air Force, Navy, DARPA, and the contractor. • Contractor and government personnel are receiving affordability training and funding has been identified to support training.
MATERIALS/ PROCESSES DEFENSE TECHNOLOGY AREA	
Composite Armored Vehicle (CAV) (1997)	The CAV ATD was a key element of the Army's effort to develop lighter, more deployable & survivable ground combat vehicles. It demonstrated the technical feasibility and operational potential of composite materials for vehicle hull structure and armor. The demonstrator was designed to support the development of future lighter weight vehicles with at least a 33 percent reduction in hull structure and armor weight and with reduced development time, costs and risks. One of the two model programs originally selected by the ATF for "best practices", additional affordability details are found at Section 3.1.

MATERIALS/ PROCESSES DEFENSE TECHNOLOGY AREA (CONT'D.)	
Nanoscale Coatings (1998/1999)	Navy program to reduce ship maintenance costs (over $4B in 1996) by coating parts with a protective spray (i.e., tungsten carbide cobalt – WC/Co) that increases part life, extends the period between scheduled maintenance, and allows for repair of parts vice costly replacement. Notable affordability practices: • IPT participants from the program's technology developers (e.g., industry and university developers), shipyard personnel, and the user of the nanostructured materials technology (i.e., NAVSEA CVN77). • Reduction in life cycle costs by applying these revolutionary coatings to parts. For example, applying this technology to the launch catapult yields an estimated cost reduction of about $30 million over 10 years. • State-of-the-art coatings have revolutionized the coatings industry to the point where ships that have been docked can now come back into service by repairing them with nanostructured materials technology.
Laser Eye Protection (1998)	Air Force program to develop next generation eye protection (i.e., holographic filters or eye-centered rugate filter technology) to counter an evolving laser threat. Flexible manufacturing techniques are being investigated to replace expensive visors originally developed using laser absorbing dies and reflective filters. Notable affordability practices: • Good management support – AF execs supports IPPD training; 3-day training session on IPPD conducted shortly after the April '97 Kickoff meeting. • IPT has a wide range of participants including industry, government, customers and "house of quality (HOQ)" advisors. • A Technology Transition Plan in place that contractually requires industry assessments, manufacturability analyses, and cost analyses throughout program. • Program designed to meet the joint warfighting needs of both the Air Force ACC and Special Forces (SOCOM), with a goal to include transition funding in POM 00.
Composites Affordability Initiative (1998)	Joint Air Force/Navy/Industry long range (8-10 years) initiative to develop the tools and technologies necessary to enable aircraft designers to design an "all-composite" airframe to enable reductions in cost and weight. Notable affordability considerations: • User requirements identified early on. • Multiple applications (i.e., aerospace control, air-to-surface, and special operations forces) modeled. • JSF is a committed customer. Also Rotary Wing Structures ATD, another Affordability Program, is to collaborate with AF on CAI. • IPT consists of government and the four main airframe companies (Boeing, Lockheed Martin, Northrop Grumman, and Scaled Composites), who share data and funding. • IPPD process well defined and an Executive Council consisting of industry and government members heads up the entire IPPD. • A 6 ft. graphite epoxy composite structure was initially demonstrated for the target of $150/pound versus $1500/pound manufacturing cost.

MATERIALS AND PROCESSES DEFENSE TECHNOLOGY AREA (CONT'D.)	
Modular Hybrid Piers (1999)	Four year $3.2M Navy program to develop composite reinforced concrete pier concepts in order to obtain stronger, flexible piers that require less maintenance (i.e., 80% reduction in waterfront maintenance/repair). Existing steel structures built in the 1940's need to be replaced, and this program is to determine the feasibility of replacing these old piers with composite piers that are slightly more expensive (1.0/1.05 difference in cost) but that reap the benefits of extended life. Specific technical areas addressed include a technique to bond polymer matrix composite strands to concrete piers vice rebar. Notable affordability practices: • Unit cost of building piers with composites as opposed to steel is slightly higher, however, there are potential life cycle cost savings using composite materials, the piers are modular (i.e., able to be relocated), and allow operational flexibility. • Naval Station San Diego has endorsed and is to provide 6.4 funds to the program to rebuild Pier 14 of the San Diego facility.
GROUND & SEA VEHICLES DEFENSE TECHNOLOGY AREA	
Advanced Enclosed Mast (1997)	$23M, 3-year ATD program (See Section 3.3 on case study report) that seeks to introduce composite structures into Navy surface combatants. Objective is to demonstrate an integrated composite antenna mast for surface ship applications having reduced signature, reduced topside weight, and improved antenna/sensor performance. Notable affordability practices are discussed in Section 3.3.
Future Scout & Cavalry System (1998)	Focused on meeting the Army's tactical reconnaissance armored combat equipment requirement (TRACER). As a Fast Track program, results from the 6.3 ATD will feed directly into EMD. The program is a joint U.S./U.K. effort. Notable affordability practices: • The user (at Fort Knox) has budgeted EMD funds to transition this program. • Exit criteria have been identified -- such as the minimal acceptable signature reduction detection time of 3% for the thermal optical radar. Thresholds are defined for the current baseline and at the end of the ATD. • IPPD will be contractually required when the program begins in August 1998. Texas Instruments, who helped the Army develop their IPPD methodology, will be on the team. • Good use of CAIV, especially with a high percentage of "tradable" requirements.

GROUND AND SEA VEHICLES DEFENSE TECHNOLOGY AREA (CONT'D.)	
SC-21 Manning Technology for Affordability (1998/1999)	Program to develop multi-modal watchstations that optimize human-computer interaction. Goal to change the traditional Navy approach to shipboard manning by enabling at least a 2-to-1 combat systems manning reduction with sustained performance. Notable affordability practices: • IPT structure utilizes multidisciplinary team from 6.1, 6.2, 6.3, 6.4 communities and the Fleet operators. • Excellent communication system in use with quarterly IPT Reviews, frequent communications via a website, monthly electronic reporting, and biweekly video teleconferences. • Unit/life cycle savings – multi-modal watchstation function combined to reduce the number of functions for cost avoidance of $1.1M/year/ship & overall life cycle cost savings estimated at $100K/watchstation. • Multiple platforms being analyzed for multi-modal watchstation technology application, include SC21, CVX, AEGIS Block 6 and 7, LHX, and NSSN.
Reduced Ships Crew by Virtual Presence (RSVP) (1999)	Navy ATD ($14.5M) is to demonstrate a multi-functional, fault tolerant, microelectromechanical system (MEMS) based, wireless sensor network for real-time internal ship situational awareness. Purpose is to significantly contribute to DD21 manning reduction requirements by replacing the human sense, fuse and information assessment functions for monitoring and evaluating the health of machinery, structure, environment and personnel. Notable affordability practices: • IPPD approach established with an IPT structure that includes all the stakeholders including the warfighters, the primary transition customer (DD21), other potential transition customers, prime contractors and subcontractors. • IPT training planned, including refresher training on an annual basis. • Affordability metrics established and part of the program trade analyses. • Technology transition enabled by a memorandum of agreement (MOA) executed between ONR and the PEO/PM DD21. • Leveraging of existing DARPA-developed technology and is use of open systems architecture approach (application of common components across multiple systems).
WEAPONS DEFENSE TECHNOLOGY AREA	
Concentric Canister Launcher (1997)	ONR-sponsored program to develop a universal launcher for the next generation combatant ships. Notable affordability practices: • 50% LCC savings (compared to MK-41). • 30% production cost savings. • Technology development has been advocated by Chief Maintenance Office of Atlantic Fleet and has potential to apply to multiple systems (SC21 and CVX).

WEAPONS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Enhanced Fiber Optic Guided Missile (EFOGM) ATD (1997)	Validate Army missile technology for precision strike at 15 km by guiding missile as it travels through the atmosphere with an online view. Notable affordability practices: • Contractual IPPD requirement. • Cost plus incentive fee contract with 50/50 share line. • Development of cost avoidance plan to help transition technology. • Extensive use of electronic drawings and simulation exercises with soldiers; maximum COTS. • Co-location of IPTs in contractor facilities. • Committed customer (Ft. Benning infantry school/XVIII Airborne Corps) to buy 300 missiles.
Objective Individual Combat Weapon ATD (1998)	Army program to apply an open systems approach to replace weapons (i.e., the M16 rifle family, M203, and modular weapon system) with one OICW that integrates many different weapons components (e.g., CCD magnifying video camera, laser rangefinder, kinetic energy module, thermal sight, etc.). The OICW is a dual munition weapon that performs high explosive, air-bursting munition as well as NATO kinetic energy projectile (5.56 mm). Notable affordability practices: • Users of the weapon are involved in the program planning from the start. • IPPD team training (QFD, design for manufacturability, Cp-Cpk, and team building) was conducted for government and industry team members for 1 week at Motorola University. • OICW provides more than 5 times the firepower and greater than 5 times the lethality at a lower cost and weight comparable to other systems. • In comparing the OICW system to ammo procurement costs, there are potentially millions in dollars of cost savings.
Large Aircraft Infrared Countermeasure (1997/1998)	Air Force program (6.3-funded at $20M over 5 years) to develop and test advanced laser IRCM technology. Notable affordability practices: • AF model for affordability in S&T contractually required to be used with good support from senior management and well-constructed IPT (with warfighter participation). • CAIV goals being implemented and tracked. • Meets joint warfighting needs of AMC, and is being reviewed by JROC. • Technology Transition Plan (TTP) in place with funds identified in EMD to effect transition.

WEAPONS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Integrated Situation Awareness and Targeting ATD (1999)	Army program to integrate radar, missile and laser warning spectrums to provide full dimensional threat protection and to increase the number of sensors in the tactical battlefield to provide real-time target location, identification and hand-off. Extensive test and evaluation will be conducted as part of the ATD. Notable affordability practices: • Acquisition program managers endorse transition of technology and funding is planned for EMD. • Exit criteria established by warfighter, acquisition and S&T communities. • Software and hardware affordability metrics specified and include design to unit production cost. • Open system architecture approach being applied to technology insertion. • IPT structure established including all stakeholders in government and industry. • IPPD training of both government and industry team members. Additional training is planned during the first year of the program. • Leveraging of completed and on-going S&T and product improvement activities. • Clear management support for affordability.
Objective Crew Served Weapon (OCSW) (1999)	This model program of affordability practices is a new, four-year, $30M Army 6.2/6.3 funded program that includes $2M from the Marine Corps. The objective is to develop and demonstrate a lightweight, 2-man portable weapon with overwhelming lethality for the dismounted soldier that includes lightly armored vehicle penetration capability. The approach includes the development and demonstration of successive levels of sub-system integration and capability. Notable affordability practices: • IPPD tools and procedures are understood and are being applied. • IPPD is required in contracts. • QFD implemented with the customer to identify key issues. • Life-cycle IPTs in-place with specific operating procedures, guidelines, and empowerment. • User involvement maximized to ensure first time product solution that complies with operational requirements. Large emphasis on design for manufacturability, reliability and maintainability. SOW requires "design for production affordability". • Leveraging of Army ManTech activities and of commercial processes. Also use of common components across multiple platforms. • Transition to the PM Small Arms is planned and EMD funding is planned. • MOA in preparation. • Specific exit criteria have been defined including affordability goals. ATD metrics being used to assess progress toward ATD goals, EMD entry risk and Operational Requirements Document (ORD) compliance. • ATD co-located with the acquisition program manager.

SENSORS/ELECTRONICS DEFENSE TECHNOLOGY AREA	
Power Electronic Building Blocks (1997)	The Navy PEBB program is to enhance the affordability of a military system by developing a single package with a multi-function controller that: replaces complex power electronic circuits with a single device; reduces development and design costs for complex power circuits; and simplifies development and design of large electric power systems.
Improved Space Computer Program (1997/1999)	6.3-funded Air Force space development electronics program ($55M/5 years from FY97-01) to identify, develop and demonstrate an open, affordable architecture that can meet the requirements for the majority of next generation DoD space systems. Phase 2 and 3 are to investigate flexible, scaleable open architecture systems for next-generation DoD space systems. Notable affordability practices: • SOW requires that affordability assessment be made for all proposed Phase 1 ISCP architecture concepts. • Good examples of affordability measures provided such as developer surveys, HOQ, sensitivity analyses, etc. HOQ indicates that acquisition and warfighter community committed to implementing the results of this program. • Leveraging of work on NASA Jet Propulsion Lab Remote Exploration and Experimentation Project.
Ballistic Wind Sensors (1997)	Air Force program to develop affordable multi-platform eye-safe airborne wind profiler system. Notable affordability practices: • Dual use applications for technology. • Strong IPPD/IPT structure. • Leverages ManTech funds. • Good use of producibility tools, including assessment of contractor's manufacturing capabilities, investments in CAD tools, use of a bottoms-up cost model, and lab experiments to validate tolerance for key components.
3-D Optical Memory (1997)	$5M, 3-year, 6.3-funded Air Force program being conducted by Call Recall, a group of university professors, to develop optical device technology to store digital data in 3D. Potential dual-use program that could lead to better computer storage devices for commercial use.
Integrated Sight Module (1997)	$6M Army program with Texas Instruments (awarded in June 1996) to design and build 12 integrated sight modules to deliver to the Land Warrior program for evaluation. Program purpose is to develop technology for target location and "call-for-fire". The 21st Land Warrior and the Thermal Weapon Sight programs are both customers for this technology and are actively involved in the program developments. Notable affordability practices are: • Contract IPPD requirements include tailored strategy for IPPD, establishment of process/quality goals via estimation of sigma levels (currently at 4.4 sigma), affordability status reporting at program reviews, and well-defined exit criteria (i.e., weight, performance and power). • Users interviewed by contractor in order to develop program goals. • Program focus on technology integration of completed design; plans for EMD and technology transition being developed. • Team and IPPD training was conducted by contractor before contract was let and funds for training have been set aside.

SENSORS/ELECTRONICS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Miniature Module Microwave Receiver (1998)	Navy program to develop series of 5 common MMIC RF modules. These high performance miniature RF receivers and RF channelizers are to be integrated across a variety of platforms such as aircraft, submarines, and ships. Notable affordability practices: • Reduces size, weight and cost of RF receiver – 1 "black box" replaces 4 components. • R-300A MIMIC receiver replaces the TN-613 tuner for a weight savings of over 30 lbs., volume reduction from 900 cu. in. to 11.5 cu. in and a cost from $120K each to less than $50K each. • Weight savings translates into fuel savings. • Customer committed -- Navy Cooperative Engagement Capability is targeted for this technology in 2000. • MTBF expected to increase to greater than 1,000 hours (previously less than 100 hours) for added life cycle cost savings. • Applicability of new receiver to a wide range of platforms.
Acoustic Sensors & Sources (1997/1998)	Navy program to demonstrate a new all-optical acoustic sensing technology that greatly reduces the cost and complexity of towed arrays. Submarine towed arrays are to replace the TB-29 by the year 2000, and the Anti-Submarine Warfare (ASW) program is another prospective application. Notable affordability practices: • Focus on building smaller, lighter and more capable products. • Good connection to the customer in creating transition plans. • Cost savings ($1K versus approximately $10K cost for the TB-29 acoustic channel). • Trade studies being done to identify cost drivers, measure performance, estimate LCC, and demonstrate cost savings and overall best value to DoD. • Reduced number, cost, and complexity of acoustic (wet end) components.
Multi-Mission Common Module Unmanned Air Vehicle Sensors (1998/1999)	Army ATD in which 2 synthetic aperture radar (SAR) prototypes are being built at a target price of $7.3M. The acquisition strategy for this program includes incentives for the contractor to better this cost goal as the government and industry share in the profit (60/40). Notable affordability practices: • The contractor performing cost/performance tradeoffs. • Two IPTs established – one team to discuss contractual issues and a second IPT, "Sensor Suite Commonality Tradeoffs", to discuss technical trades. Each team consisted of both government and industry members. • Customer (TRADOC) has specified unit production cost goal. • CAIV used as an affordability tool. • Training in IPPD, Taguchi methods and QFD. • Transition path to Tactical UAV for EMD identified and production funding in POM.

SENSORS/ELECTRONICS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Multifunction Staring Sensor Suite (1999)	Army ATD to provide "leap ahead" target acquisition technology for future ground vehicles with an emphasis on the Scout. Program is addressing most affordable combination of infrared (IR) bands that will enable improved target detection, recognition and identification. Notable affordability practices: • IPPD is contractual requirement. • Affordability goals established with production cost estimates for affordability tradeoffs. The baseline concept and costs have been identified. Metrics are being monitored at all program reviews. • The transition customer (PM Scout) is on the IPT. • Application Steering Group established that includes the warfighter and potential acquisition representatives to facilitate effective transition. Close collaboration with PM Night Vision to assure technical maturation sufficient for adoption by future ground systems beyond Scout. • COTS, open architecture approach used and leveraging of prior detector/cooler ManTech work.
Advanced Common Electronic Modules (1999)	Navy program ($12.8M/4 years) to reduce the life cycle cost, weight, power and wiring of air, surface, undersea and space platforms by developing highly integrated common RF electronic modules capable of transmitting and receiving signals between 50MHz and 45MHz for radar, electronic warfare, communication and data link functions. Notable affordability practices: • Program organization structured as a high-level IPT with both government and industry participants including the prime contractor for the transition target. • Program appears to have a solid, systems engineering approach to achieving the objective and mitigating risks.
Enhanced Recognition & Sensing LADAR (ERASER) (1999)	Air Force program ($5.5M) to extend the capabilities of the FLIR/Designator Targeting Systems (FDTS) to improve non-cooperative target identification for combat missions. Laser illuminated ID techniques are being integrated into the FDTS to achieve high resolution TV-like images. Notable affordability practices: • Program decision milestones heavily influenced by affordability concerns. • IPTs formed and training in process. • There is leveraging of other S&T funding of all three Services and DARPA to reduce program risk.

SENSORS/ELECTRONICS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Affordable Multi-Missile Manufacturing (1999)	DARPA ATD to demonstrate advanced missile design and manufacturing enterprise concepts and systems. Focuses on missiles, seekers, and guidance control section (typically 60% of a missile's cost). Through reduction of design in manufacturing span times, development of common architectures, and introduction of improved technologies without significant redesign, M3's goals are to reduce costs of mature missile systems by25% and developing systems by 50%. Notable affordability practices: • Emphasis on rapid product development, enterprise integration/information sharing between primes and suppliers and improved supplier management practices. • All stakeholders, including industry and PEO/PM reps, part of decision-making process. • Cost sharing between government and Lockheed Martin/Raytheon. • Formal training with the suppliers (e.g., activity-based management). • .Leveraging of internal IR&D and many S&T programs. • Use of common components across multiple platforms, including Army missile systems, BMDO technology insertion activities in the navigation area for use of common interferometric fiber optic gyro (IFOG) components across many BMDO missile systems, and a number of commercial processes. • Technology transition handled directly between the two missile contractors and program executive offices.
SPACE PLATFORMS TECHNOLOGY AREA	
Thin-Film Space Solar Cells (1999)	Air Force program whose objective is to increase power on-orbit while decreasing power system mass and cost. Specifically, this effort is developing lightweight, flexible array structures with 12-15% efficient solar cells with 150-200W/Kg costing less than $50/W. Applicability is for next generation, defense-unique small satellite missions. Notable affordability practices: • Plans to incorporate affordability tools and practices within this new effort. • IPT formed including government and industry. SPO representatives will be invited to attend meetings. • Leveraging DARPA and other Air Force 6.1 & 6.2 solar cell development programs.
High Efficiency Solar Cells (1999)	This is a new, three-year, dual use S&T Air Force program with $9M plus funding that began in FY99. This is a fifty/fifty industry/government cost share effort in which the objective is to develop a 35% efficient solar cell to increase power at a given size (W/M^2). Benefits include reduced storage volume, aerodynamic drag and radar cross-section at a specific power level, and the ability to provide sufficient power at a reasonable size for Largesats and Monstersats. Notable affordability practices: • Leveraging of Navy, NASA, BMDO, DARPA and other Air Force space technology alliance efforts to improve solar cell technology. In addition, the vendors for the commercial satellite industry are the same vendors funded under this effort. • IPT formed including government, industry and SPO representatives before program start, and training is planned. • Specific cost per watt goal has been established. • Six sigma statistical process control techniques being implemented. • Exit criteria include a specific cost goal and transition.

INFORMATION SYSTEMS TECHNOLOGY AREA	
C2 Protect (1999)	Army five year ATD ($34M) to develop, integrate and validate hardware and software tools that will secure the systems and networks of the First Digitized Division (FDD) and beyond. Some areas of interest include intrusion detection, situational awareness, whiteboarding, video teleconferencing on the battlefield, SINCGARS radio interoperability, and Tactical Internet. Notable affordability practices: • COTS technology used extensively with a goal to "fix" the vulnerabilities that are associated with inserting commercial technology into military systems. • Leveraging of funds with Dual Use S&T program and the customer (Division Integrated Systems Command, Control, Communications and Computers). • Though no formal transition plans are in place, there appears to be good dialogue with monthly IPT meetings that include participation by the warfighters and program executive offices (PEOs).
HUMAN SYSTEMS DEFENSE TECHNOLOGY AREA	
Next Generation Soldier System ATD (1997)	The Army's GEN II ATD is the cornerstone program of the 21st Century Land Warrior (21 CLW) Integrated Technology Program (ITP). It is the primary effort to address future dismounted soldiers as a system and as a weapons platform. The purpose of the GEN II ATD is to enhance individual soldier's survivability, lethality, mobility, and situational awareness. The GEN II ATD will accomplish these tasks by improving upon current dismounted soldier capabilities while reducing the size, weight, bulk and power requirements relative to current equipment as well as provide new capabilities previously unavailable to dismounted soldiers. The GEN II program, one of the two initial "model" programs selected by the ATF, is detailed in Section 3.2.
Advanced Embedded Training (1997)	Navy/ ONR-sponsored ATD program (funded at $11M over 3 years) to improve tactical team combat readiness through enhanced embedded training. Directly addresses the affordability issue of training costs as a major contributor to system life-cycle costs. Goal is to reduce pier-side and shore-based training and their associated cost. Notable affordability practices: • AET transition plan being formulated. • Customer (Navy PMS 400 AEGIS Program office) actively involved in technology development program. • Good use of COTS. • Metrics established by AEGIS team (i.e., decision making speed and accuracy is expected to improve by 25-40%, while life cycle costs of training are to be reduced). • No formal IPT training; however, program development being conducted by research psychologists who typically utilize tools for IPPD/IPT (team dynamics, QFD, etc).

HUMAN SYSTEMS DEFENSE TECHNOLOGY AREA (CONT'D.)	
Modular Aircraft Support System (1997)	Air Force 6.3-funded ($7.5M/5 year) program to improve the mobility footprint of aerospace ground equipment. Notable affordability practices: • Extensive "up-front" work in defining maximum customer (JSF) requirements (i.e., the F-16 only needs 20 kW power, not 60 kW formerly specified) • Good IPPD/IPT tool planning (use of QFD, design of experiments and six sigma). • Addressing potential savings to be gained by dual use. • Participation by Army and Navy in IPTs. • SOW requires IPPD/IPT participation by contractor. • High degree of common interfaces between future ground equipment (e.g., frames, engines, and power functions, etc.). • Good management support with attention through Armstrong labs up to the air Technical Executive office.

APPENDIX D

TRAINING AND EDUCATIONAL COURSES

TRAINING AVAILABLE RELATED TO S&T AFFORDABILITY

The courses listed below represent a sampling of what is available from industry to support the implementation of Integrated Product and Process Development principles and related methods and tools. The list is not complete, and only those courses indicated have actually been attended by government personnel from whom feedback on course quality and content has been obtained.

E.1 IPPD Overview.

Course Title	Provider	Description	Time	'98 Cost
Affordability in S&T: An Introduction	James Gregory Associates	Affordability overview with hands-on excercises. Address web-based training, metrics and value analysis.	2 Days	$595
IPPD in ATDs & ACTDs	National Center for Advanced Technologies	Short course, aimed at government & industry, Washington perspective	3 days	$100
Affordable Technology Through IPPD	James Gregory Associates	In-depth, hands-on course in methods and tools to achieve affordable new technologies. An end-to-end example is worked in class.	3.5 days	$895
IPTs & IPD	Boeing	Internal Course open to customers & suppliers	6 hrs	-
IPPD Background/ Overview	NTU (Video, Distance)	Video Course, 2 hrs/wk, 6 months, delivery over VTC (Broad Offering, Jul-Dec 93)	48 hrs	$900
Concurrent Engineering Short Course	UCLA	Definitions, concepts, tools and case studies	5 days	-
Fundamentals of Concurrent Engineering	Society of Mfg Engrs	Provides background to initiate development of detailed, company plan	2 days	$475
World Class Concurrent Engineering	MIT	MIT Video, CE Princpals, Enhanced QFD, Taguchi Qualification	4 tapes, 50 min ea	$975
Customer-Focus Product Devel. System	Raytheon	Overview of Hughes IPPD Process Implementation	2 hrs	No cost

E.2 IPTs/Teaming

Course Title	Provider	Description	Time	Cost
IPT Team Training (Dynamics & Methods)	WPAFB Campus	TQ concepts, collective analysis, process improvement	32 hrs	-
Team Leadership	T.I.	Team building, group decision making, conflict resolution	4 days	$715
Team Works	GPA/ QPC	Team selection, empowerment, basic tools	3 days	$825
IPTs & IPD	Boeing	IPD implementation, multi-disciplinary team structure, roles, responsibilities	6 hrs	-

Course Title	Provider	Description	Time	Cost
Implementing IPTs	Raytheon/ Hughes	IPT Team Definition, Roles, Deliverables	8 hrs	$104
Leading IPTs (Workshop)	Raytheon/ Hughes	IPT Management, IPT Process, Leadership Skills	16 hrs	$239
Implementation Specialist Workshop	Raytheon/ Hughes	Practical Application of IPPD Principles via IPTs	2.5 days	$401
Communicating in an IPPD Environment	Raytheon/ Hughes	IPT Communication Skills and Methods – Dialog	8 hrs	$97
Team Development Training	Raytheon/ Hughes	Four 4-hr Sessions in Team Development/Interaction	16 hrs	$286
Concurrent Engineering	Army,	Increases CE Team's Awareness of Techniques	16 hrs	-

E.3 IPPD Management

Course Title	Provider	Description	Time	Cost
A Quality Culture, the New role of Managers	Am. Supplier Inst.	Shared Decision making, Tool Selection, Team Agendas	2 days	$695
Seven Management & Planning Tools	GPA/QPC	Summary of Key Tools, including Pareto, Fishbone, etc.	2 days	$725
Risk Analysis Seminar	Expert Choice	Aimed at Marketing their Software Tool for Risk analysis	3 days	$875
Working Together in an IPT Environment	Raytheon/ Hughes	Hughes Model: How Managers Interact and Lead Teams	8 hrs	$104

E.4 Design to Cost

Course Title	Provider	Description	Time	Cost
Design To Cost	Raytheon (T.I.)	High Level Overview, DTC Principles, Benefits	1 day	$275
Fundamentals of Cost Analysis	Defense Acq. Univ.	In-Depth Acquisition Cost Analysis Training	15 days	-
Design to Cost (Including CBT)	Raytheon	Overview of Basic DTC Principles and Practice	8 hrs	$104

E.5 IPPD Design Principles – Design for Producibility

Course Title	Provider	Description	Time	Cost
Design for Six Sigma Manufacturability	Raytheon (T.I.)	Six Sigma, DPU, Variability, Cp, Cpk	2 days	$350
Design for Manufacturability	Motorola	Six Sigma, DPU Measurements, Cp, Cpk	2 days	$450
Taguchi Methods	American Supplier Inst.	Understand Robust Design, Taguchi Loss Function	1 day	$395
Taguchi Quality Engineering for Robust Design	American Supplier Inst Video	Video Overview of Robust Design Principles and Practice	1 hr	-
Six Sigma for Manufacturability	Boeing	IPD Process, impact of Manufacturing Defects, 6 Steps of 6 Sigma	18 hrs	-

E.6 Supportability

Course Title	Provider	Description	Time	Cost
IPD Design for supportability	Boeing	Supportability in Product Development, Concept, Assembly, & Packaging	6 hrs	-
Maintainability	Boeing	Basic Maintainability Concepts, Tasks and Techniques	3 days	-
R&M in Design in Systems Acq.	AFIT	Failure Analysis, Failure Modes, Testability, Accessability	10 days	-

E.7 Requirements Analysis

Course Title	Provider	Description	Time	Cost
QFD	ASI	QFD Overview, Tools, Requirements, Collection & Analysis	3 days	$845
QFD	Boeing	QFD Overview, Translate Customer Requirements into Organization Requirements	12 hrs	-
Enhanced QFD	MIT	QFD Integrated with the Pugh Concept et al Enhancements	5 tapes	$975

E.8 Design of Experiments

Course Title	Provider	Description	Time	Cost
Design of Experiments Overview	WPAFB	Conceptual Overview, Role & uses of DOE	8 hrs	-
Design of Experiments	Raytheon (T.I.)	In-Depth DOE, Latest Techniques, Hands-on	4 days	$700

E.9 Value Engineering

Course Title	Provider	Description	Time	Cost
Value Analysis & Value Engr.	Amer. Supplier Institute	Overview, Benefits, Relationship between VA/VE and QFD	2 days	$850

E.10 Cost Analysis

Course Title	Provider	Description	Time	Cost
Fundamentals of Cost Analysis	Defense Acq. Univ.	Enables entry-level DoD personnel to prepare weapon system LCC estimates.	15 days	-
Software Cost Estimating	Defense Acq. Univ.	Software cost estimating for practitioners. Software life cycle mgmt., architecture, interoperability, design approaches, metrics, capability evaluations, reuse.	7.5 days	-
Executive Cost and Price Analysis	Defense Acq. Univ.	Advanced pricing techniques for estimating costs in large procurement actions. Statistical accounting tools, cost estimating relationships, etc.	10 days	-
Reliability and Maintainability	Defense Acq. Univ.	Overview of R&M activities, based on policies in DoD 5000.2 (Defense Acquisition Mgmt. Policies), relationship to Logistics Mgmt. & Sys. Engineering	2.5 days	-

E.11 Other Applicable Courses Available from the Defense Acquisition University (DAU).

DAU consolidates and integrates education and training for more than 110,000 people in the Defense

Acquisition Workforce. Consortium member schools provide more than 85 acquisition courses to entry, intermediate, and senior level civilian and uniformed personnel to allow them to attain certification in one or more of the 11 defense acquisition career fields. A sampling of course offerings follows:

- AUD 4120 Statistical Sampling. Statistical Sampling concentrates on the knowledge and skill necessary to perform statistical sampling in the contract audit environment.

- BCF 101 Fundamentals of Cost Analysis. (15 days course) Fundamentals of Cost Analysis enables DoD personnel new to the cost estimating field to prepare materiel system life cycle cost estimates. Topics include a statistics review, regression analysis, learning curves, risk analysis, software cost estimating, exploratory data analysis, inflation adjustments, cost as an independent variable (CAIV), analysis of alternatives (AOA), contract cost structure, earned value, cost estimation for budget preparation, and economic analysis

- BCF 204 Intermediate Cost Analysis. The course emphasizes the development and application of cost analysis techniques and interpretation of the results.

- BCF 206 Cost Risk Analysis. Cost Risk Analysis prepares cost analysts to model the cost risk associated with a defense acquisition program. Topics covered include basic probability concepts, subjective probability assessment, goodness-of-fit testing, basic simulation concepts, and spreadsheet-based simulation. Practical exercises, a small-group workshop, and a capstone article review reinforce techniques taught.

- BCF 207 Economic Analysis. Economic Analysis prepares students to conduct economic analyses of materiel systems. Topics covered include multiple-attribute decision analysis, cost analysis, present value analysis, and sensitivity analysis. Students apply their expertise in practical exercises and a group workshop.

- LOG 203 Reliability and Maintainability. (2.5 day course) The course concentrates on R&M-related activities throughout the acquisition life-cycle. The aim is to enable logistics managers to understand the relationships between R&M (engineering disciplines) and acquisition logistics; and to more effectively evaluate the potential impact of R&M decisions on the logistics aspects of a systems acquisition program.

- PQM 101 Production and Quality Management Fundamentals. An entry level course that emphasizes basic production, manufacturing and quality assurance principles, policies, processes and practices used in DoD. It exposes participants to manufacturing and quality scheduling, and control techniques as well as production surveillance activities. Course content includes systems engineering, initiatives and trends, performance specifications, material control, source selection, quality assurance, technical support, and analytical tools.

- PQM 201 Intermediate Production and Quality Management. The Intermediate Production and Quality Management course emphasizes journeyman level production, manufacturing, and quality assurance principles, policies, processes and practices used in DoD. Students follow a curriculum which exposes students to manufacturing and quality processes, scheduling and control techniques, surveillance activities, and systems level production and quality planning.

- PQM 301 Advanced Production and Quality Management. The course investigates day-to-day decision making issues relevant to successfully managing three core technical tasks in DoD acquisition: systems and process development, manufacturing, and product quality management. It stresses the logical thinking process and the ability to identify and effectively work within policy, regulatory, technical, or physical constraints to management effectiveness.

- SYS 201 Intermediate Systems Planning, Research, Development and Engineering. This course covers steps in the system engineering process, requirements analysis, functional analysis and allocation, synthesis, and systems analysis/control. Specific techniques introduced include the systems engineering management plan, the functional flow diagram, requirements allocation sheet, work breakdown structure, design reviews and audits, design to cost influence, technical performance measurement programs, configuration management, developmental baseline, risk identification, and management. Special emphasis is placed on characteristics of a system such as life cycle cost affordability; readiness/supportability; reliability; testability and producibility.

- SYS 301 Advanced Systems Planning, Research, Development, and Engineering. This course uses a facilitated case study to help students become more effective in the use of the science, technology and systems engineering processes and procedures that must be followed during each phase of a system's life cycle. Students will employ requirements analyses, risk management, technical performance measures, trade-off analyses, configuration and data management, technical reviews, forecasting, design of experiments, work breakdown structures, and specification and statement of work tailoring to control and evaluate the evolutionary design of a target system. Special emphasis is placed on exploring the relationships between science and technology, systems engineering, and acquisition management.

CONTACT: Defense Acquisition University
Email: http://www.acq.osd.mil/dau/

[18] DoD 4245.7 Transition from Development to Production

Chapter 1 – Introduction

Chapter 2 – Funding

Chapter 3 – Design

Chapter 4 – Test

Chapter 5 – Production

Chapter 6 – Transition Plan

Chapter 7 – Facilities

Chapter 8 – Logistics

Chapter 9 – Management

Appendix A - Acronyms

Forward, Preface, References

DoD 4245.7-M

Transition from Development to Production

(Includes Change 1 Dated 13 Feb 89)
September 1985

Department of Defense
Assistant Secretary of Defense Acquisition and Logistics

The Assistant Secretary of Defense
Washington, D.C. 20301

Foreword

DoD 4245.7-M

Transition from Development to Production

(Includes Change 1 Dated 13 Feb 89)
September 1985

Department of Defense
Assistant Secretary of Defense Acquisition and Logistics

The Assistant Secretary of Defense
Washington, D.C.20301

Foreword

This Manual is issued under the authority of DoD Directive provides 4245.7M, *"Transition from Development to Production,"* January 19, 1984. It provides assistance in structuring technically sound programs, assessing their risk, and identifying areas needing corrective action.

This Manual applies to the Office of the Secretary of Defense (OSD), the Military Departments, the Organization of the Joint Chiefs of Staff, and the Defense Agencies. The Term "DoD Components," as used herein, refers to the Military Departments and the Defense Agencies.

This Manual is effective immediately and is authorized for use by all DoD Components. The guidance contained in this document shall be used in and tailored to individual acquisition programs. Heads of DoD Components may issue supplementary instructions, when necessary, to provide the unique requirements within their respective Components. The Commandant, Defense Systems Management College, shall review the guidance set forth in this Manual and incorporate the material in College curricula.

Send recommended changes to the Manual through channels to:

Director, Major Systems-Acquisition
Assistant Secretary of Defense for Acquisition and Logistics
Room 2A330, The Pentagon
Washington, D.C.20301

DoD Components may obtain copies of this Manual through their own publications channels. Other Federal agencies and the public may obtain copies from the Department of Defense, Technical Information Center, Cameron Station, Alexandria, VA 22304, and from the U.S.

Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

\Signed\
James P. Wade, Jr,
Assistant Secretary of Defense
Acquisition and Logistics

Preface

We have been developing and producing material with which to defend this country ever since our independence over 200 years ago. Unfortunately, we do not handle the job as well as we should. Even the programs we classify as successful can be improved.

To my way of thinking, there has been, is now, and may always be one principle in which we must strive for further improvement. That principle is disciplined engineering. It is of such fundamental importance that it drives all aspects of development and production in any successful material acquisition. When recognized, disciplined engineering dictates all facets of management. In short, everything in the acquisition process in the Department of Defense should be subservient to it; yet most of our management systems are designed to circumvent it or excuse its omission. The irony is that in today's explosion of computer utilization and the attendant time it takes to incorporate changes, we should be seeing disciplined engineering in all of its grandeur and splendor: disciplined engineering in design, disciplined engineering in test, and disciplined engineering in production.

Additionally, we must strive for improvement in the understanding and the timing of the disciplines of design, test, and production. Successfully accomplishing the engineering tasks on schedule is the important "key" to reducing the risk of a program. This has a direct and profound impact on the quality of the decisions we make on individual programs, and, in my judgment, has a more immediate and potentially much greater return on investment in time and effort (and thereby on both cost and performance as well). Most importantly, we can achieve this return on investment with the application of current policy cited in the parent document to this Manual (DoD Directive 4245.7) and using established procedures within the presently defined acquisition process.

The key word is discipline! This document is designed to facilitate that discipline that will help us collectively make wiser decisions on ongoing programs. The term selected to describe this discipline pretty well conveys its purpose and manner of use in a figurative sense. The term is "template." We would like to be able to compare ongoing programs with these templates to see whether our decisions and the actions on which they are based fall within the boundaries of an effective and efficient, low risk program.

I know full well that sound professional judgment always will be needed, and these templates are not offered as a substitute.1 also know that we tend to repeat mistakes in certain key areas in the acquisition process and that these mistakes are correctable largely by better technical decisions well within existing policies and established procedures. Therefore, these templates are provided to introduce discipline into the system, to identify and give visibility to high risk factors, and then to provide the tools by which risk can be minimized progressively.

Accordingly, I strongly commend this document to you and urge you to use it diligently.

\Signed\
W.J. Willoughby, Jr.
Chairman, 1982 Defense Science Board
Task Force on 'Transition from Development to Production"

References

(a) DoD Directive 5000.1, *"Major System Acquisitions,"* March 29, 1982

(b) DoD Instruction 5000.2, *"Major Systems Acquisition Procedures,"* March 8, 1983

(c) Military Handbook 46855B, *"Human Engineering. Requirements for Military Systems, Equipment, and Facilities,"* January 31, 1979

(d) Military Handbook 727, *"Design Guidance for Producibility,"* April 5, 1984

(e) Military Standard 785B, *"Reliability Program for Systems and Equipment Development and Production,"* September 15, 1980

(f) Military Standard 781 C, *"Reliability Design Qualification and Production Acceptance Tests: Exponential Distribution,"* October 21, 1977

(g) DoD Directive 5000.40, "Reliability and Maintainability," July 8, 1980

(h) DoD Directive 4245.6, *"Defense Production Management,"* January 19, 1984

(i) DoD Directive 4245.7, *"Transition from Development to Production,"* January 19, 1984

(j) DoD Instruction 5000.38, *"Production Readiness Reviews,"* January 24, 1979

(k) DoD Directive 5000.39, *"Acquisition and Management of Integrated Logistic Support for Systems and Equipment,"* November 17, 1983

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Chapter 1 -- Introduction

Efforts to Shorten Acquisition Process Failed

An often discussed aspect of the acquisition process in the Department of Defense is the length of time it takes to develop and deploy weapon systems. Although there have been numerous attempts to shorten this cycle, relatively little has been accomplished. The cycle has grown longer and the criticism stronger.

The reasons for shortening the cycle are directed mainly toward cost, and to some extent-though not enough-toward readiness. However, in the past few years, the issue of readiness has rightfully gained visibility and importance. Although the long acquisition cycle certainly is not a desirable situation, it might be tolerable if the process yielded satisfactory results. But most new weapon systems are less than satisfactory and require burdensome maintenance and logistics efforts. Even with the best of efforts, resultant low readiness often requires additional equipment in order to meet the needs the Military Services. This is due primarily to a lack of: "discipline in addressing logistics requirements during design and development".

Transition From Development to Production is the Problem

In the acquisition process, first evidence of weapon system problems sometimes does not become apparent until a program transitions from full-scale development (FSD) into production. This transition erroneously is thought to be a discrete event in time. Most acquisition managers seem to recognize that there is a risk associated with the transition, but perhaps do not know the magnitude nor the origin, because the transition is not a discrete event but a process composed of three elements: design, test, and production. Many programs simply cannot succeed in production, despite the fact that they've passed the required milestone reviews. These programs can't succeed for technical reasons, notwithstanding what is perceived as prior management success related to DoD acquisition policy. A poorly designed product cannot be tested efficiently, produced, or deployed. In the test program there will be far more failures than should be expected. Manufacturing problems will overwhelm production schedules and costs. The best evidence of this is the "hidden factory syndrome" with its needlessly high redesign and rework costs. In addition, field failures will destroy operational and training schedules and increase costs.

The transition process is very broad and it is impacted by activities that are, or more accurately, are not done in the early design and test activities. For contractors who have been successful in designing and producing acceptable products, it generally is recognized that the control techniques needed to successfully complete the design, test, and production elements dictate the management system needed to direct the overall effort. In fact, the current management systems in today's industrial processes had their origins in these design, test, and production requirements.

DoD Corrective Measures Have Focused on Management First

Corrective measures by the Department of Defense have focused on establishing a series of management checkpoints and review activities. This becomes apparent when the acquisition process is reviewed, beginning with the management perspective in DoD Directive 5000.1 (reference (a)) and DoD Instruction 5000.2 (reference (b)); descriptions of the Defense Systems Acquisition Review Council (DSARC) and related procedures; and the wealth of material that is available on the planning, programming, and budgeting system (PPBS) and other elements of defense planning, budgeting, and funding processes. This approach has been responsible for adding numerous layers of management, and has tended to compartmentalize, matrixes, and polarize the major areas of the acquisition process: design, test, and production.

These documents and the requirements that they spell out are important in that they establish a management grid that the various participants in the acquisition process must follow. However, they do not describe the industrial process, nor do they provide intelligence on the management and control of those technical activities and their related details that can either make or break a program. What has evolved as today's management system for material acquisition hardly recognizes the importance of development and production, much less does it utilize the vast resources of development and production data in any decision process. "Manage the fundamentals of design, test, and production and the management system will describe itself." However, and this is a particularly important point, the converse can never be true! It is impossible to describe the management system first that will take care of the fundamentals of the industrial process-engineering and manufacturing.

This patently is obvious when the management system used by the Department of Defense and its Military Services is reviewed. Yet, it seems to be the subject of continued and ongoing interest at ail levels of both the Department of Defense and the Military Services. The central cry heard in the halls of the Pentagon when things go wrong is "reorganize, restructure the management system." Some think that if enough organizational boxes or enough people are moved, the problem will go away. Of course, it doesn't, yet those responsible for creating the organizational mess think so. Consequently, we are left with a legacy that only grows worse with time. Why is this the case? Most probably because it is the path of least resistance.

The current review process, culminating in a DSARC decision for major programs, has no structural mechanism that can articulate with any degree of certainty the risk associated with the engineering and manufacturing elements of the weapon system acquisition process.

Causes of Acquisition Risk Are Technical, Not Managerial

Some communities have suggested that the problem is mainly one of delivering weapon systems that are too complex, and that reducing complexity would increase readiness. However, a recent Defense Science Board (DSB) summer study deliberated the issue of complexity versus readiness and concluded that although there is a relationship, it is relatively small and threat-driven. It was suggested that the probable cause is inadequate engineering and manufacturing disciplines combined with improperly" defined and implemented logistics programs. This industrial process of weapon system acquisition demands a better understanding and implementation of basic engineering and manufacturing disciplines. Once rigorous, disciplined engineering practices are employed and institutionalized, both the risk of deploying unsuitable

weapon systems and the time in the acquisition cycle associated with design, test, and production will be reduced.

Current DoD systems acquisition policies do not account for the fact that systems acquisition is concerned basically and primarily with an industrial process. Its structure, organization, and operation bear no similarity whatsoever to the systems acquisition process as it is described conventionally. It is a technical process focused on the design, test, and production of a product. It will either fail or falter if these processes are not performed in a disciplined manner, because the design, test, and production processes are a continuum of interrelated and interdependent disciplines. A failure to perform well in one area will result in 'failure to do well in all areas. When this happens-as it does all too often-a high risk program results whose equipment is deployed later and at far greater cost than planned.

The answers to these problems won't be found in another revision of DoD Directive 5000.1 (reference (a)) or DoD Instruction 5000.2 (reference (b)). Nor will they be found in adjustments to the DSARC or other administrative procedures. They won't be found in these areas, because the problems are technical, not managerial.

DSB Task Force Corrective Measures Focus on Technical Solution

The Under Secretary of Defense for Research and Engineering (USDR& E) recently has expressed more and more concern regarding this transition phase. Consequently, a task force was formed under the auspices of the DSB to review the various subsets of the transition from development to production. The formal terms of reference are summarized as follows:

- Examine ways and methods that will define more clearly and accelerate the transition from development into production.

- Direct the inquiry toward both the producing industry and the administering Government agency.

- Recommend those disciplines and controls for application in those activities comprising design, test, and production that result in the timely delivery of a quality product to the operating forces.

Templates Minimize High Transition Phase Product Risk

The major thrust of the DSB report is directed toward the identification and establishment of critical engineering processes and their control methods. This will lead to a more organized accomplishment of these activities and will place more significance and accountability on them. In order to do this, the task force generated a matrix of the most critical events in the design, test, and production elements of the industrial process. These events were then transformed into what are referred to as "templates," a term that defines their nature and intended use.

The underlying principle of this approach is the recognition that everyone in the Department of Defense and all of its contractors sincerely want to do a good job. If the proper environment exists and the necessary tools to accomplish the work are developed, satisfactory products will be forthcoming. Having first established these fundamentals as a reference point, it is now

necessary to ensure the right environment, which in this case, is a matter of obtaining adequate visibility, and establishing the tools, which by their use form a frame of reference to evaluate their proper application. In this case, the tools are the templates.

Figure 1-1. represents the DSB task force perspective of the transition problem and the action level that must be reached in order to define understandable and achievable engineering: solutions to repetitive transition risks. The key here is to recognize that risk is eliminated only when the industrial process is changed, and that change is effected at a level of detail normally not visible to the technical decision maker. Understanding for this crucial point is paramount to electing the low risk course of action.

The templates describe techniques for improving the "acquisition process" by recognizing it for what it is-an industrial process concerned with the design, test, and production of low risk products.

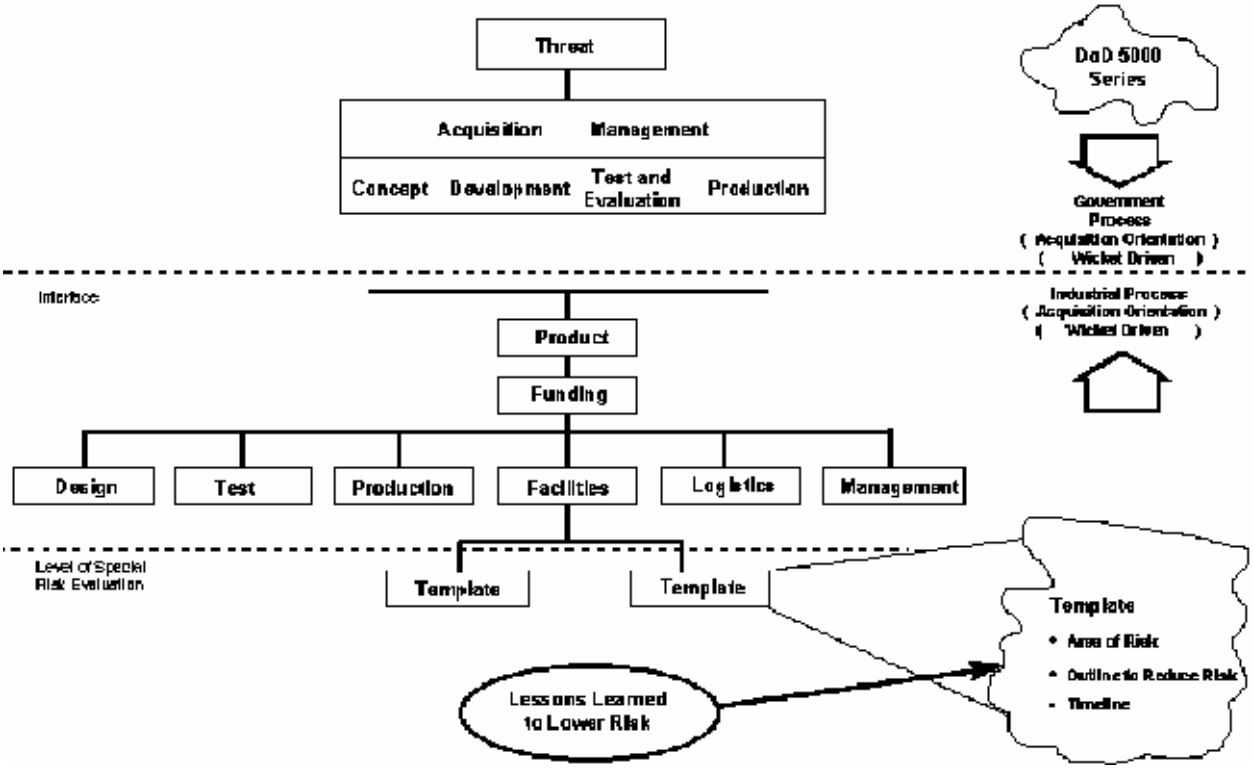


Figure 1-1. -- Transition Problem Perspective and Action to Lower Production Transition Risk

Selected areas of this document stress the electrical and electronic disciplines because of the significant role that the electronics field is playing in improving system effectiveness and productivity. Recent surveys have shown that the majority of the key technologies affecting future weapon system capability and DoD budgets are in the electronic fields. These technologies include such disciplines as very high-speed integrated circuits, advanced software and algorithms, machine intelligence, and space-based and short wave-length radars. However, emphasis shall be placed on maintaining program technical balance within all disciplines.

Specific attributes override all detail requirements. These are (1) assurance of design maturity, (2) measurement of test stability, and (3) certification of manufacturing processes. Design maturity is a qualitative assessment of the implementation of contractor design policy: Test stability is the absence or near absence of failures in development testing of a stable design. Certification of the manufacturing processes implies both design for production" on and proof of process that occur during pilot production (concurrency). Each of the above attributes is a function of the proper application of all of the templates identified in the design, test, and production sections of this document.

Templates are Based on Task Force Experience

The templates were initiated using the reports of the five panels that made up the DSB task force. The total set of recommended initiatives and principles were tested against their relationship to "technical risk," using the background and knowledge of the members of the task force as the basis for defining these technical risks and for setting out methods for minimizing them during the transition from development to production. From the results, a set of templates was developed for use in describing low risk programs. A low risk program is a program that is not likely to give trouble during the transition out of development.

Each template describes an area of risk and then specifies technical methods for reducing that risk. The templates themselves are nominally two-or three-page documents that usually describe a technical problem that in turn creates a high risk program. The templates then describe a readily available technical solution to the problem based on the lessons learned from analysis of a substantial number of programs.

Justification for the use is then provided along with supporting data.

Throughout this document there are timelines for many template activities that begin and/or end between two major milestones. In such cases, the timeline is depicted for simplicity purposes as beginning and/or ending in the middle of the program phase. It is left to the users of this document to determine how early or how late in the phase ' the template activity begins or ends; and such a determination will be influenced by the types of program, the acquisition plan, and the best judgment of experienced Government and industry personnel.

The subsequent pages of this document contain all the templates generated by the DSB task force to reduce risk inherent in the design, test, and production processes. Additional templates have been generated as a result of a DoD and industry wide review. Since some risk is associated with funding, facilities, management issues, and the transition plan for design, test, and production, the entire network of templates is arranged in a sequence considered logical from a typical program manager's viewpoint. Funding is presented prominently because it influences every other template in the transition document. The total network of critical path templates is shown in figure 1-2.

Template Applicability is Correlated With Acquisition Phases and Milestones

In figure 1-3, the time phasing associated with development of each of the templates is identified as the program progresses through the material acquisition cycle. Program risk is introduced when a particular template activity is started after or continued beyond the timeline. For those

less familiar with the DSARC process and its typical relationship with program phasing, the conceptual phase begins after the justification for major system new start (JMSNS) is approved. Between Milestones I and 11, the demonstration/validation phase occurs and Milestone II is the beginning of FSD. The production phase begins at Milestone 111A (tooling, long lead time, and pilot production) notwithstanding the production preparations that must begin early in the FSD phase, and Milestone IIIB generally signifies the beginning of rate production.

New DoD Management Initiative Takes Precedence

Change 1 to this Manual is a new template added to Chapter 1 to incorporate Total Quality Management (TQM). In the event of conflict with other templates, the TQM template takes precedence.

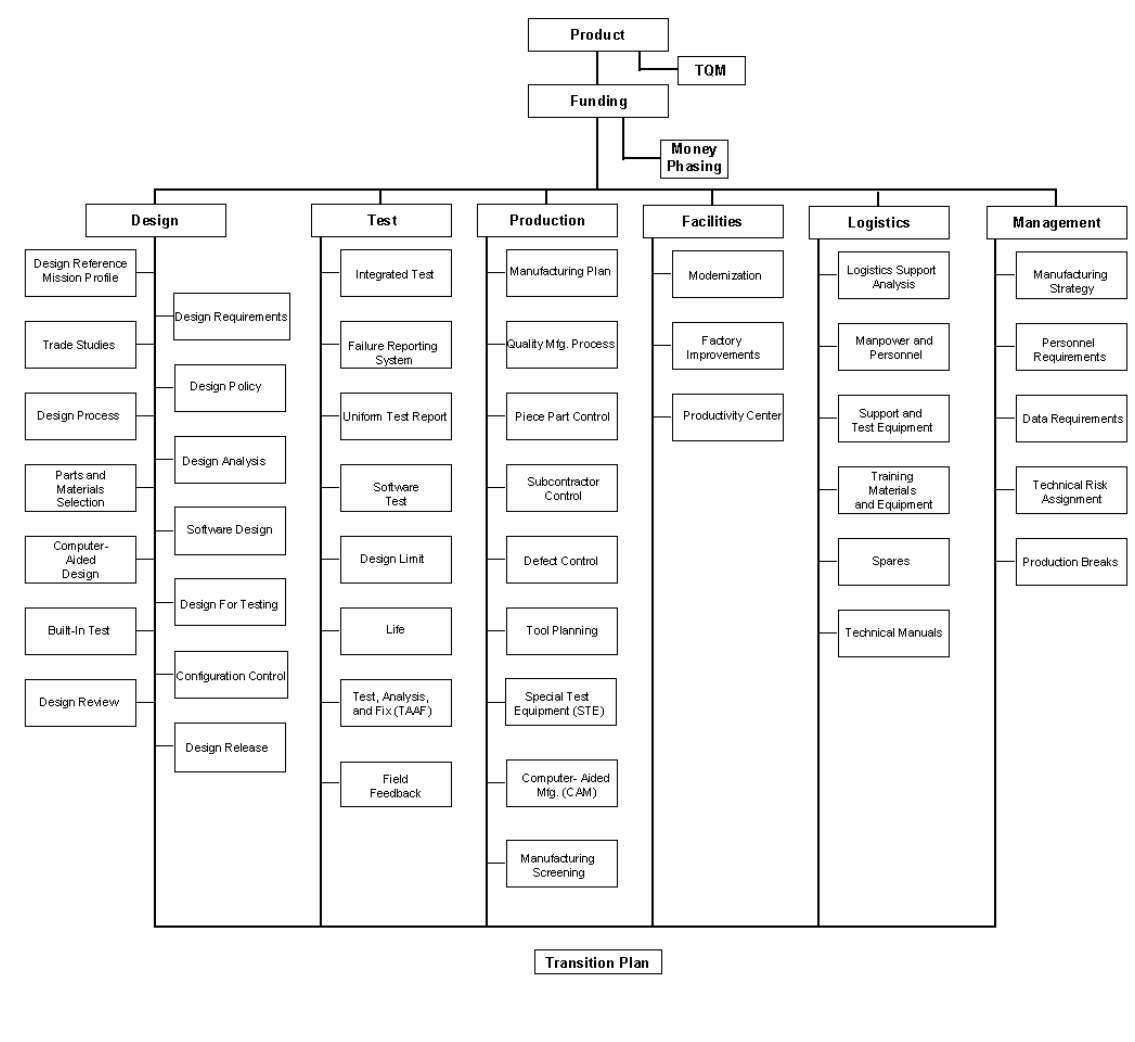


Figure 1-2. -- Critical Path Templates

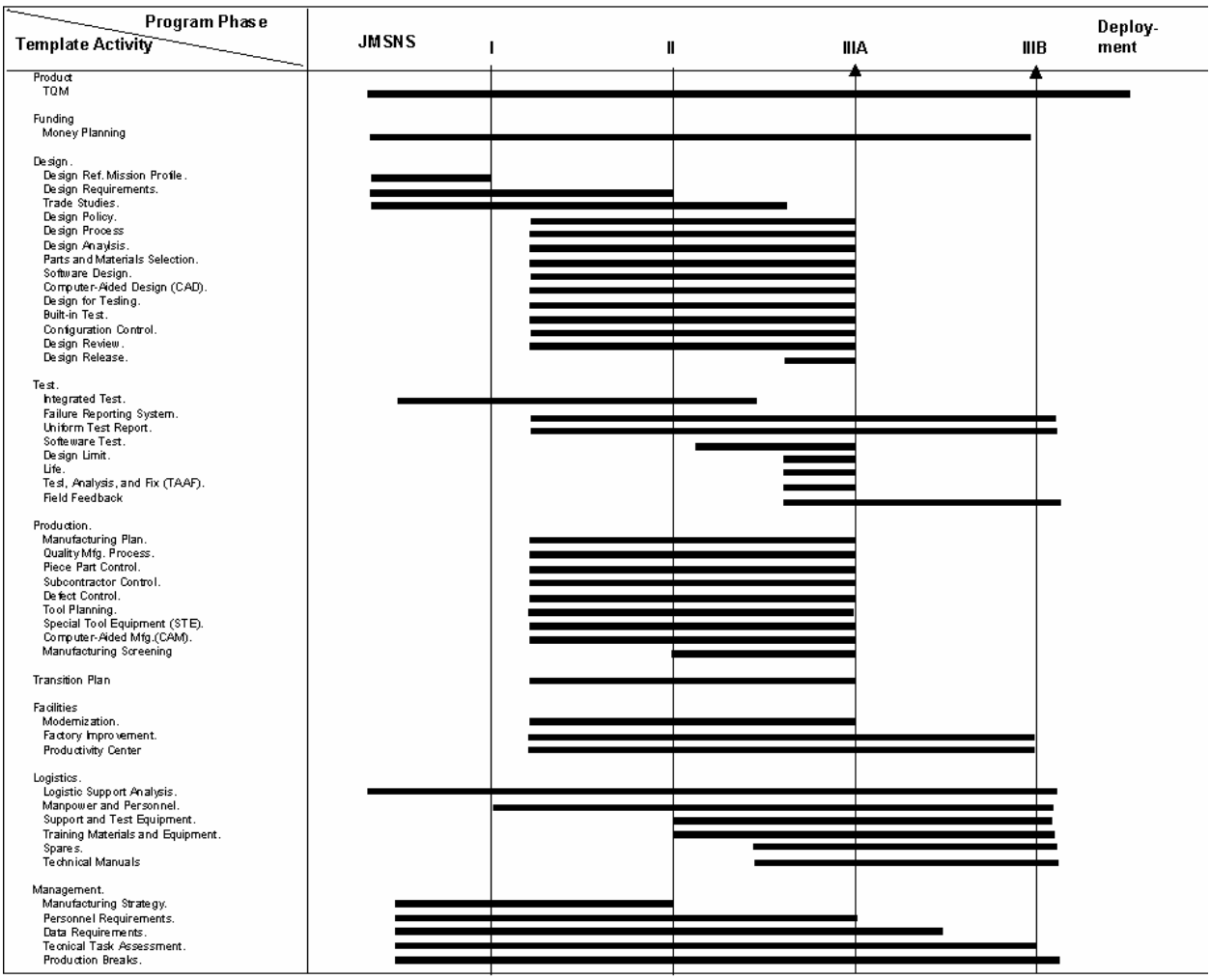
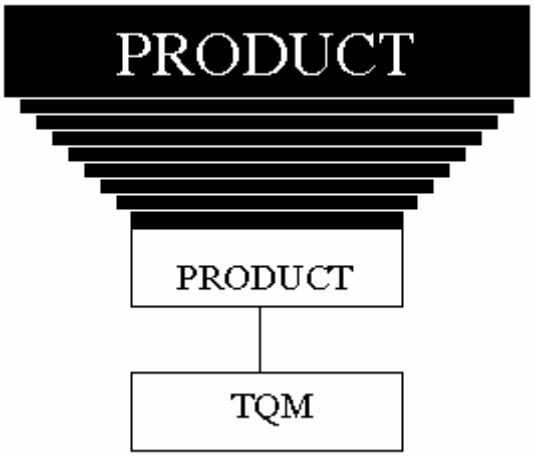


Figure 1-3. -- Template Timelines



A. -- Introduction for TQM Critical Path Template

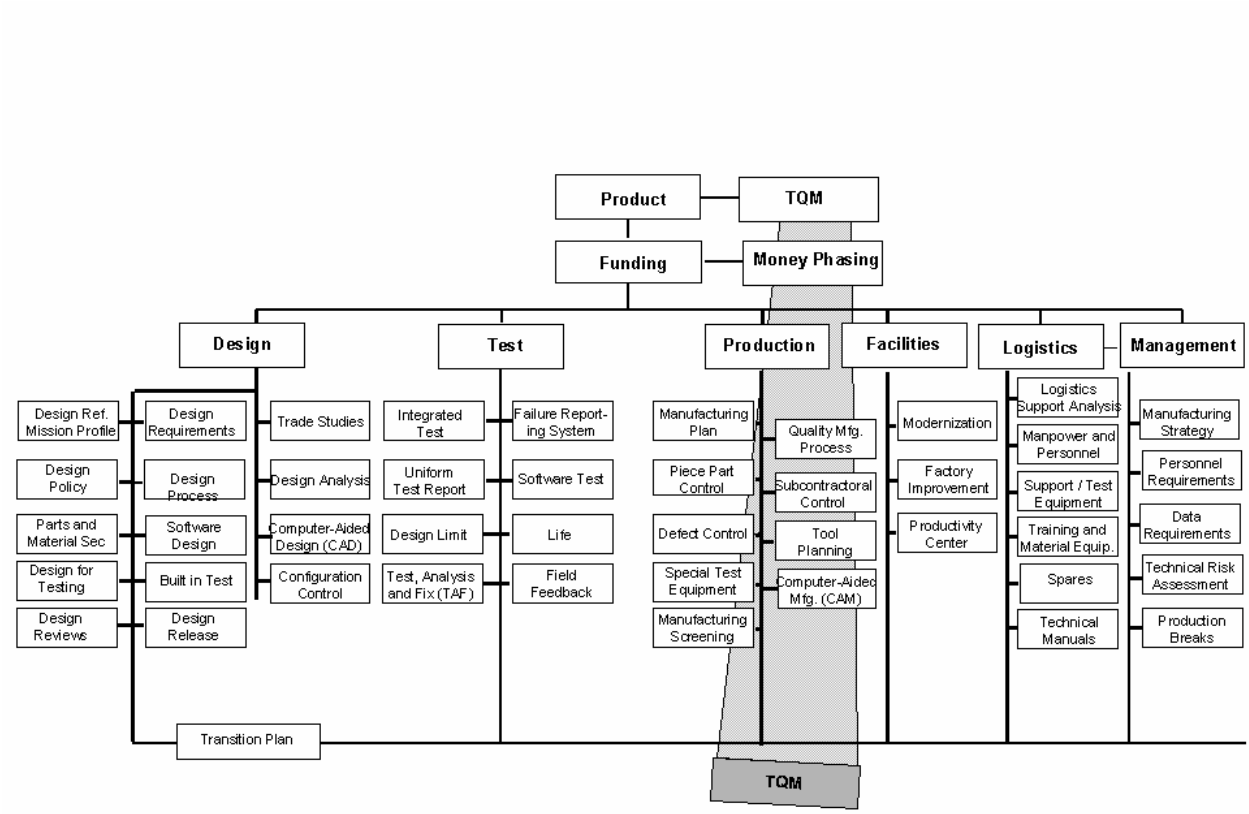
Since publication of this Manual in September 1985, a major New DoD initiative has. . been instituted called TQM. Change 1 to this Manual provides additional guidance to implement the philosophy and managerial approach involved with TQM and consists of a new template inserted in chapter 1. The new template aggregates TQM provisions now contained in the Manual by highlighting key DESIGN, TEST, and PRODUCTION template activity and identifying certain advances in TQM methods and techniques that have come to prominence. Pending a more extensive revision to this Manual, guidance in the TQM template shall take precedence in the event of conflict with other templates.

TQM is the disciplined process of continuous improvement in performance at every level and in all areas of responsibility within the Department of Defense. Improved performance is directed toward goals assigned to cost, schedule, mission need, and operational suitability. Increasing "user" satisfaction is the paramount objective. Whereas this Manual concentrates on the industrial process concerned with the acquisition of materiel, TQM principles are applicable equally to supporting functions and military operations.

TQM was approved for application DoD-wide by the Secretary of Defense on March 30, 1988, assigning it "top priority." The DoD posture statement on quality is reproduced. On August 30, 1988, the Under Secretary of Defense for Acquisition issued direction to implement TQM in the acquisition process and called for a climate in both Government and industry that would foster TQM implementation.

The TQM template is portrayed at the top of the template network in figure 1-2, directly supporting the product. By "product" is meant systems, equipments, hardware, or software, and supporting services. TQM affects everything the Department of Defense produces, procures, or performs. It is appropriate to all templates and non-acquisition activities. TQM requires professional discipline and commitment from both the Department of Defense and industry.

B. -- Total Quality Management (TQM) Template



Area of Risk

TQM is an organized process of continuous improvement by private defense sectors and DoD activities aimed at developing, producing, and deploying superior materiel. The primary threat to reaching and sustaining this superiority is failure to manage with a purpose of constantly increasing the intrinsic quality, economic value, and military worth of defense systems and equipments. The Armed Forces and defense industrial entities may not attain a lasting competitive military posture and long-term competitive business stature without a total commitment to quality beginning at the highest managerial levels. TQM is applicable to all functions concerned with acquisition of defense material, supplies, facilities, and services. Being satisfied with sub-optimum, short-term goals and objectives has adverse impacts on cost, schedule, and force effectiveness. A short-term approach also leads to deterioration in the efficacy of specific products, the firms that produce them, and the industrial base overall. Major risk also is entailed with the inability to grasp and respond to the overriding importance attached to quality by the "customer" or user activities.

Outline for Reducing Risk

- The organization has a "corporate level" policy statement attaching highest priority to the principles of TQM. This policy statement defines TQM in terms relevant to the individual enterprise or activity and its products or outputs.

• The corporate policy statement is supported by a TQM implementation plan that sets enduring and long range objectives, lists criteria for applying TQM to new and on-going programs, provides direction and guidance, and assigns responsibilities. Every employee at each level plays a functional role in implementing the plan.

• All personnel are given training in TQM principles, practices, tools, and techniques. Importance is placed on self-initiated TQM effort.

• TQM effort begun in the conceptual phase of the acquisition cycle is vitally concerned with establishing a rapport between the producer and the user or customer and a' recognition of the latter's stated performance requirements, mission profiles, system characteristics, and environmental factors. Those statements are translated into-meas-urable design, manufacturing, and support parameters that are verified during demonstration and validation. Early TQM activity is outlined in the Design Reference Mission Profile template and Design Requirements template. The Trade Studies template is used to identify potential characteristics which would accelerate design maturity while making the design more compatible with and less sensitive to variations in manufacturing and operational conditions.

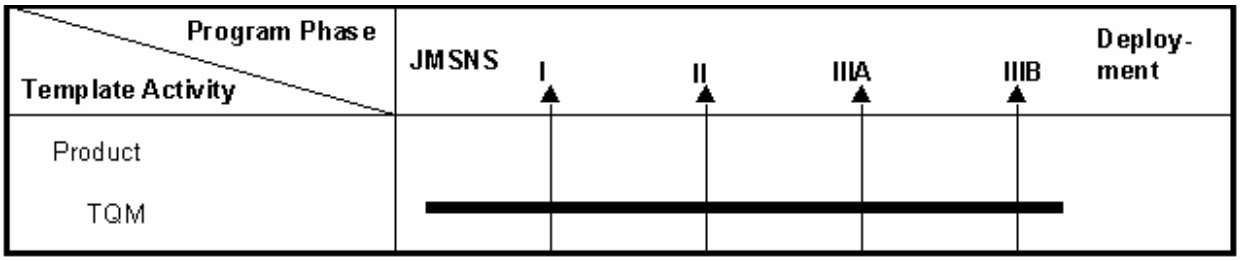
• Design phase TQM activity is described in the Design Process template. Key features enumerated include: design integration of life-cycle factors concerned with production, operation, and support; availability of needed manufacturing technology; proof of manufacture ng process; formation of design and design review teams with various functional area representation; and use of producibility engineering and planning to arrive at and transition a producible design to the shop floor without degradation in quality and performance. The Design Analysis template and Design Reviews template provide guidance in identifying and reducing the risk entailed in cent rolling critical design characteristics. Both hardware and software are emphasized (reference the Software Design template and Software Test template). A high quality design includes features to enhance conducting necessary test and inspection functions (reference the Design for Testing template).

• An integrated test plan of contractor development, qualification, and "production acceptance testing and a test and evaluation master plan (TEMP) covering Government-related testing are essential to TQM. The plans detail sufficient testing to prove conclusively the design, its operational suitability, and its potential for required growth and future utility. Test planning also makes efficient use of test articles, test facilities, and other resources. Failure reporting, field feedback, and problem disposition are vital mechanisms to obtaining a quality product.

• Manufacturing planning bears the same relationship to production success as test planning bears to a successful test program (reference the Manufacturing Plan template). The overall acquisition strategy includes a manufacturing strategy and a transition plan covering all production related activities. Equal care and emphasis is placed on proof of manufacture as on proving the design itself. The Qualify Manufacturing Process template highlights production planning, tooling, manufacturing methods, facilities, equipment, and personnel. Extreme importance is attached to subcontractor and vendor selection and qualification including flow down in the use of TQM principles (reference the Subcontractor Control template). Special test equipment, computer-aided manufacturing, and other advanced

equipments and statistical based methods are used to qualify and control the manufacturing process.

Timeline



TQM oriented defense contractors and Government activities concentrate on designing and building quality into their products at the outset. Successful activities are not content with the status quo or an acceptable level of quality approach. Those activities respond to problems affecting product quality by changing the design and/or the process, not by increasing inspection levels. Reduction in variability of the detail design and the manufacturing process is a central concept of TQM and is beneficial to lower cost as well as higher quality. Defect prevention is viewed as key to defect control. Astute TQM activities are constantly on the alert to identify and exploit new and proven managerial, engineering, and manufacturing disciplines and associated techniques.

DoD Posture On Quality

The Secretary of Defense
Washington, The District of Columbia

- Quality is absolutely vital to our defense, and requires a commitment to continuous improvement by all DoD personnel.

- A quality and productivity oriented Defense Industry with its underlying industrial base is the key to our ability to maintain a superior level of readiness.

- Sustained DoD wide emphasis and concern with respect to high quality and productivity must bean integral part of our daily activities.

- Quality improvement is a key to productivity improvement and must be pursued with the necessary resources to produce tangible benefits.

- Technology, being one of our greatest assets, must be widely used to improve continuously the quality of Defense systems, equipments and services.

- Emphasis must change from relying on inspection, to designing and building quality into the process and product.

- Quality must be a key element of competition.

- Acquisition strategies must include requirements for continuous improvement of quality and reduced ownership costs.

- Managers and personnel at all levels must take responsibility for the quality of their efforts.

- Competent, dedicated employees make the greatest contributions to quality and productivity. They must be recognized and rewarded accordingly.

- Quality concepts must be ingrained throughout every organization with the proper training at each/eve/, starting with top management.

- Principles of quality improvement must involve all personnel and products, including the generation of products in paper and data form.

/Signed/

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Chapter 2 -- Funding

A. -- Introduction for Funding Critical Path Template

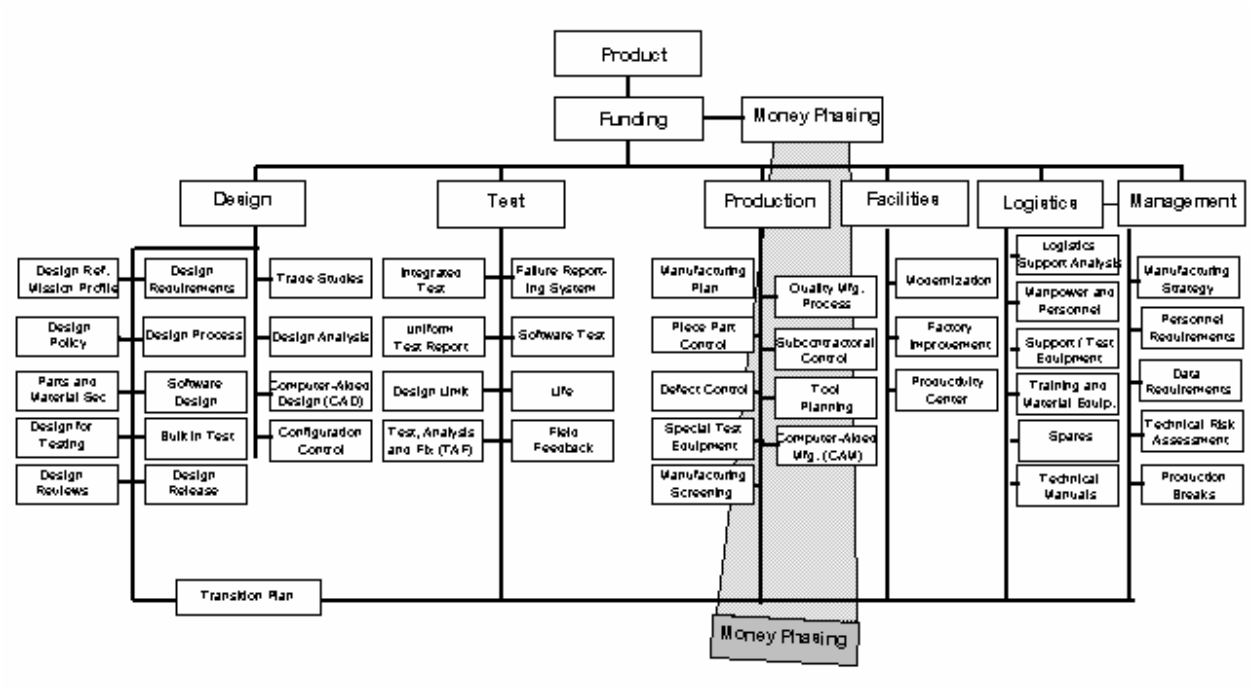
Over the years, the Department of Defense and the Military Services have been struggling to improve the acquisition process. There has been a seemingly endless proliferation of "blue ribbon" panels, ad hoc reviews, summer studies, task forces, and audits, whose memberships consisted of the most respected representatives of Government and industry. Many of these efforts were mandated congressionally, but the increasing congressional focus (General Accounting Office (GAO) reports and staff member inquiries) on DoD acquisition programs indicates that Congress is not convinced that the overall objective, namely, "more bang for the buck," is being accomplished.

There is no doubt that past studies and reviews have provided many practical recommendations and those that were acted upon helped formulate current procedures for the DSARC process and the PPBS. Yet, there is still concern whether the taxpayer's money is being well spent and whether our Armed Forces are being provided equipment that works when needed. Why do we have so many cost overruns and why does our operating equipment fail so frequently?

The answers are not simple. Some of the more lofty answers pertain to the increasing complexity of our hardware, greater administrative reporting burdens, changes in administration policy from one election to the next, and variations in the level of our international military commitment as it influences and is influenced by the existing attitude of the American public.

However, there are at least three answers that are not so lofty and over which we can exert significant control. One relates to the need for more discipline in the technical side of the acquisition process, that is, more attention to the engineering fundamentals of design, test, production, and supportability; this answer is the basic purpose of this Manual and is well described in the Preface and Introduction. A second answer involves the critical resource of personnel" and is discussed in a separate template in the Management section. The third answer is sound funding policy. In order to avoid "biting off more than we can chew," and because there are many facets to funding policy concerns, the following template on money phasing is confined to research, development, test, and evaluation (RDT& E), and initial production funding.

B. -- Money Phasing



Area of Risk

Inadequate RDT&E funding is, of course, an obvious major risk area. Aside from this "quantity" issue, however, there are the other funding risk areas that deal with the phasing of money: (1) inadequate early RDT&E funds, and (2) inadequate early production funds during the latter phases of development (initial production funds (IPF) and long lead). Risk is aggravated by authorizing development without production in mind. The development decision is a commitment to production that must be supported by properly phased funding.

Outline For Reducing Risk

- If the all-important design and engineering effort is to be funded adequately, provide a reasonable proportion of total RDT&E funds in the early years. Figure 2-1. is a representation of an idealized RDT&E funding profile.

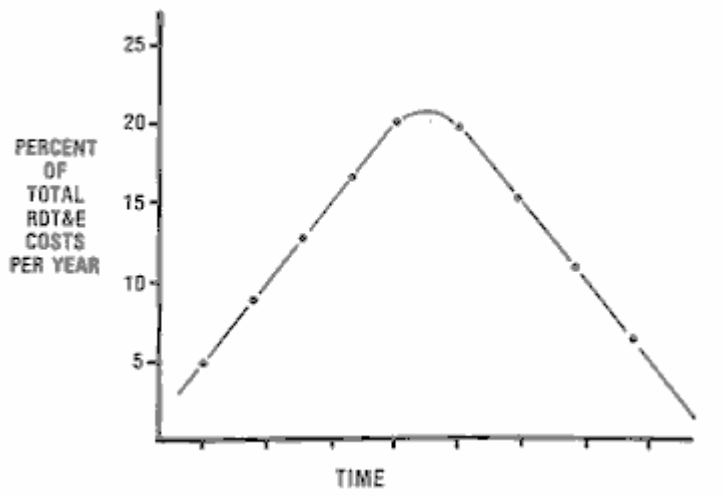


Figure 2-1. -- What We Should Do (RDT&E Funding Profile)

Rarely, however, are funds provided on this type of schedule. Early dollars are hard to find and the profile shown in figure 2-2. is a much more typical situation. This condition is aggravated when programs are started on short notice.

A significant initial subset of this profile is the RDT&E funding spent on production preparations. If this funding profile is changed, the impact on transition must be assessed.

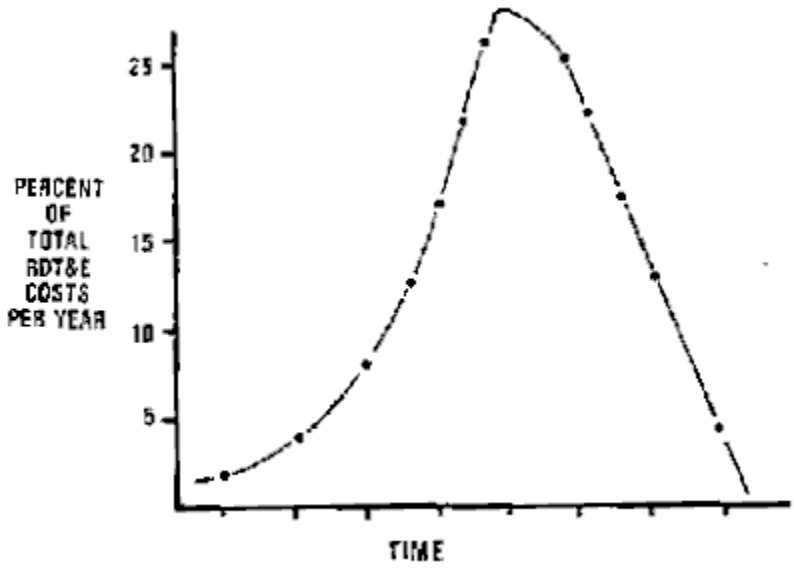


Figure 2-2. -- What We Do (RDT&E Funding Profile)

Figure 2-3. combines these idealized and actual funding profiles, and the shaded area represents a “design and engineering gap” from which the program cannot recover by application of later funds.

The first type of funding risk, therefore, can be ascertained by comparison of a program's funding profile with those of figures 2-1. and 2-2.

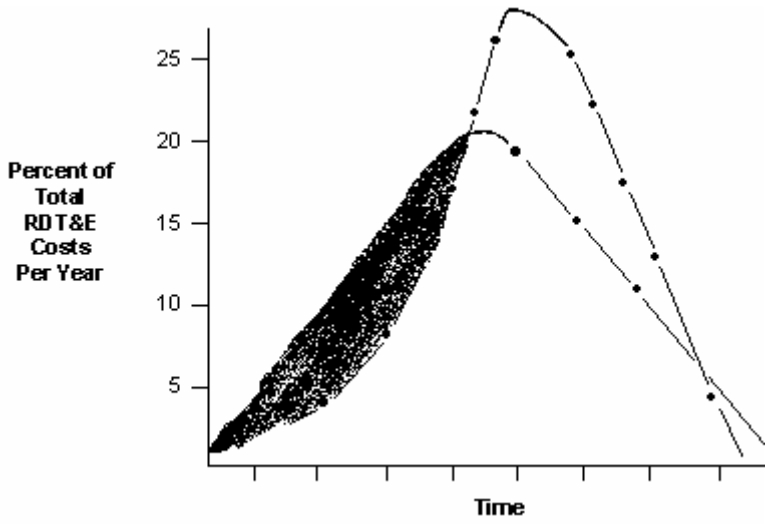


Figure 2-3. -- The "Design and Engineering" Gap

- The second type of risk reduction involves the early commitment of production funds-while development is still ongoing-for tooling, long lead materials, and production line startup. Figure 2-4. shows a graphic representation of the needed buildup of production funds during RDT&E phase down. The "fly before buy" school of acquisition policy tends to drive the "too late" line. Excessive concurrency can result in unwise commitments indicated by the "too early" line. For all programs there will be an optimum middle ground that results in low RDT&E risk and a controlled "transition to production" (shaded area).

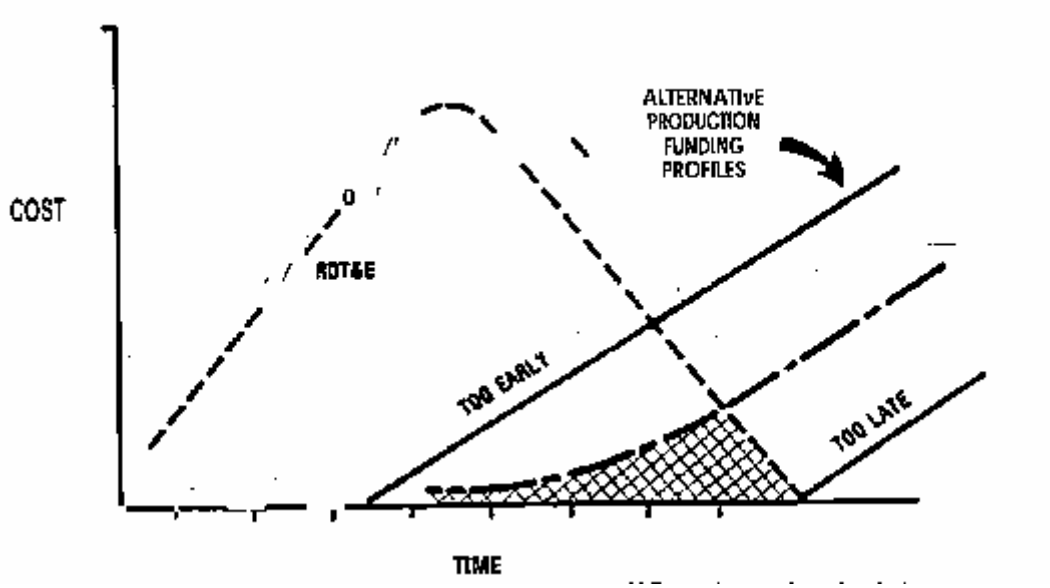
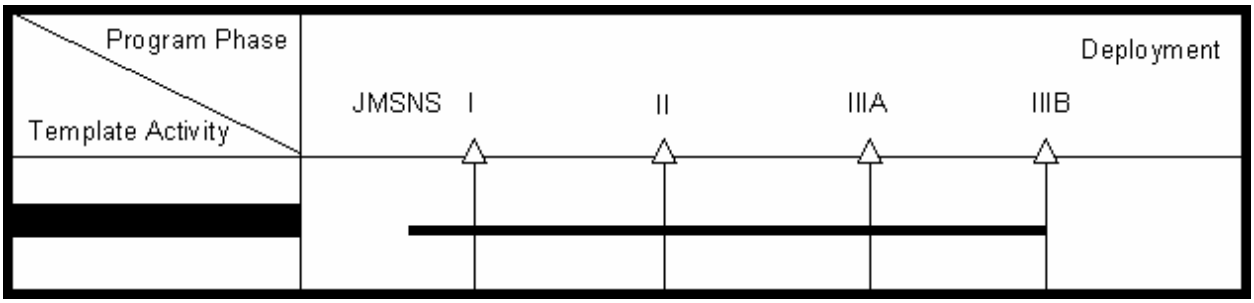


Figure 2-4. -- Funding Profiles (RDT&E and Production)

Timeline



Early availability of enough funding from the RDT& E and procurement appropriations is essential for a smooth transition from development to production and early deployment. The proper focus must continue during each annual budget cycle. Without a proper funding profile, it will be impossible to keep the program in technical balance.

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Chapter 3 -- Design

A. -- Introduction for Design Critical Path Templates

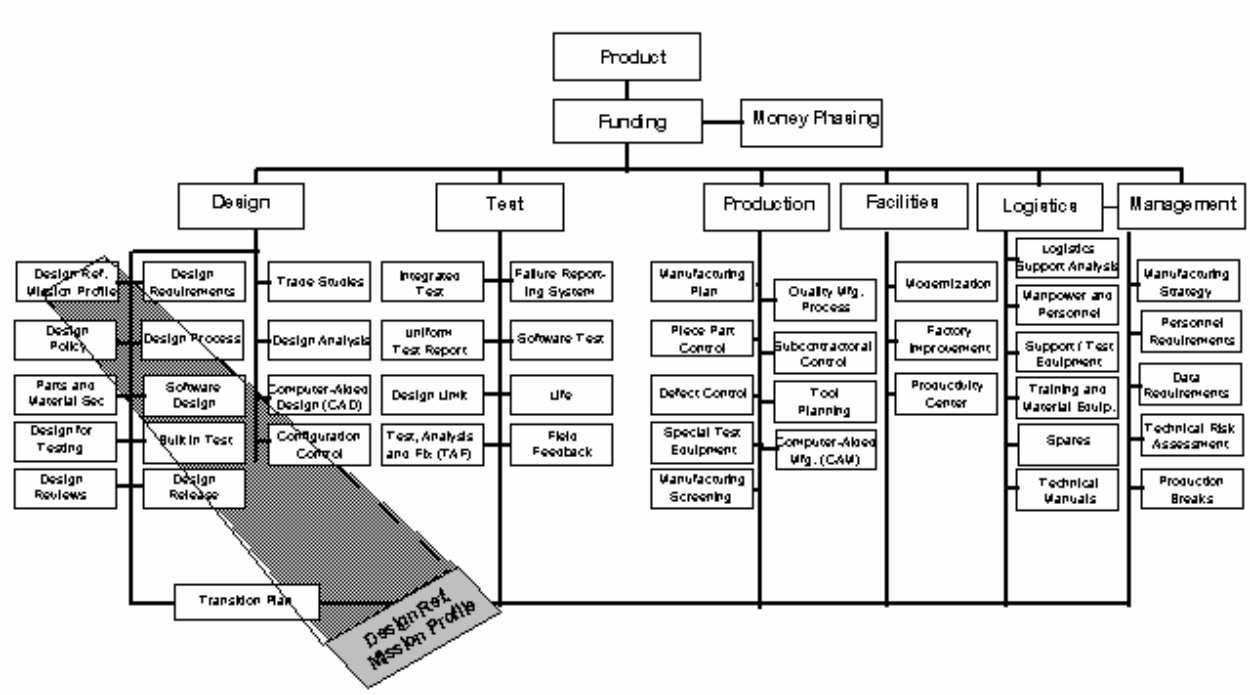
High risk of failure of Government material acquisition programs occurs at the outset of the design process. While some level of risk associated with a new technical concept may be unavoidable, historically this risk has been magnified by the misunderstanding of the industrial design disciplines necessary to turn the concept into a mature product. The Government and its contractors must share equal responsibility for this misunderstanding. The industrial proposal and Government source selection process provide the last cost-effective opportunity to ensure application of critical disciplines during design and therefore the ultimate achievement of design maturity. The application of these disciplines is the source of the requirement for "up front funding" to minimize material acquisition program risk.

What is design maturity? It is defined easily in the operational environment. A mature design meets operational requirements without additional Government or contractor intervention -- no further field modifications or additional equipment and spares are required to overcome design shortfalls. In the factory, design maturity might be indicated by the tapering off of engineering change proposal (ECP) traffic, once the test phase is underway, if it can be assumed that contract requirements are being met. But what constitutes design maturity at the conclusion of the design effort before entering the formal test phase? This is the question faced at the critical design review (CDR), when a decision to proceed with fabrication of formal test articles must be made, a decision on which hangs this matter of risk.

Among the many engineering disciplines that must be applied to arrive at a product design are several, bearing directly on risk, that have been under emphasized by the Government and underutilized by its defense contractors. These disciplines share a common thread -- all serve to reduce stress in the broadest sense. At the micro-level, parts age at a rate dependent on the stress they must endure. A design can be said to be mature when it meets its functional performance requirements and the applied stresses are well-known, and the ability of every part to endure those stresses can be ensured for the required life of the product. The engineering disciplines that determine stress and ensure the ability of the parts to endure stress are those that have received the least attention in defense system acquisition.

The templates in this section address those neglected engineering design disciplines. The Government and its contractors bear equal responsibility to address the issues in all material acquisition programs. The outlines for reducing risk will serve to guide the Government both in the preparation of requests for proposals and in proposal evaluation during source selection. They also will serve to guide program managers in the conduct of formal design reviews; and the outlines will serve notice to Government contractors of the unclaimed risk issues on which the Government intends to take action, as a guide to ordering their internal policies and procedures.

B. -- Design Reference Mission Profile



Area of Risk

Accurate and complete specification of the design reference mission profile is required in order to support the entire acquisition process: design definition, stress analysis, test design, logistic support analysis, et. al. The degree to which the specified mission profile corresponds to ultimate service use directly determines the degree of risk. Conversely, this degree of correspondence also affects progress toward design maturity, which is ultimately decided by service use, not development and operational testing. Yet the mission profile is often left to the contractor's discretion, based on a board definition of the Government's intended use of the product.

Outline for Reducing Risk

- A functional mission profile is prepared that shows on a time scale all the functions that must be performed by the system to accomplish the mission. The functional mission profile of a system having multiple or variable missions is defined by a hypothetical design reference mission profile that contains a comprehensive listing of all functions expected in every potential mission.

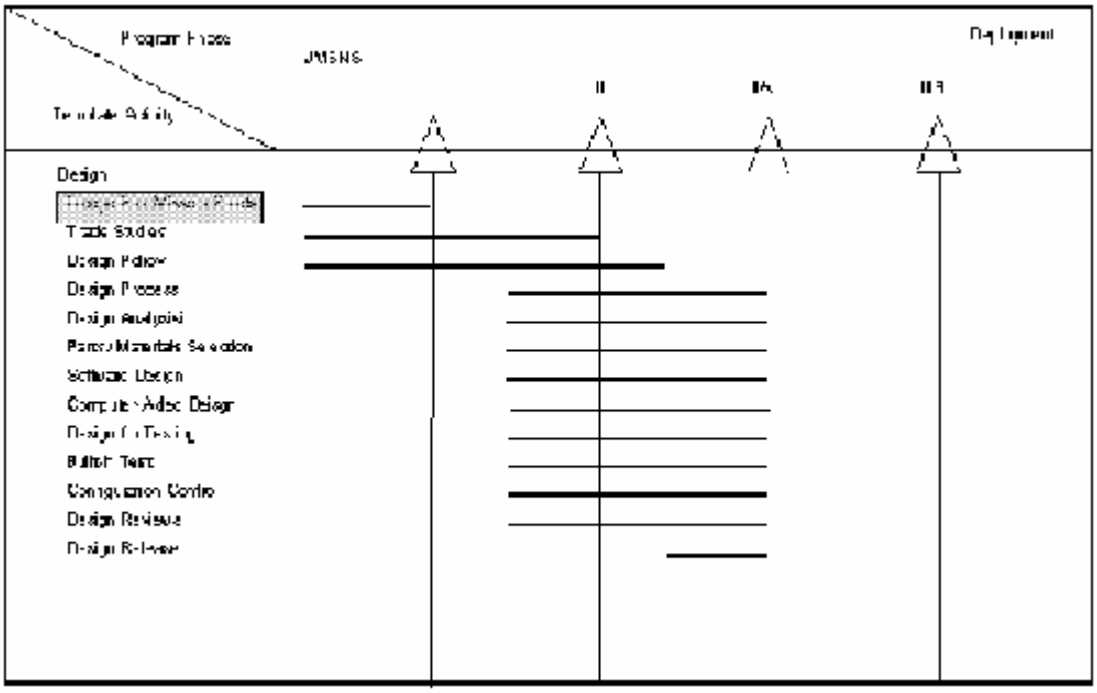
- An environmental mission profile is prepared that shows on a time scale the significant properties of the surroundings (and their limits) that are likely to have an effect on the operation or survival of the system. It defines the total envelope of environments in which the weapon system must perform, including conditions of storage, maintenance, transportation, and operational use.

• Mission functional and environmental profiles are prepared by the Government and included in requests for proposals, forming a basis for proposals, source selection, and contracts.

• System functional and environmental profiles are prepared by the contractor on the basis of the total envelope of external environments given by the mission profile, to define the functional requirements and induced environmental conditions for the system and its component parts. These become the design requirements for the component parts of the system.

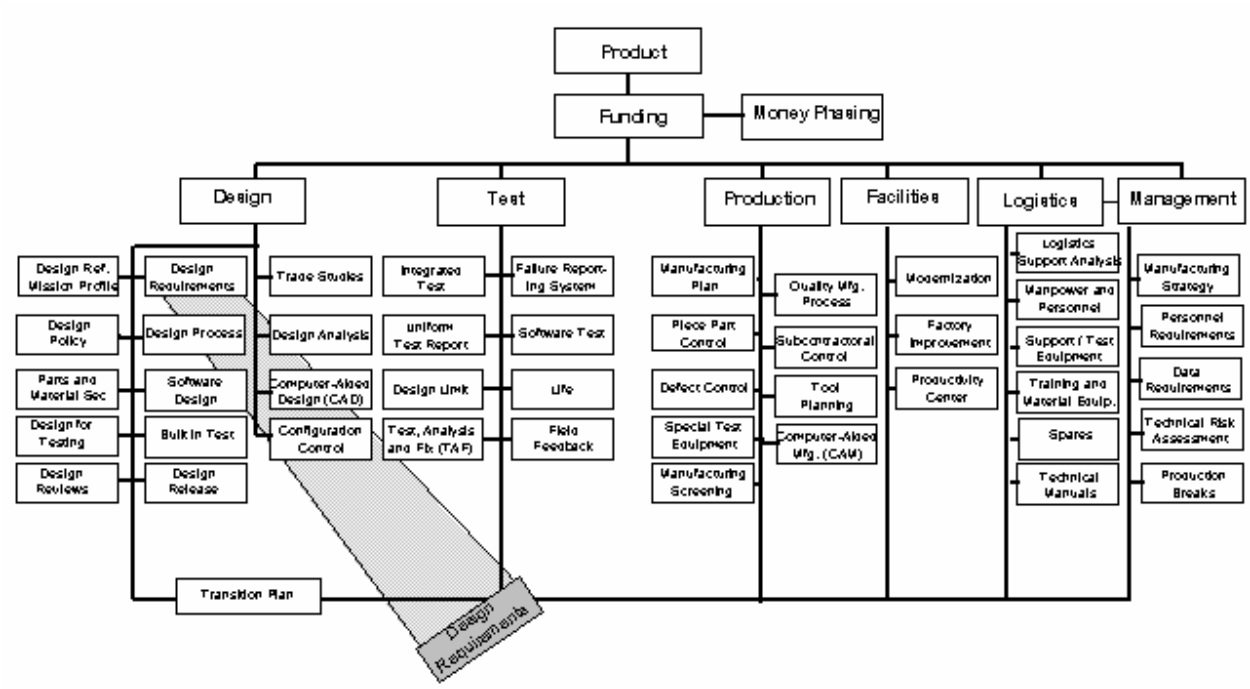
• The design requirements and concept should include a determination of support and operability factors such as the need to interoperate with other Military Service and allied systems.

Timeline



System functional and environmental profiles are prepared by the contractor during the early stages of concept development.

C. -- Design Requirements



Area of Risk

Design requirements are translated from operational requirements, stated by the "user" activity, and frequently negotiated or evolved during the course of design. They may include design requirements that are not measurable directly during the design process, but only can be verified by extended formal tests. Such intangible design requirements are a common cause of high risk.

Outline for Reducing Risk

- Design requirements are developed in parallel with the development of the design reference mission profile. They are defined completely in the requests for proposals, in order that one basis for source selection may be the offeror's approach to satisfying those requirements, including Government evaluation of corporate design policy bearing on product risk. The complete design reference mission profile, including support-related "design to" requirements, is specified in these design requirements.

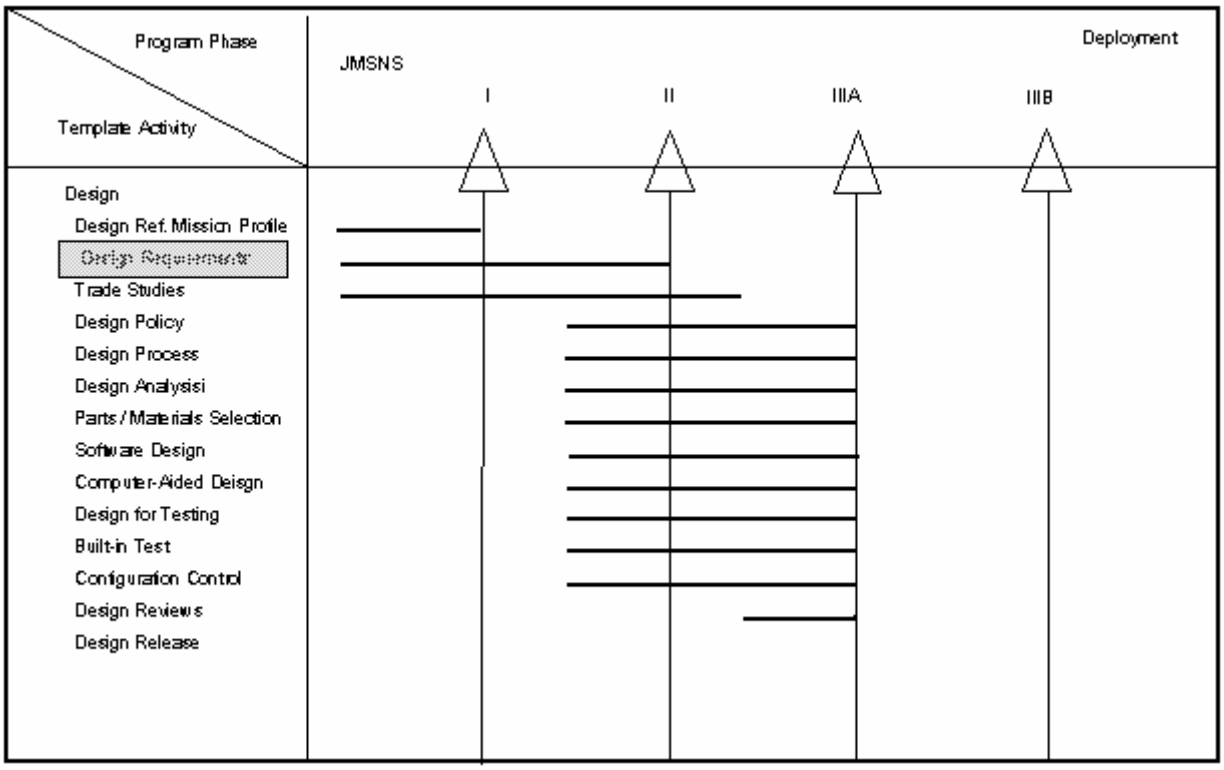
- Primary design requirements are stated in terms of parameters that can be measured during the design process, by breadboard testing or analogous design action. Probabilistic specifications that would require extended system level testing to verify compliance cannot be used by the design engineer for real time design decision making, and are therefore considered secondary, to be used for planning purposes only.

- When the achievement of specific quantitative system requirements is conditional upon the performance of a set of predefined tasks, the contract establishes the requirements for development of approved program plans for the accomplishment of these tasks. This will apply to such disciplines as structural analysis, weight control, reliability, maintainability,

systems safety, survivability, corrosion prevention, parts standardization, and similar activities.

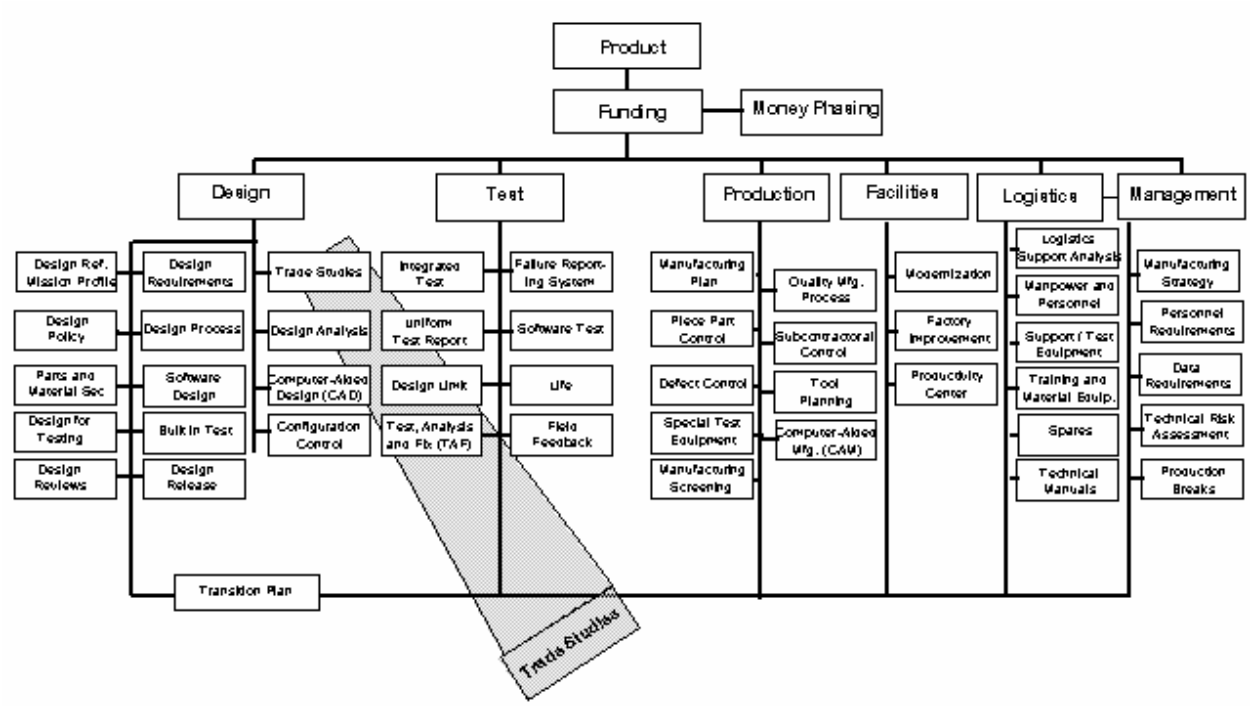
• Contractors are responsible for ensuring that subcontractors and suppliers have complete and definitive design requirements that flow down Government requirements such as measurable parameters and performance of predefined tasks.

Timeline



Design requirements are established early in the conceptual phase and may be altered during validation as well as increased in level of detail and specificity. The design reference mission profile influences the design requirements for the component parts of the system. The contract for validation should be structured to require contractor recommendations for selection and tailoring of the optimum specifications and standards for application before the start of FSD.

D. -- Trade Studies



Area of Risk

Trade studies are essential elements of material acquisition programs, not only in defining concepts that best meet mission needs, but also in fine-tuning selected concepts during the design process. Concept validation may not be complete at the beginning of full-scale development, however, there is the expectation that significant conceptual problems can be resolved during the design process. In addition, reducing production risk frequently is not a trade study criterion.

Outline for Reducing Risk

- Concepts representing new technology untested in the production environment are validated fully before FSD.

- Trade studies during the design process are oriented towards reducing product risk, by such means as design simplification, design for compatibility with production processes, design for ease of both factory testing and built-in test, and design for supportability and readiness.

- Early in the design phase, full consideration is given to standard components that have been developed and can meet the mission requirements (such as standard avionics, egress seats, etc.).

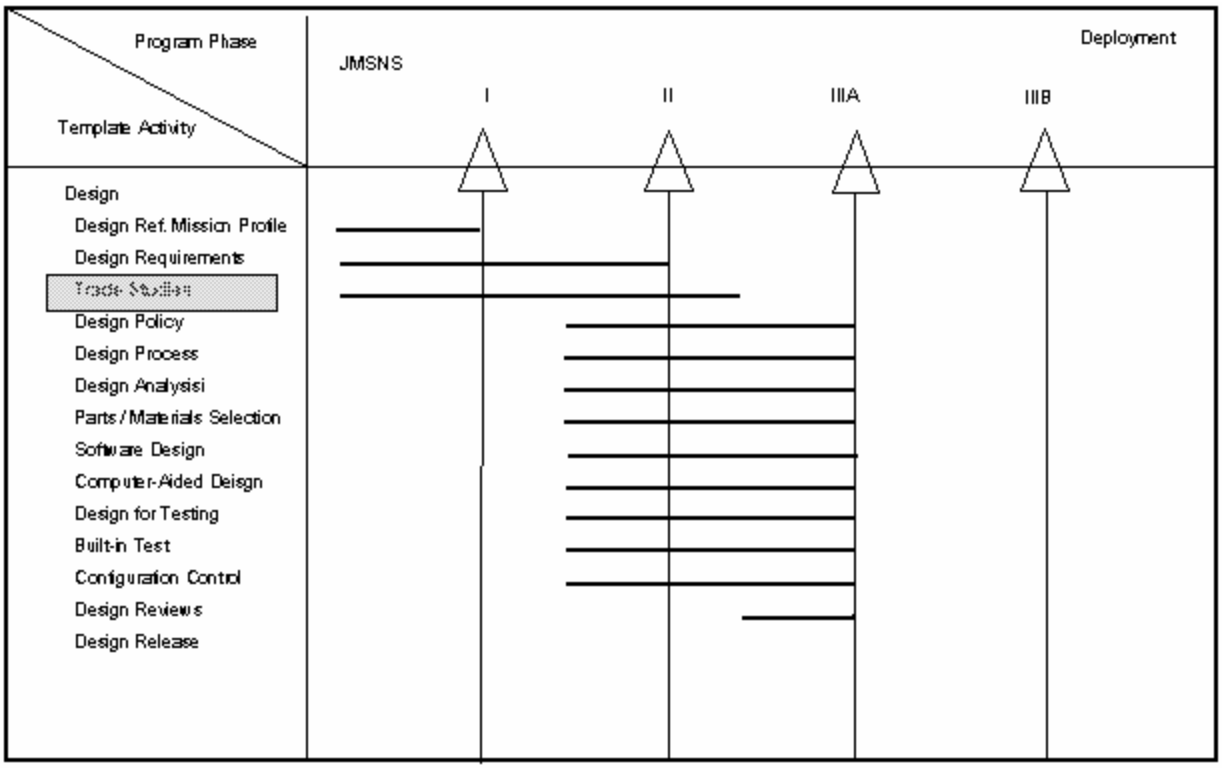
- A quantitative trade parameters list is developed and standardized across all design, manufacturing, and quality disciplines as a priority task early in the RDT&E program.

- Trade study alternatives are documented and preserved formally in design review documentation to ensure system engineering traceability to design characteristics downstream.

- Production transition trade studies are based on design and performance criteria as weight factors for trade study decisions.

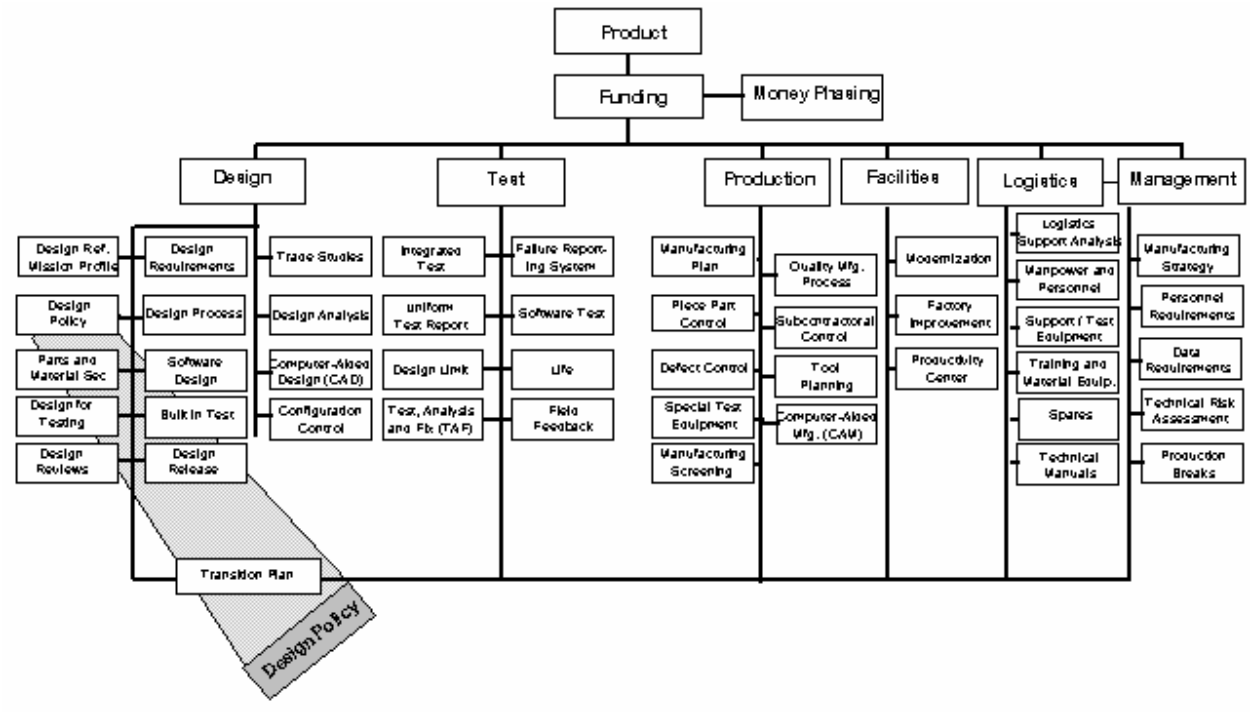
- Product quality and reliability are not trade study parameters to be sacrificed for cost, schedule, or performance gains.

Timeline



A broad spectrum of trade studies is initiated during the concept exploration phase. These trade studies continue on into FSD as a logical approach to selecting the best design once the mission profile and design requirements have been specified. The final selection and fine turning of the design approach must consider such factors as producibility and operational suitability as well as performance, cost, and schedule.

E. -- Design Policy



Area of Risk

The implementation of the engineering design disciplines involved in reducing product risk is the responsibility of Government contractors. The existence or absence of documented corporate policies, backed up by controlled engineering manuals to the necessary degree of detail, has a direct bearing on the degree of product risk associated with material acquisition. Many Government contractors do not have such corporate policies, and when these policies do exist, they often lack implementation at the operating level and often lack substantive direction on design for low risk.

Outline for Reducing Risk

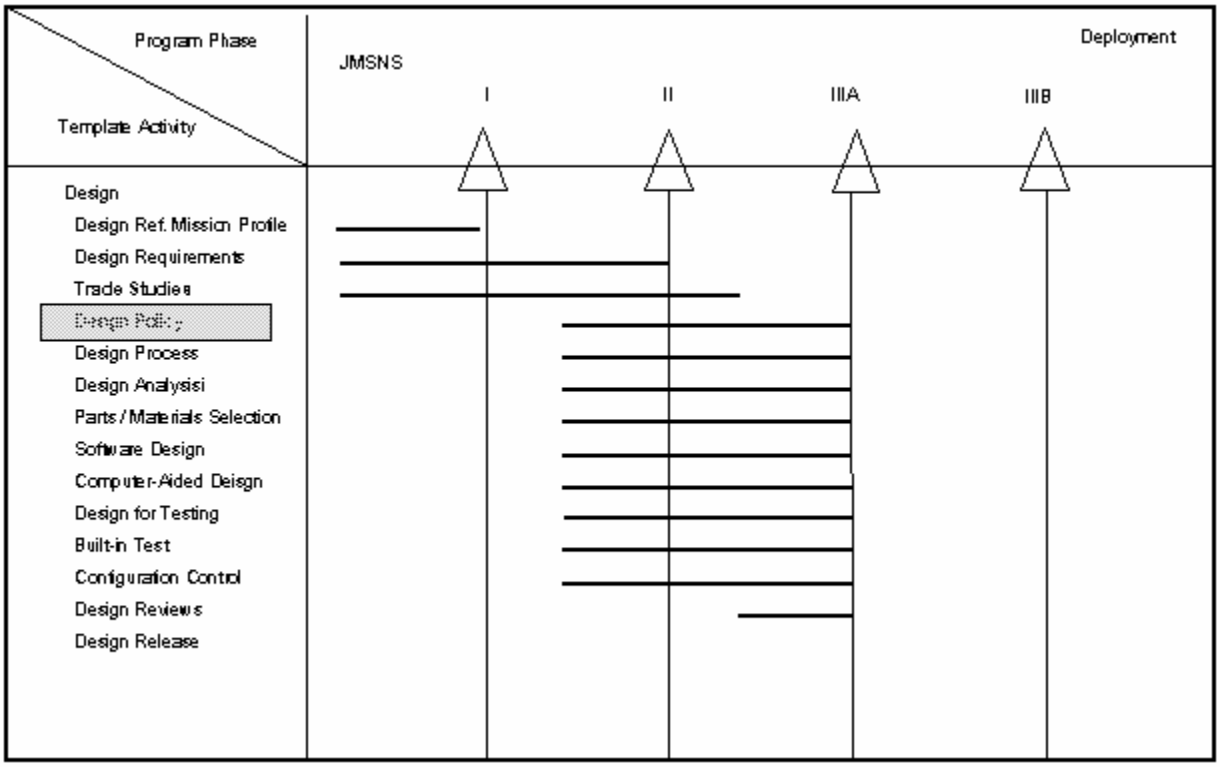
- Documented design policies and comprehensive engineering documents implementing these policies are visible and adhered to in design, test, and manufacturing practices.
  - Policies and practices are sensitive to "lessons learned" on past programs.
  - Abundant evidence is available that engineering practices are tailored to product lines.
  - Policies and practices reflect the importance of designing for supportability as an integral part of all design efforts.
- Engineering design has the documented responsibility not only for development of a low risk design but also for specification of test requirements and design for production and support.

• Engineering practices in the form of criteria and standards are included in an integrated data base accessible by design, test, production, and logistics engineering personnel.

• Established design review criteria are available and are used by an expert design review team. These criteria, along with specific means of assessing maturity, are tailored specifically to product lines.

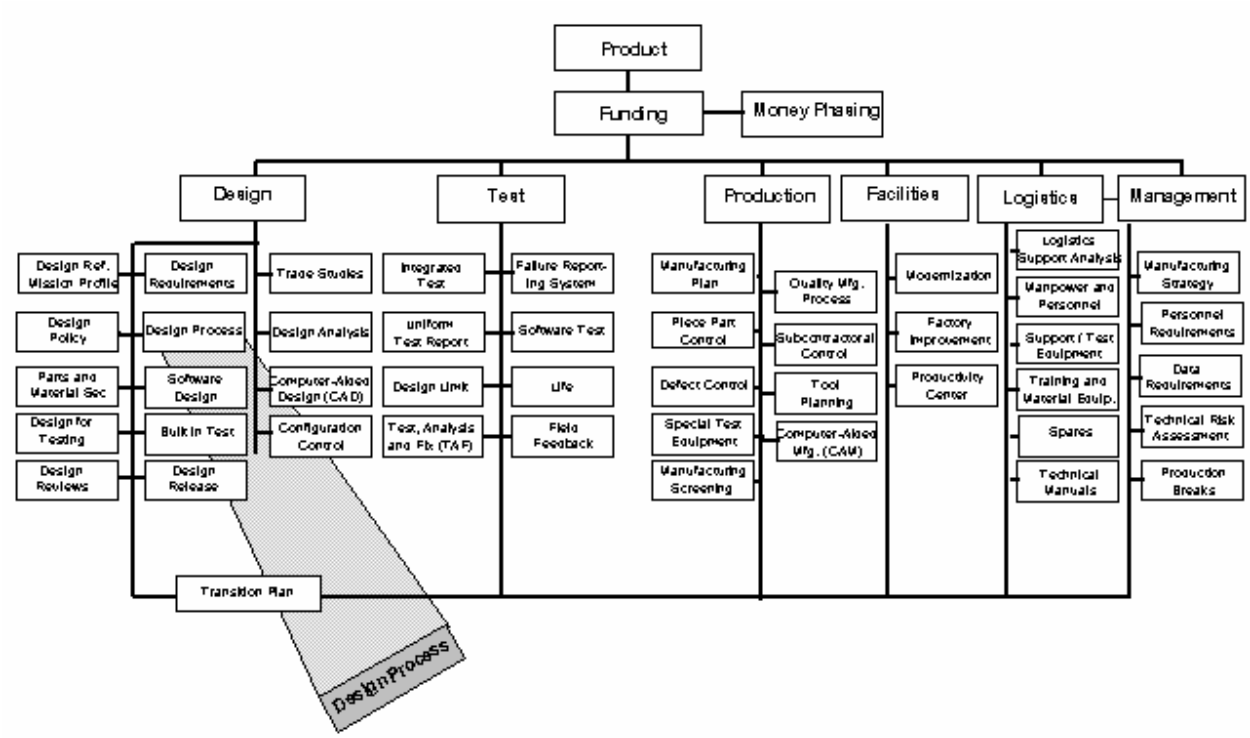
• Design emphasis is placed on implementation of design fundamentals, disciplines, and practices that are known to produce a low risk design and that ensure design maturity before design release.

Timeline



The implementation of best practices in engineering design is the responsibility of contractors. The existence or absence of documented corporate policy has a direct bearing on the degree of product risk associated with material acquisition. Appropriate design policies are developed and proven before FSD, and they may be updated and otherwise refined as experience is gained during development.

F. -- Design Process



Area of Risk

The design process ought to reflect a sound design policy and proper engineering disciplines and practices -- an integration of factors that influence the production, operations, and support of a system throughout its life cycle. Nevertheless, concepts are often selected, demonstrated, and validated with little thought given to the feasibility of producing a system employing those concepts. This omission is then carried forward into design, with voids appearing in manufacturing technology and absence of proven manufacturing methods and processes to produce the system within affordable cost. One of the most common sources of risk in the transition from development to production is failure to design for production. Some design engineers do not consider in their design the limitations in manufacturing personnel and processes. The predictable result is that an apparently successful design, assembled by engineers and highly skilled model shop technicians, goes to pieces in the factory environment when subjected to rate production. A design should not be produced if it cannot survive rate production without degradation.

Outline for Reducing Risk

- The potential to produce a system is investigated carefully during the demonstration and validation phase by means of appropriate producibility analyses. Voids in manufacturing technology projects and manufacturing methods and processes peculiar to the design of the specific system, subsystems, and components are addressed during engineering development. These methods and processes are proven by pilot lines and pilot quantities, when necessary.

- The design avoids reliance on a single unproven manufacturing technology for system critical performance characteristics. Alternative technologies and design approaches are carried through Milestone II and into engineering development, when warranted.

- Producibility engineering and planning is an integral element of the design process. Close coordination between production and design engineering is established from the outset. Integration of life cycle factors in the design is fostered by forming design teams with production engineering and support area representatives. Manufacturing coordination is part of production drawing release. Production engineers participate in design concept development and design engineers participate in production planning to ensure design compatibility with production.

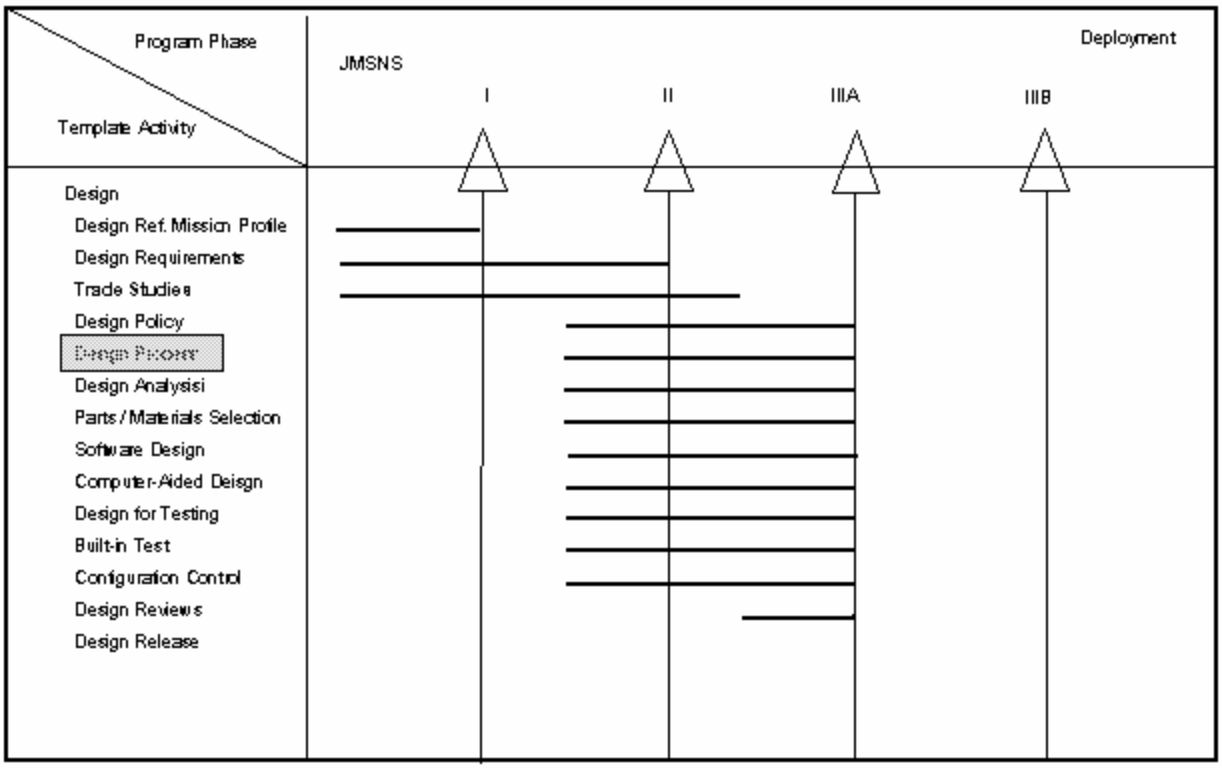
- The design process specifically ensures both performance and producibility considerations for packaging of electronic components. Factors such as envelope clearance, package density, predicted versus actual weight, tooling, and power access are equally as important as component and circuit design considerations in reducing transition and production risk.

- The design is evaluated to ensure that the producibility and supportability factors are being incorporated. Producibility and supportability design changes are expedited and incorporated as early as possible to reduce cost and are not resisted automatically. These changes are substantiated promptly by necessary testing.

- A task analysis approach, as called out in Military Handbook 46855B (reference (c), is used to divide tasks among hardware, software, and operators. System design then proceeds with this partitioning in mind, thus reducing the risk of complex tasks being "dumped" on operators when they are better performed by software. This partitioning also helps to bound and define the entire design effort.

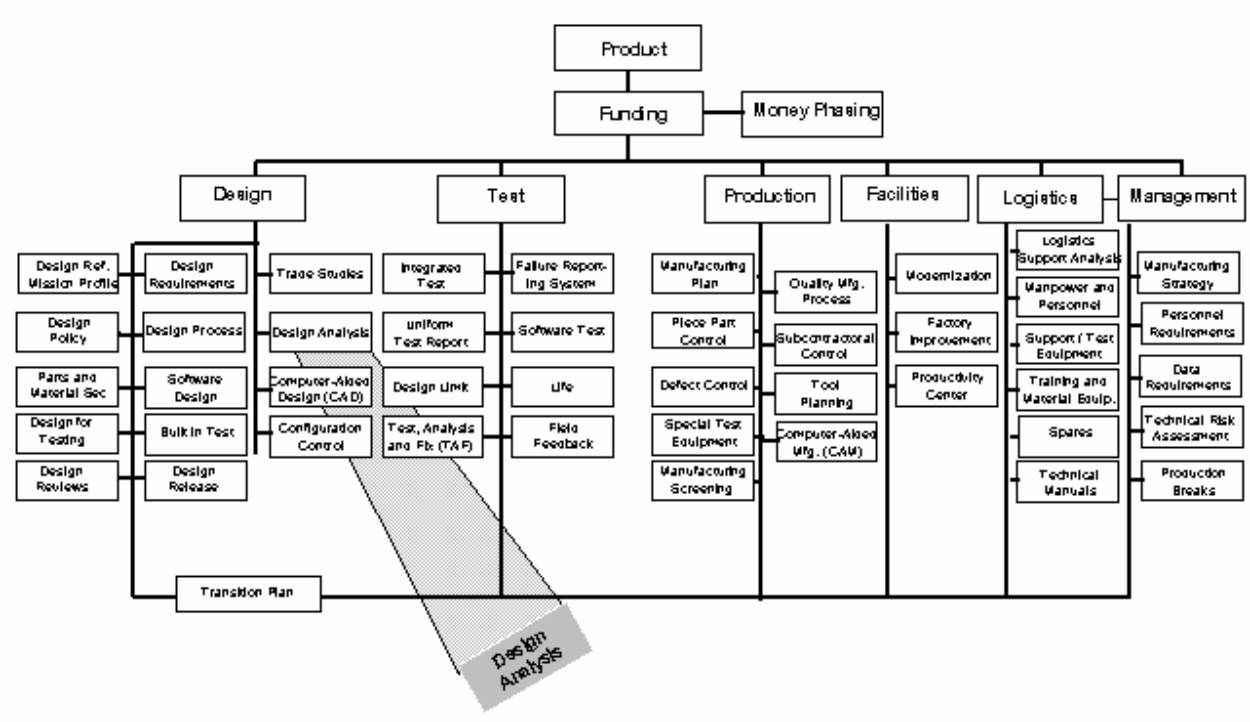
- Cross training of engineers in design and manufacturing disciplines actively is supported. Design engineers stay abreast of developments in manufacturing technology that would affect the design.

Timeline



The design process describes all the actions taken that culminate in a set of drawings or a data base from which a model can be constructed for testing to verify specification compliance. Design criteria are developed and proven before FSD, and may be updated and otherwise refined as experience is gained during development. Production design occurs concurrently with the other elements of the design process. Much useful information guidance technology on obtaining a producible design is in Military Handbook 727 (reference (d).

G. -- Design Analysis



Area of Risk

Engineering design involves many specialized analyses, most of which are oriented towards meeting desired performance specifications. There also are specialized analyses oriented towards proofing design risk but they are not practiced widely. When they are completed, it is often by personnel other than the design engineers most familiar with the product design. These analyses are critical to ensuring a low risk design.

Outline for Reducing Risk

- Stress and stress/strength analyses are performed to ensure that applied values of all parameters specified in the derating, margin of safety, and safety factor criteria for all component parts and materials meet those criteria.

- "Worst case" tolerance analyses are performed to ensure that the system design performance remains within specified limits for any combination of component part parameters within the limits of their own allowable tolerances.

- Sneak circuit analyses are performed to detect such unexpected failure modes as latent circuit paths, timing errors, or obscure "cause and effect" relations that may trigger unintended actions or block desired ones without any part failures having occurred.

- Failure modes and effects analyses are performed in order to understand the effect of each component part failure on overall design performance, and system and equipment supportability. Each component part is analyzed for the purpose of reducing these effects to a minimum through design changes.

• A thermal survey is conducted on electronic systems to validate the accuracy of the thermal stress analysis, which is then revised as indicated by the survey to yield more accurate results.

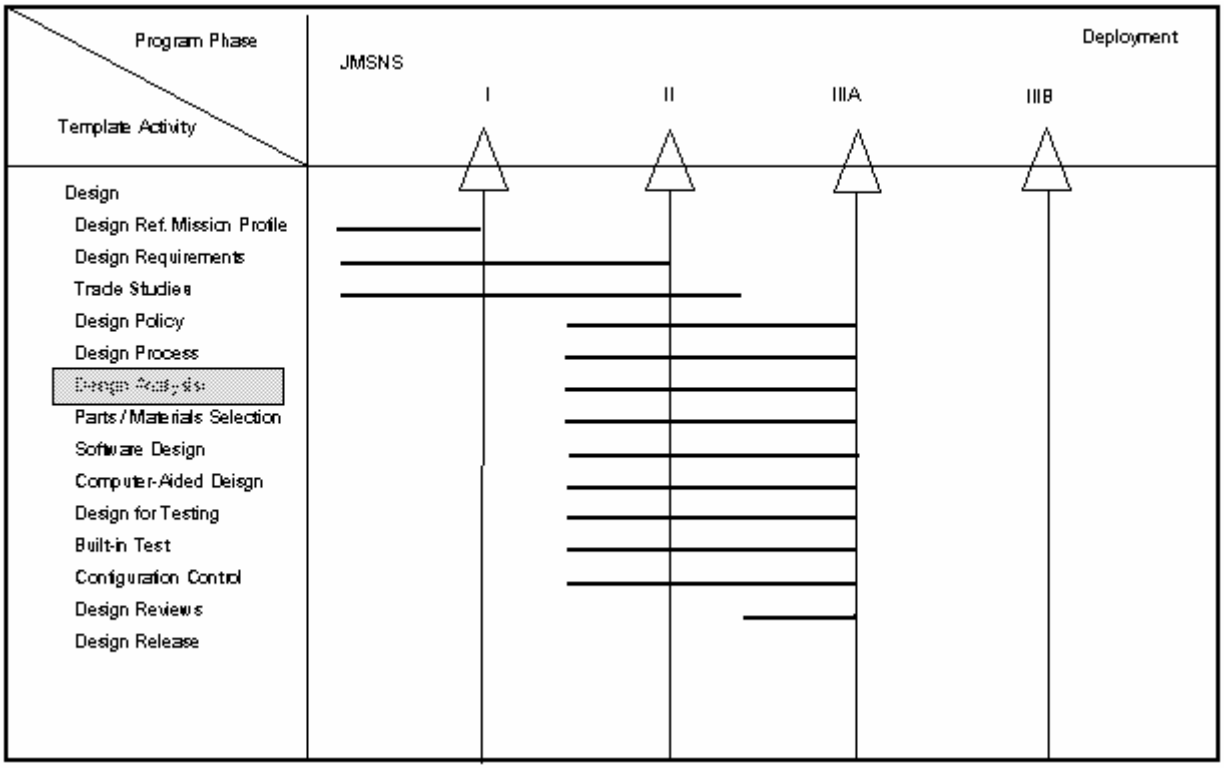
• Other analyses that may be applied effectively are fault tree, mass property, system safety, maintainability, life cycle cost, fault isolation, redundancy management, and vibration survey.

• The results of these analyses are used to revise the design, as necessary, to reduce design risk, and the analyses are update, as necessary, for changes in design. Design risk analyses are not performed simply for the sake of meeting contract data requirements.

• CAD techniques are developed or acquired, as necessary, to conduct these analyses to the maximum extent possible, both as a potential savings in engineering time and cost, and in the interest of improved and more consistent analytical accuracy.

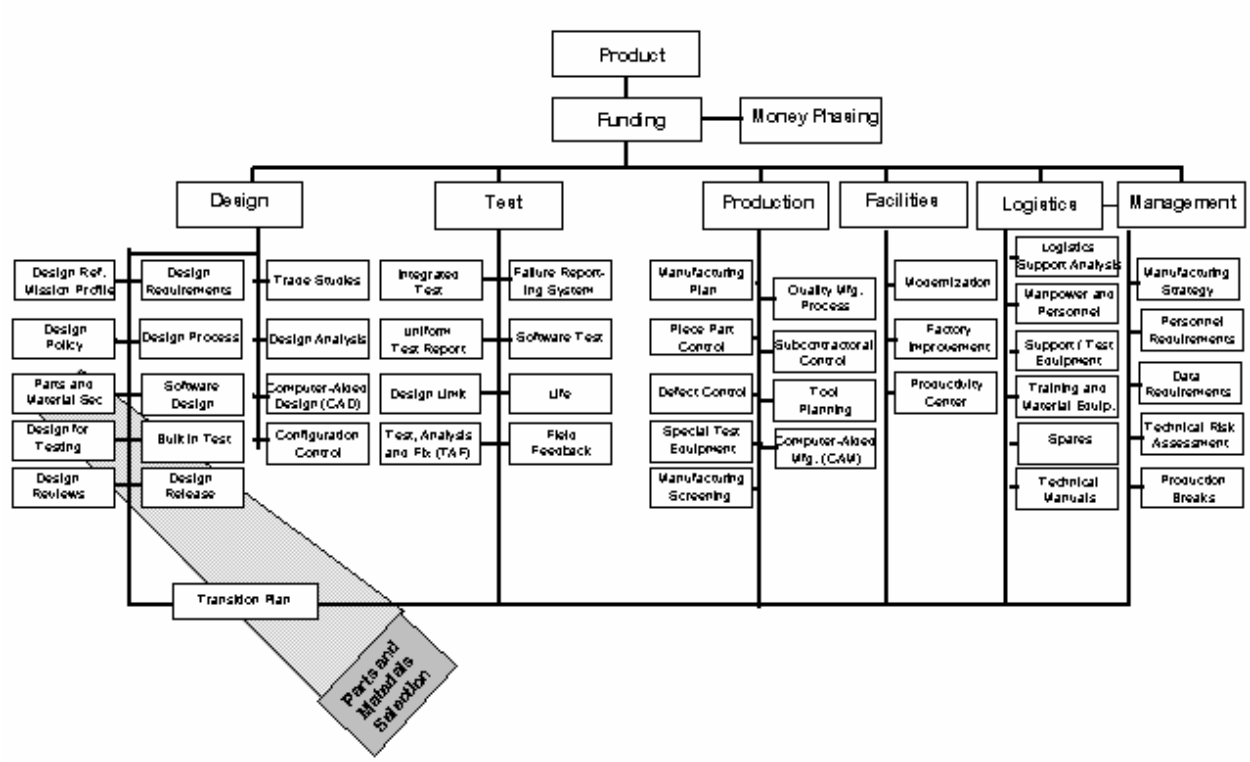
• Integrated logistics support analyses are performed to understand and determine the effects of a design on supportability and logistics resources requirements for the purpose of reducing any adverse effects.

Timeline



Design analysis policies are developed and proven before FSD, but shall be updated and otherwise refined as experience is gained during development. Their use is completed largely, except for engineering changes to correct failures, at the conclusion of the design process.

H. -- Parts and Materials Selection



Area of Risk

Low risk designs allow parts and materials to operate well below their maximum allowable stress levels. Performance-oriented military programs often attempt to use these same parts and materials at much higher stress levels. Pursuit of interoperability and parts standardization also may introduce similar risks. These choices often are made by using mathematical models and generic handbook data that are imprecise. The resultant high risk may not be discovered except by testing, often operational testing, which is too late to avoid extensive corrective action.

Outline for Reducing Risk

- The following design criteria are used for part operating temperatures (except semiconductors and integrated circuits). These criteria apply to case and hotspot temperatures.

≤ 3 watts:	40º C rise from the part ambient with a maximum absolute temperature of +110º C
> 3 watts:	55º C rise from the part ambient with a maximum absolute temperature of +125º C
Transformers:	30º C rise from the part ambient with a maximum absolute temperature of +100º C for MIL-T-27 class S insulation
Capacitors:	10º C rise from the part ambient with a maximum absolute temperature of

+85º C

Of all the forms of stress to which electronic parts are susceptible, thermal stress is the most common source of failures. The thermal stress guidelines that are highlighted have been instrumental in reducing the failure rate of electronic equipment by up to a factor of 10 over traditional handbook design criteria.

- The junction temperatures of semiconductors and integrated circuits normally should not exceed +110º C, regardless of power rating. The failure rates of semiconductors decrease by as much as a factor of two for each 10º C by which their junction temperatures can be lowered. In modern electronic systems having high semiconductor populations, this translates to an approximately equal decrease in the overall system failure rate when instituted as design policy. In one program involving 200 aircraft, each 5º C reduction in cooling air temperature was estimated to save $10 million in electronic system maintenance costs by reducing failure rates.

- The absolute values of operating temperatures for all electronic parts in a design are determined both by analysis and by measurement.

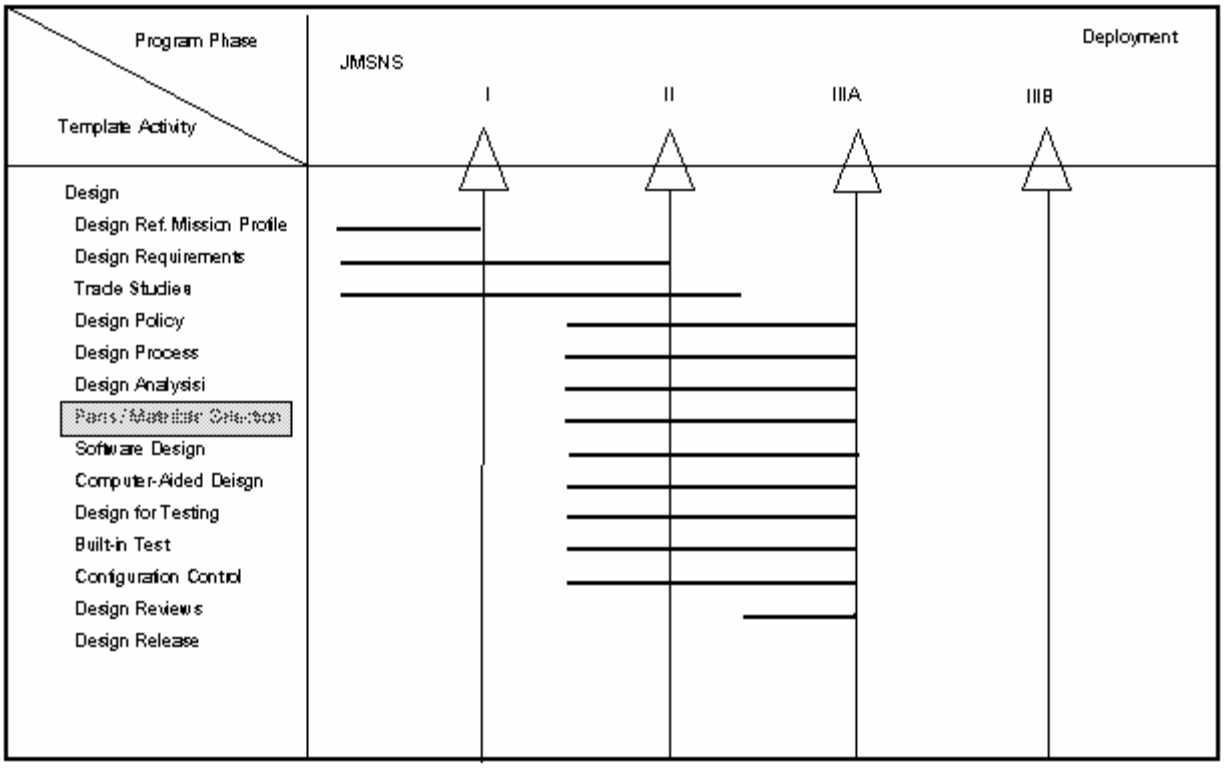
  Equipment used to perform thermal surveys on electronic systems and components now is available readily. This equipment usually is based on infrared scanning techniques, and now is capable of measuring even the junction temperatures of integrated circuits under development.

  - Government contractors include in their design policies and their parts and materials programs the derating criteria for all classes of parts and materials to be used in their products, specifying absolute limits on all parameters to which reliability is sensitive. This policy is subject to review and approval by the Government before contract award.

    Stress derating practice ranks with mission profiles as the most critical design factors associated with low risk products.

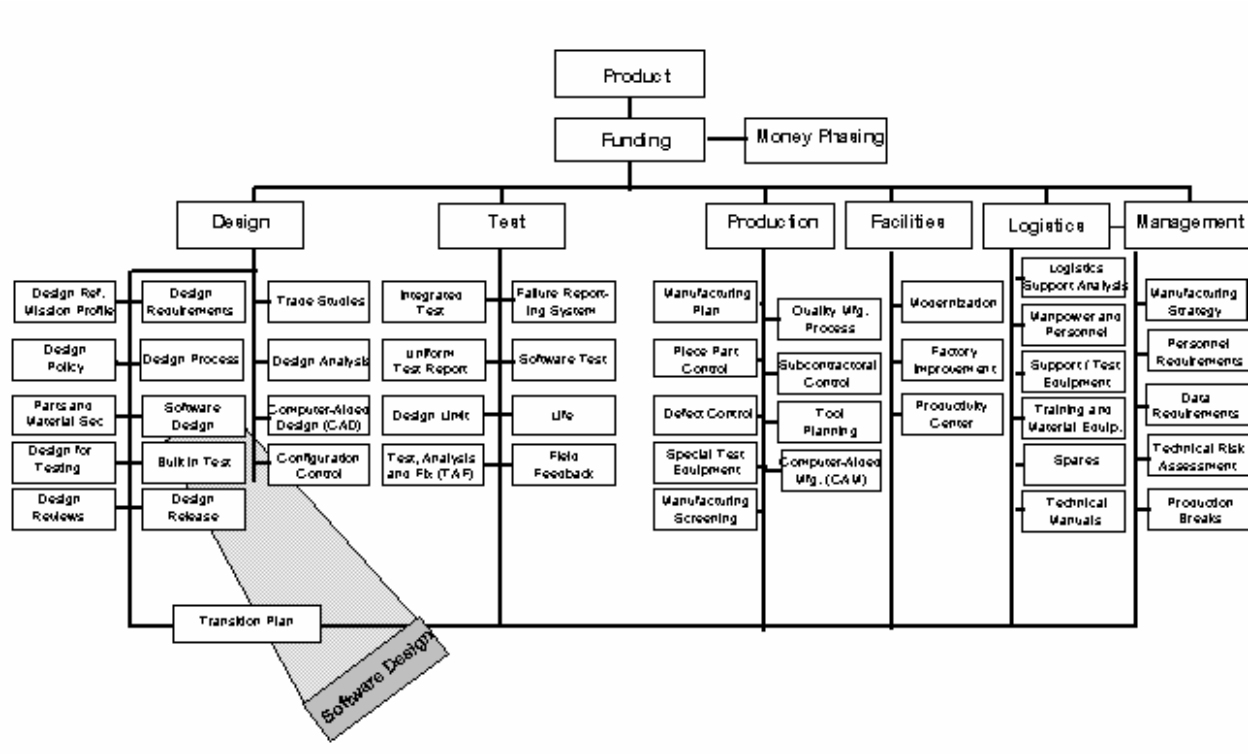
  - Program-peculiar approved parts lists (APL), in general a sub-set of the Military Specification (MIL-SPEC) lists, are issued at the start of FSD. The APL shall inform all designers of the program's standardization decisions -- on resistors, capacitors, other electronic parts, fasteners, connectors, wire, epoxies, and so forth. Designers must use the selected standard parts when they meet system requirements or justify use of nonstandard parts.

Timeline



Parts and materials selection and stress derating policies must be in place at the start of hardware development. The contractor design review process is the primary mechanism to ensure compliance with these policies.

I. -- Software Design



Area of Risk

Many weapon systems now depend upon software for their operations and maintenance. Whether the software is embedded ("tactical" or "firmware") or loaded into main memory from peripheral storage devices, the problems are the same -- the weapon systems cannot be qualification tested and they can't function, in most cases, without proper software. A software error can cause a weapon system failure. Nevertheless, software frequently fails to receive the same degree of discipline as hardware early in FSD. Failure to allocate system requirements clearly between hardware and software greatly increases the difficulty of isolating and correcting design problems. Industry experience shows that 64 percent of all software errors are traceable to functional or logical design, with the remaining 36 percent due to coding.

Outline for Reducing Risk

- The applicability to software in the outline for reducing risk of every design template is considered. Most templates are as applicable to software as to hardware, especially design process and design analysis.

- Functional requirements are allocated either to hardware or to software, as appropriate, at design start. These allocations usually are trade study topics, since it often is not clear initially which functions should be implemented in hardware, and which in software. Hardware and software responsibilities reside with one individual.

- Proven design policies, processes, and analyses governing software design are employed, including, but not limited to the following:

- Rigorous configuration control.
- Chief programmer/designer teams and modular construction.
- Structured programming and top-down design.
- Structured walkthroughs.
- Good documentation.
- Traceability of all design and programming steps back to top level requirements.
- Independent review of requirements analyses and design process.
- Thorough test plan developed and utilized from design start.
- Compliance with standards.
- Structured flowcharting.

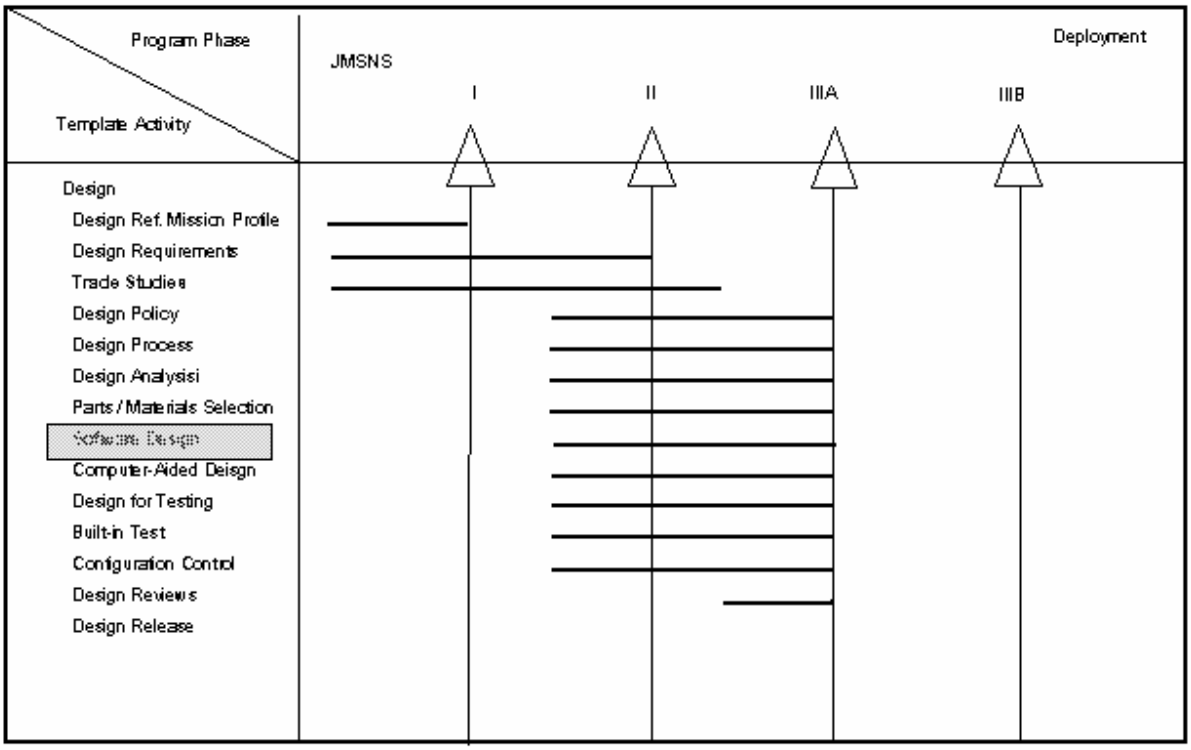
• Computer software developers are accountable for their work quality, and are subject to both incentives and penalties during all phases of the system life cycle.

• A uniform computer software error data collection and analysis capability is established to provide insights into reliability problems, leading to clear definitions and measures of computer software reliability.

• A software simulator is developed and maintained to test and maintain software before, during and after field testing.

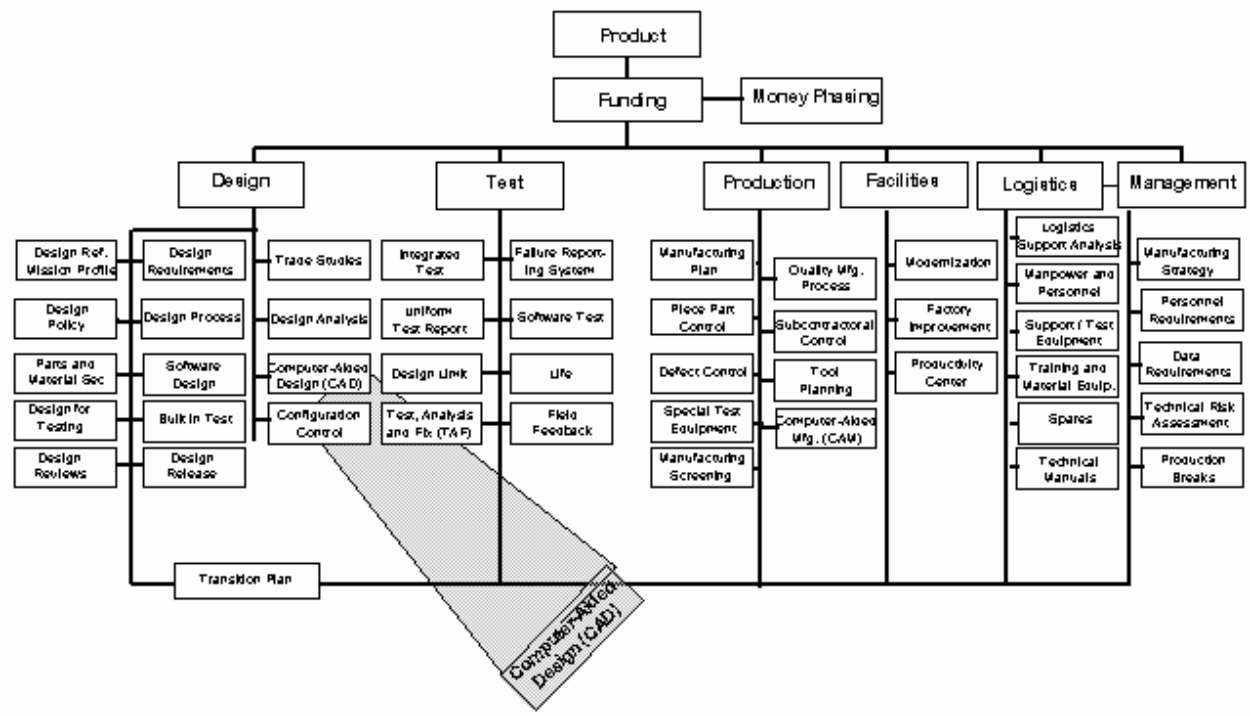
• Security requirements are considered during the software design process.

Timeline



It is essential that software design practices follow a disciplined process similar to proven hardware design practices. Design schedule for software coincide with the hardware schedule.

J. -- Computer-Aided Design (CAD)



Area of Risk

Many design tools and analysis techniques required to achieve a mature design are not used or performed at all because they are time consuming and costly. Engineers don't always follow the design rules that their companies require. Producibility and testability of the design is often lacking due to lack of communications with and knowledge of manufacturing processes. Obtaining a good understanding of the design before it is built and tested is often lacking, increasing the length and cost of test and fix periods, increasing cost of redesigning tooling and test equipment, and increasing support costs and the risk during the transition to production and early deployment. Obtaining information on part and material parameter limitations and availability, as technology produces new items, is time consuming when available only in printed form.

Outline for Reducing Risk

- Computer-aided design (CAD) is carried out in the factory as part of a thorough modernization strategy.
- Each design engineer is provided the use of an alphanumeric computer terminal.
- An interactive graphics terminal is provided for each group of four to six design engineers.
- These graphics terminals have user-friendly access to a data base that contains the following:
  - Parts and materials data.

- Design rules (both corporate policy and product specified).
- Design specifications (mission profile, performance and reliability requirements, supportability design-to requirements, limits, and boundaries).
- Manufacturing rules (special processes, testability, and estimated quantity).
- File and retrieve capability, including design data and analysis results.

• Terminals have user-friendly access to special computer software (programs) that provide a capability to accomplish the following:

- Perform modeling and prototyping.
- Perform simulation and performance analyses.
- Perform special analyses such as the following:

• Electrical stress.

• Failure modes and effects.

• Thermal stress.

• "Worst case" tolerance.

• Vibration stress.

• Sneak circuit.

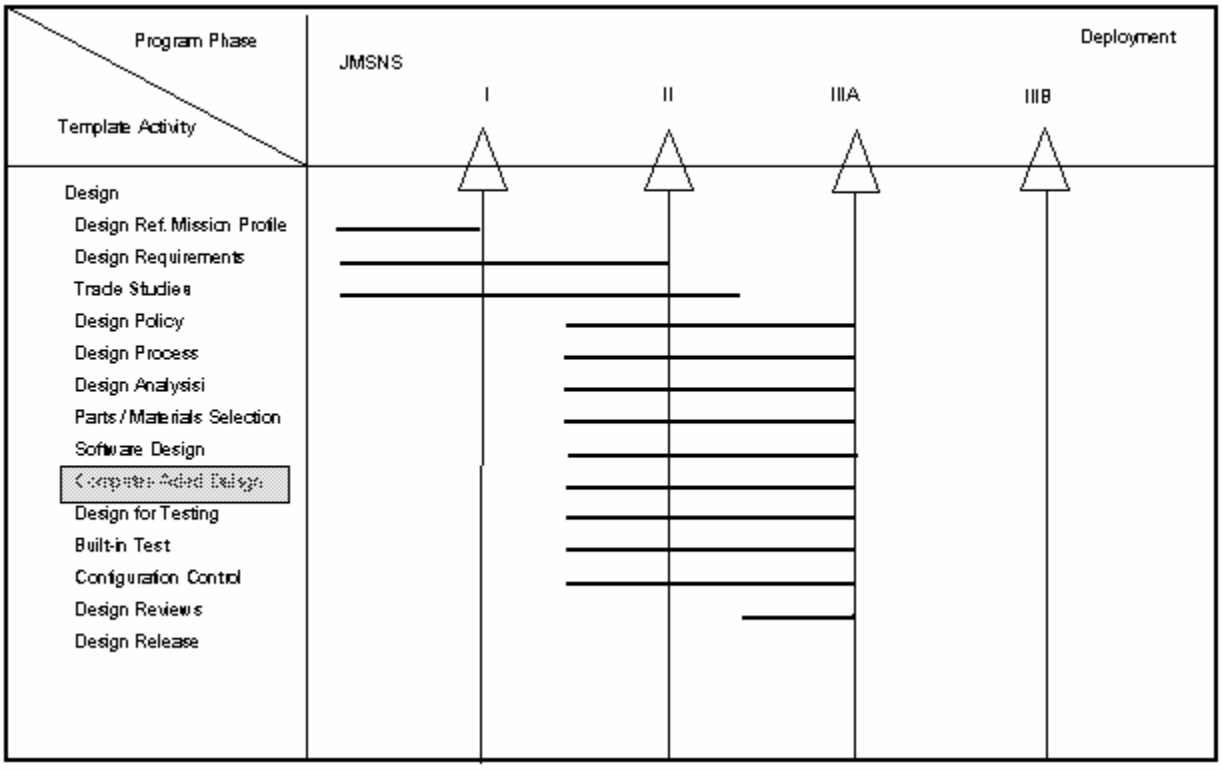
• Reliability prediction and allocation.

- Maintain configuration and design release control.
- Help design product tests.
- Manage test and failure analysis data.

• A common data base is in place to integrate CAD and computer-aided manufacturing (CAM) functions (see template on CAM) to achieve significant cost, schedule, quality, supportability, and performance benefits.

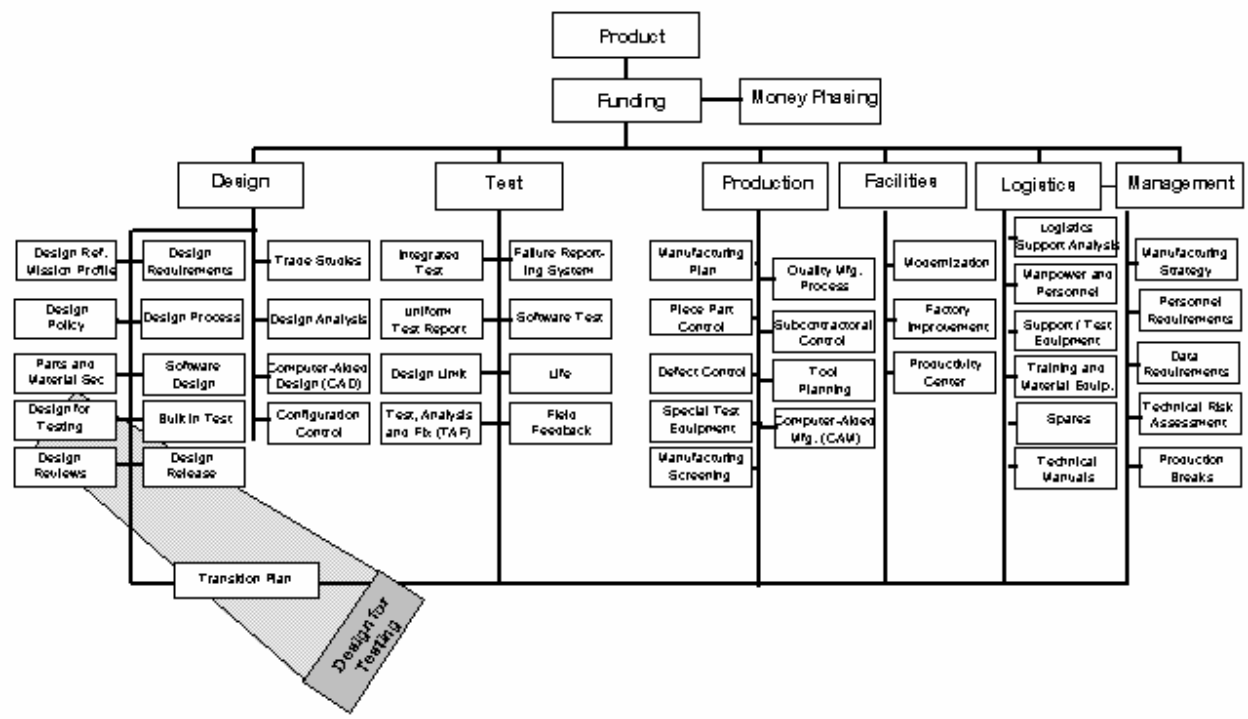
• An aggressive employee retraining program is in place to provide for orderly introduction of new skills.

Timeline



Through the use of CAD equipment, a full complement of design tools is available to facilitate the design process and satisfy producibility objectives.

K. -- Design for Testing



Area of Risk

Test and inspection are integral functions of the production and operational environment. To survive the production process without degradation, a design must allow for access by both inspectors and various types of automatic testing approaches.

Outline for Reducing Risk

- Design criteria are provided for partitioning, initialization, functional compatibility with automatic test equipment (ATE), functional coverage, modularization, and visual and physical accessibility.

- Trade studies are conducted for integrated application of built-in test (BIT), ATE, and manual testing to support fault detection and isolation.

- Production design studies are conducted to define inspection, test, and evaluation requirements; to maximize inspectability; and to minimize the need for special manufacturing tests and special factory or field test equipment.

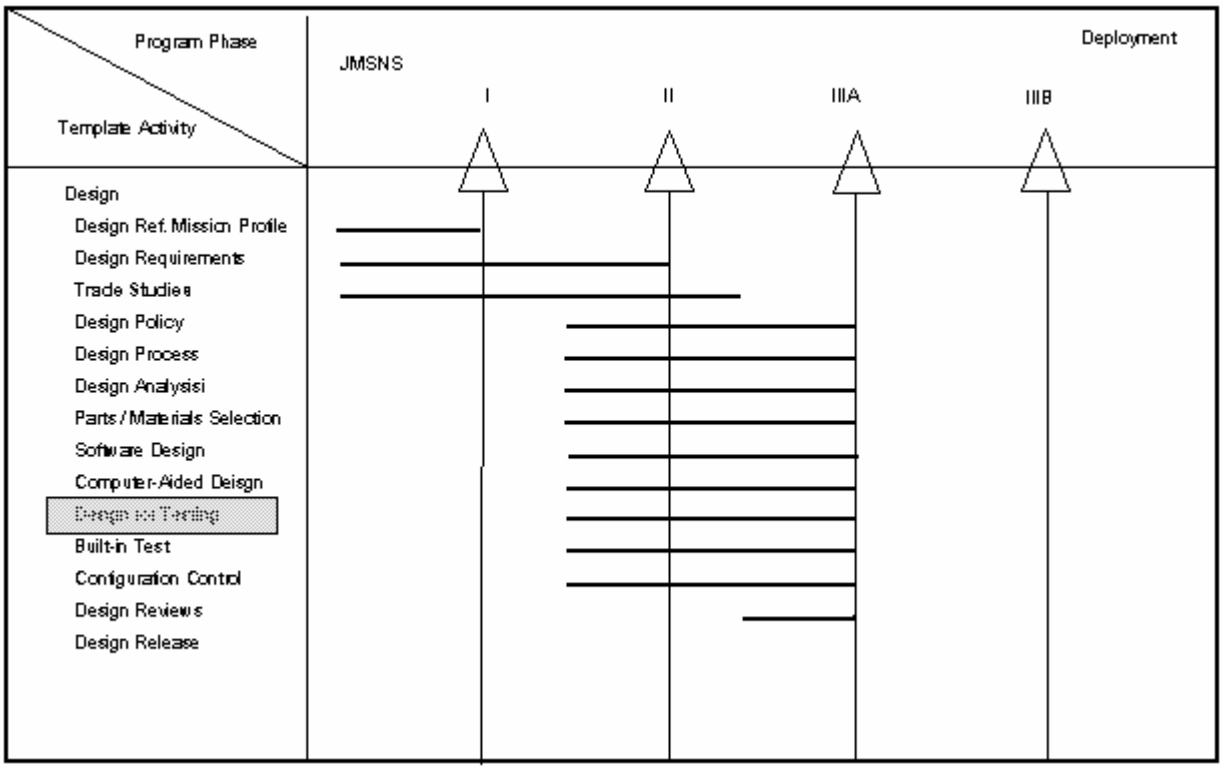
- Classification of characteristics are noted on drawings.

- Test and evaluation (T& E) are planned and coordinated to minimize the need for subjective interpretation of a system's performance design requirements.

- Factory test consumes no more than 10 percent of expected product life.

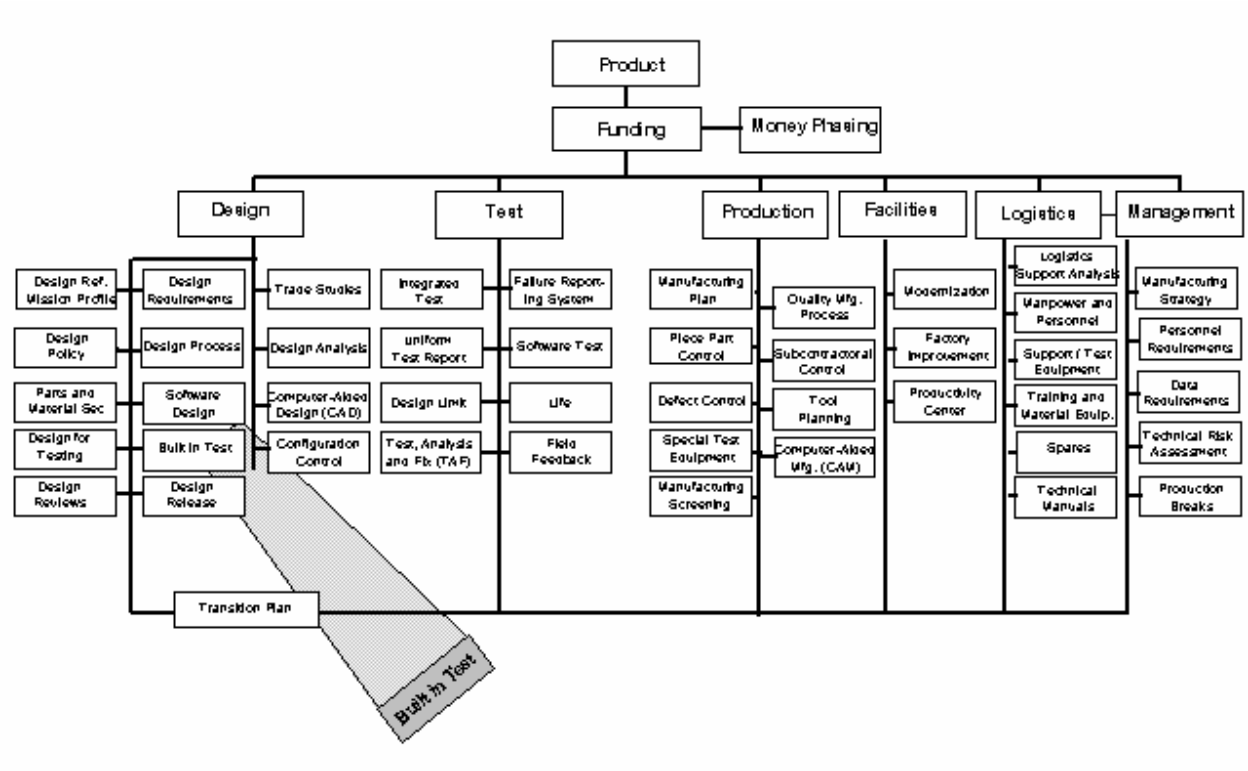
- System level functional testing is conducted at a level that meets but does not exceed operational use requirements.

Timeline



To provide for efficient and economical manufacture, consideration must be given to providing the proper test and inspection capabilities in the basic equipment design. Policies governing design for testing are established before FSD, and such design is completed largely at the conclusion of the design process.

L. -- Built-In Test



Area of Risk

Built-in test (BIT) circuitry offers not only ease of maintenance in the field but also more rapid troubleshooting during factory test and production. Many designs do not include sufficient BIT capability to isolate failures to the single faulty line-replaceable or weapon-replaceable assembly, much less the shop-replaceable assembly or component part. One of the more common results is the line removal of functional assemblies along with the nonfunctional one, increasing downtime and causing unnecessary backlogs in logistic support. The argument is heard frequently that additional BIT equipment itself adds to product risk beyond the value it might have in maintenance. This argument may have had validity in an earlier era, but not with today's complex yet low risk integrated circuitry.

Outline for Reducing Risk

- Maintenance and support requirements are defined before initiation of BIT design.

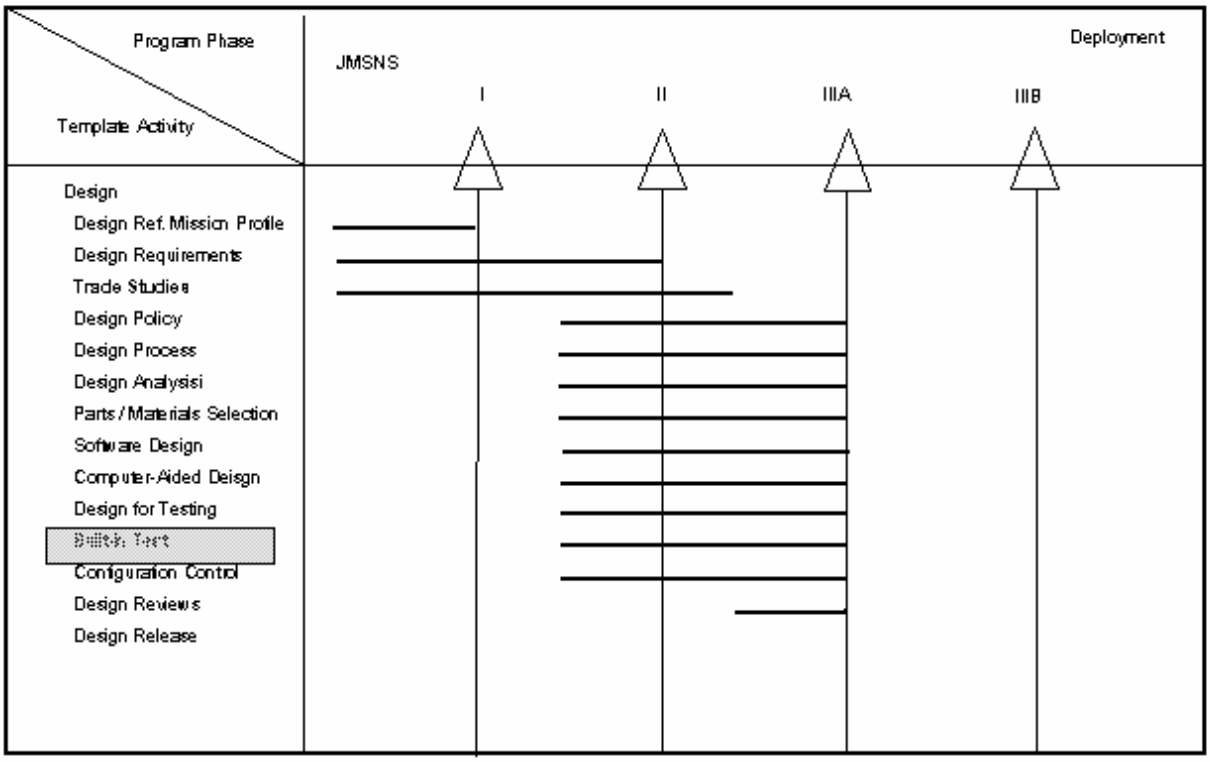
- Design criteria are provided for the contribution of BIT circuitry to product risk, weight, volume, and power consumption. These criteria are established by Milestone II.

- Trade studies are conducted for each maintenance level on the interaction of BIT, automatic test equipment, and manual test in support of fault detection and isolation; and to optimize BIT allocation in hardware, software, and firmware.

- Production design studies are conducted to define the use of BIT in manufacturing inspection, test, and evaluation.

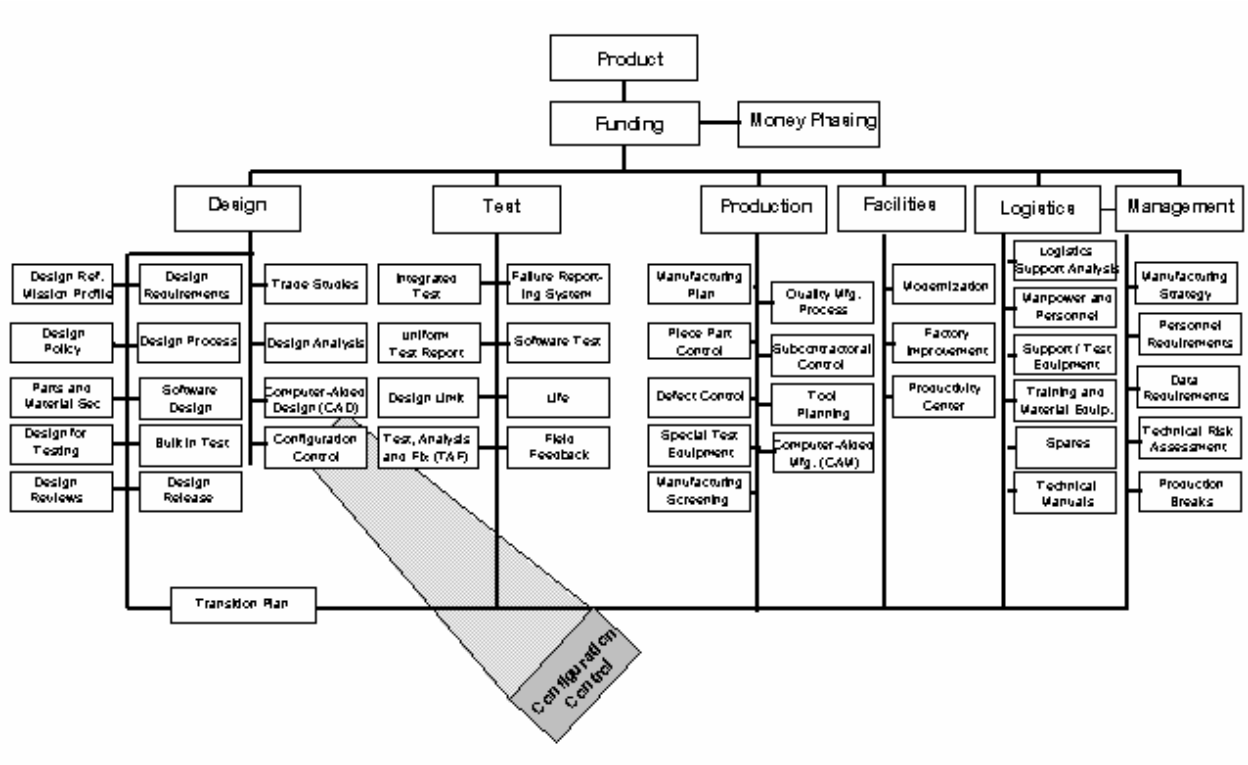
• BIT criteria, at a minimum, detect all mission compromising failures, and validate all redundant functions.

Timeline



BIT is a significant factor in the initial design planning and tradeoff analyses and must be evaluated in subsequent design reviews. Concepts for BIT that are validated during the normal program validation phase may be adopted for the final design. BIT design is completed and validated during full-scale development.

M. -- Configuration Control



Area of Risk

A common source of risk in the transition from development into production is failure to establish and maintain a strong configuration control system. Direct application of boilerplate policies and/or invoking MIL-SPECs leads to ineffective control or overly complex and costly approaches to managing configuration. In a loosely implemented control system, design changes can occur without proper maintenance of the configuration change documentation after the design freeze is established. Lack of a good configuration control system leads to many pitfalls, including an unknown design baseline, excessive production rework, poor spares effort, stock purging rather than stock control, and an inability to resolve field problems. Poor configuration control is a leading cause of increasing program costs and lengthening procurement schedules.

Outline for Reducing Risk

- An effective configuration control system contains the following features:

  – It is tailored from an effective set of guidelines and standards to fit the nature of the program including hardware and logistics support elements.

  – Corporate or division policy recognizes the importance of proper configuration management in the development of a new program, and emphasizes the need to generate an adequate plan for implementation.

  – A configuration management plan is streamlined, yet adequately encompasses the entire life cycle of the program, recognizing the requirements of each phase of the life cycle and the complexity of the system configuration.

– The configuration management plan establishes the mode of operation and interface relationship among vendors, subcontractors, contractor, and customer.

- Proper staffing and authority commensurate with responsibility are essential to the success of a configuration management organization.

- The specification tree, engineering release, and drawing discipline are managed by documentation requirements that have been established through the configuration management plan.

- Training in the established configuration management system is essential for a smooth configuration management program.

- A sound configuration management system recognizes that strict discipline is necessary to organize and implement, in a systematic fashion, the process of documenting and controlling configuration.

- Dynamic change control boards and status accounting systems that are updated frequently by timely feedback from user activities are indicative of effective configuration management.

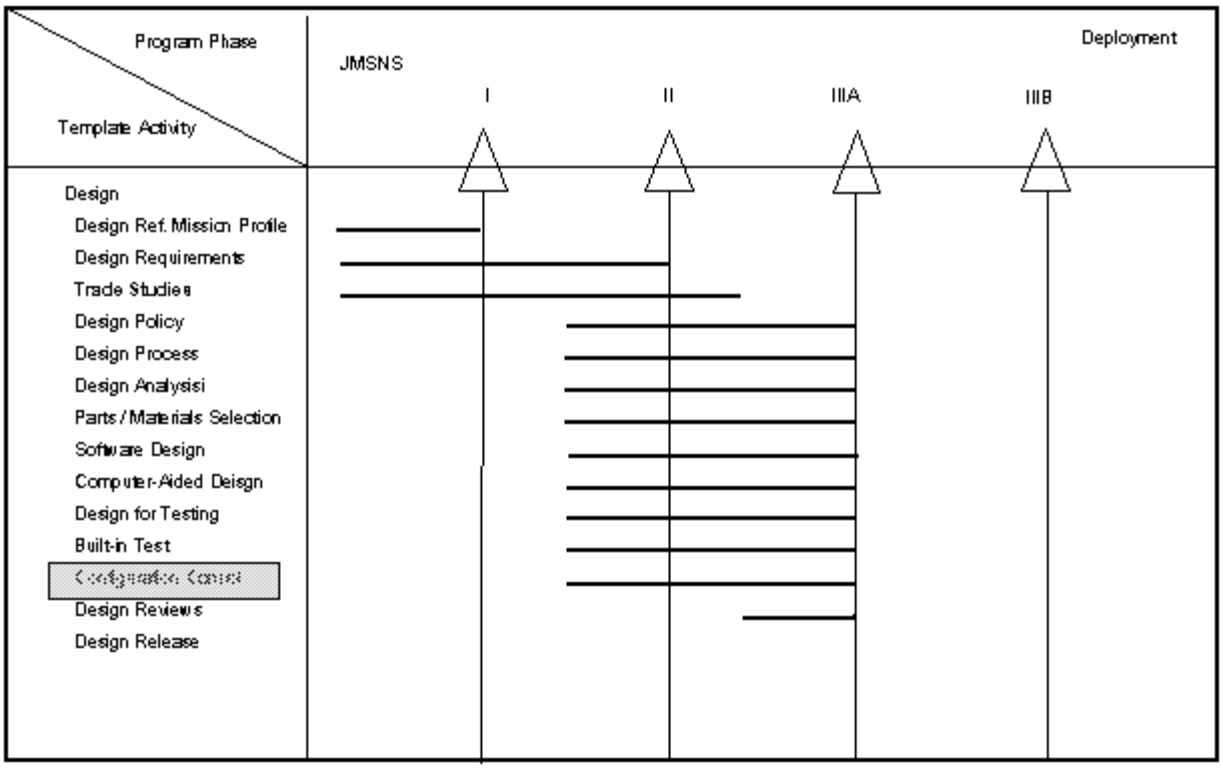
- Good configuration control procedures ensure the establishment and maintenance of design integrity.

- Configuration audits are performed to establish the design baseline and to validate the drawing package before production release.

- Manufacturing engineering interfaces with configuration control of work instruction planning.

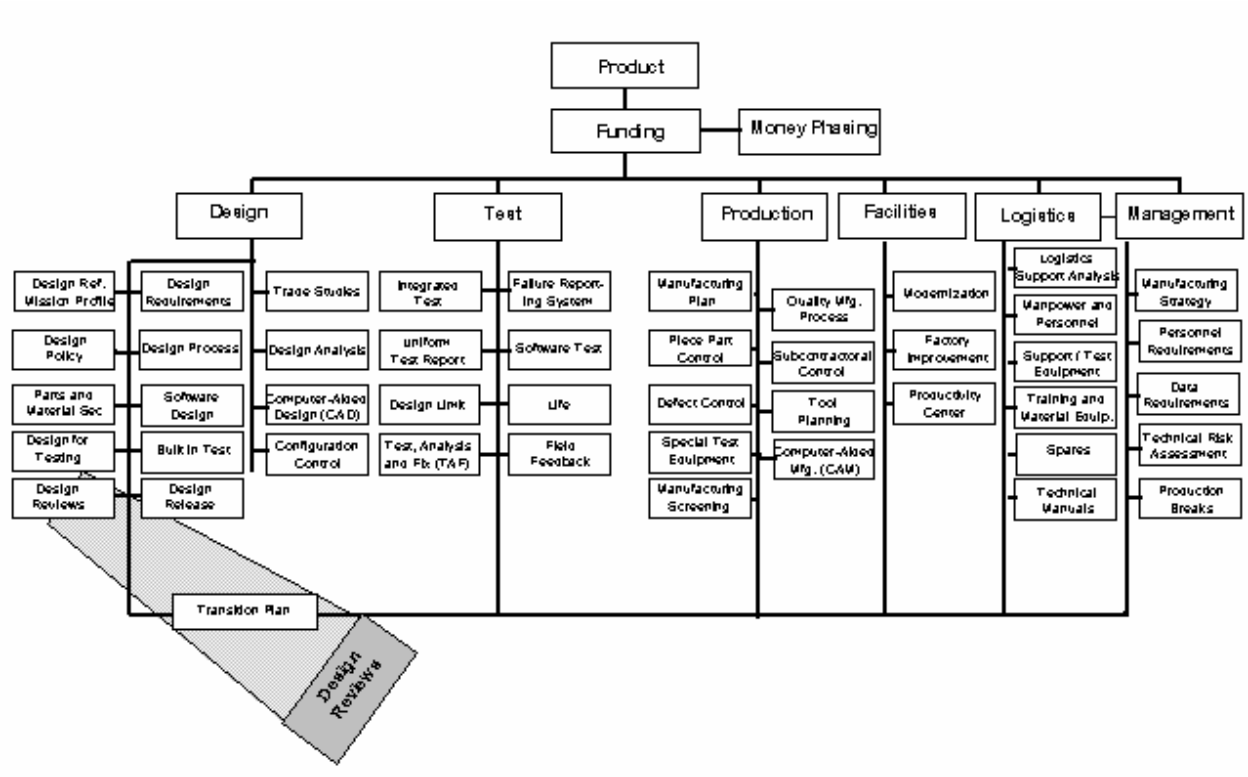
- The transition from contractor to Government responsibility is made when the design is largely mature and when field support will be enhanced.

Timeline



The application of configuration control on a program is essential. For effective utilization, it should be tailored to fit the nature of the program. Configuration control policies are established early in the development and the design baseline configuration is stabilized before production.

N. -- Design Reviews



Area of Risk

While defense contracts usually require formal design reviews, they often lack specific direction and discipline in the design review requirement, resulting in an unstructured review process that fails to fulfill either of the two main purposes of design review, which are: (1) to bring to bear additional knowledge to the design process to augment the basic program design and analytical activity; and (2) to challenge the satisfactory accomplishment of specified design and analytical tasks needed for approval to proceed with the next step in the material acquisition process.

Outline for Reducing Risk

- The Government and its contractors recognize that design reviews represent the "front line" where readiness for transition from development to production is decided ultimately. Design review policy, schedule, budget, agenda, participants, actions, and follow up are decided in view of this foremost need.

- Design reviews are included in all material acquisition programs in accordance with existing Government requirements. A design review plan is developed by the contractor and approved by the Government. The design review plan provides for both Government design reviews and internal contractor design reviews and inspections.

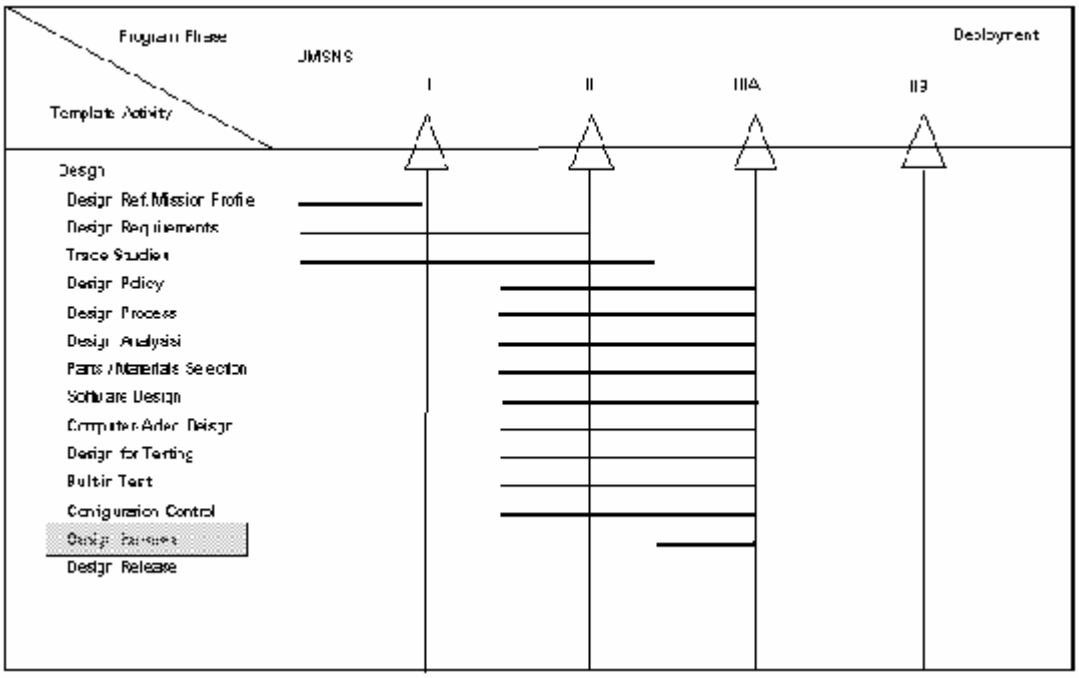
- Design review requirements flow down to subcontractors and suppliers to ensure proper subcontractor internal design review practices and to provide timely opportunities for both the contractor and the Government to challenge subcontracted material design.

• Government and contractor design review participants are selected or recruited from outside the program to be reviewed, on the basis of experience and expertise in challenging the design, and have a collective technical competence greater than or equal to that of the designers responsible for the design under review.

• Manufacturing, product assurance, and logistics engineering functions are represented and have authority equal to engineering in challenging design maturity.

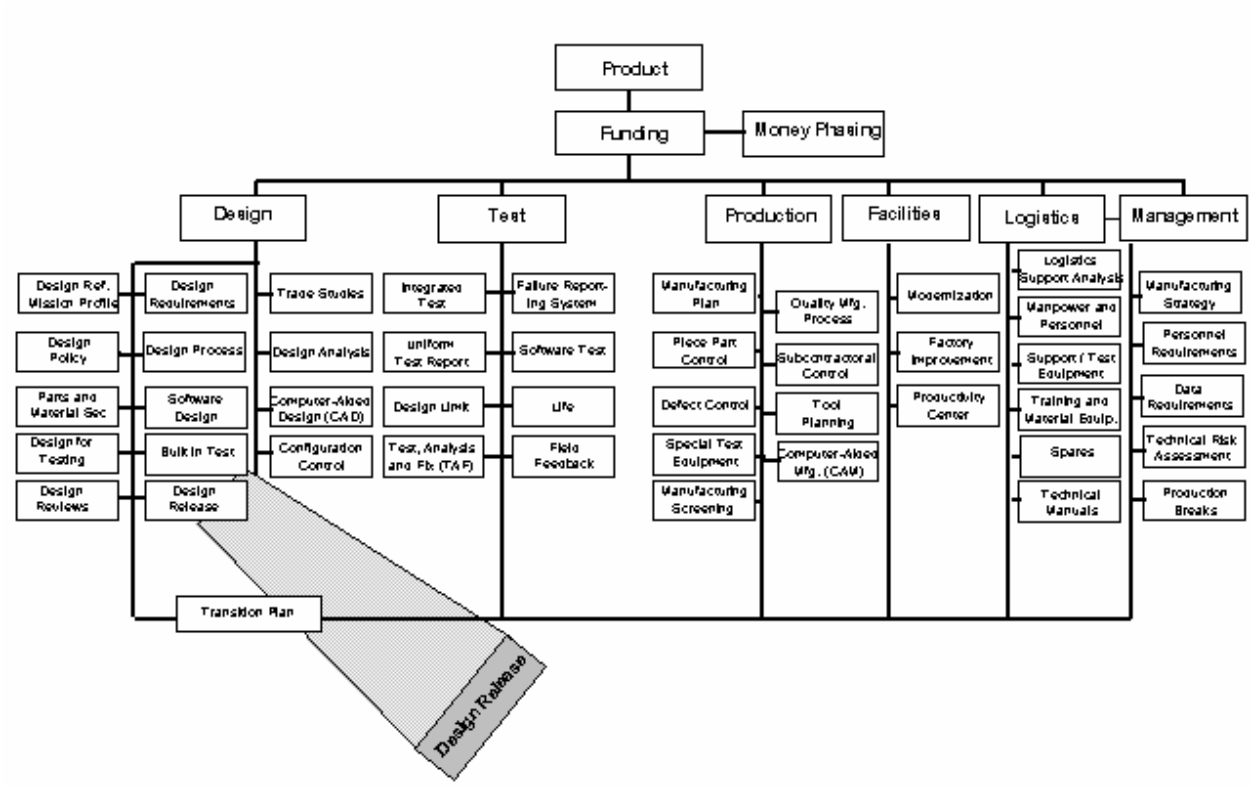
• Design reviews use computer-aided design analyses, whenever available, and include review of production tooling required at the specific program milestone.

Timeline



Design review must be performed by technically competent personnel in order to review design analysis results and design maturity, and to assess the technical risk of proceeding to the next phase of the development process. Design review policies are established before FSD, and the design reviews are completed by the conclusion of FSD.

O. -- Design Release



Area of Risk

One of the most critical concerns in the transition from development to production is the risk associated with the timing of design release. On many programs, design release schedules are established by "back planning" from manufacturing schedules or ambitious marketing considerations. As a result, the design engineer is expected to meet unrealistic milestones forcing him or her to deviate from standard design practices. The results are predictable: design solutions are not the most beneficial to the overall design, interface considerations are glossed over, costly redesigns occur, and necessary documentation is sketchy. Expedited and advanced design releases generally create the need for second and third generation effort. On the other extreme, when a design release is scheduled beyond the normal period required to complete the design, the designer is tempted to add undue complexity to the basic design rather than improve inherent reliability or maintainability or reduce costs.

Outline for Reducing Risk

- Documented corporate policy clearly identifies practices and procedures for design drawing releases to facilitate transition and reduce production risk.

- The design release disciplines practiced by the contractor are flowed down to subcontractors and suppliers.

- By applying uniform practices and procedures dealing with technical requirements and evaluating current manufacturing capability, realistic design release dates can be established.

• In areas of high manufacturing risk, alternate design approaches are planned and evaluated to ensure that the design release schedule is maintained.

• Complex designs are validated before design release by fabricating preproduction manufacturing models and feeding results back to design for corrective action. This step increases the assurance that the design release documentation will support full-scale production.

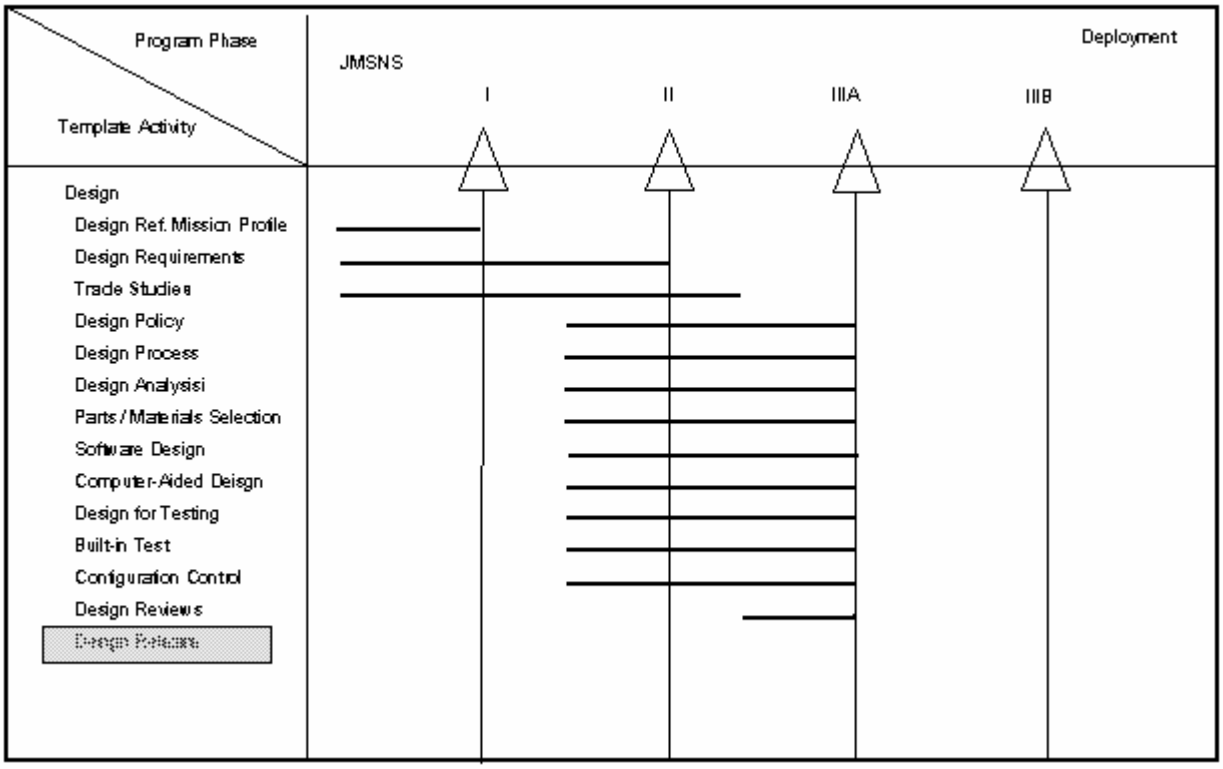
• The design release documentation includes all necessary information required for an orderly transition from design to production.

• A formal review of the design release documentation is conducted at the critical design review (CDR).

• The design baseline is established and validated as part of the design release.

• All design-related testing, including qualification testing, is completed before design release, to ensure that the design has reached acceptable maturity.

Timeline



Integral to the development process are the facts that at some point, creative design must then be released to manufacturing. Design release is completed with the acceptance of the design through the CDR and qualification test process.

Next Section

Previous Section

Chapter 4 -- Test

A. -- Introduction for Test Critical Path Templates

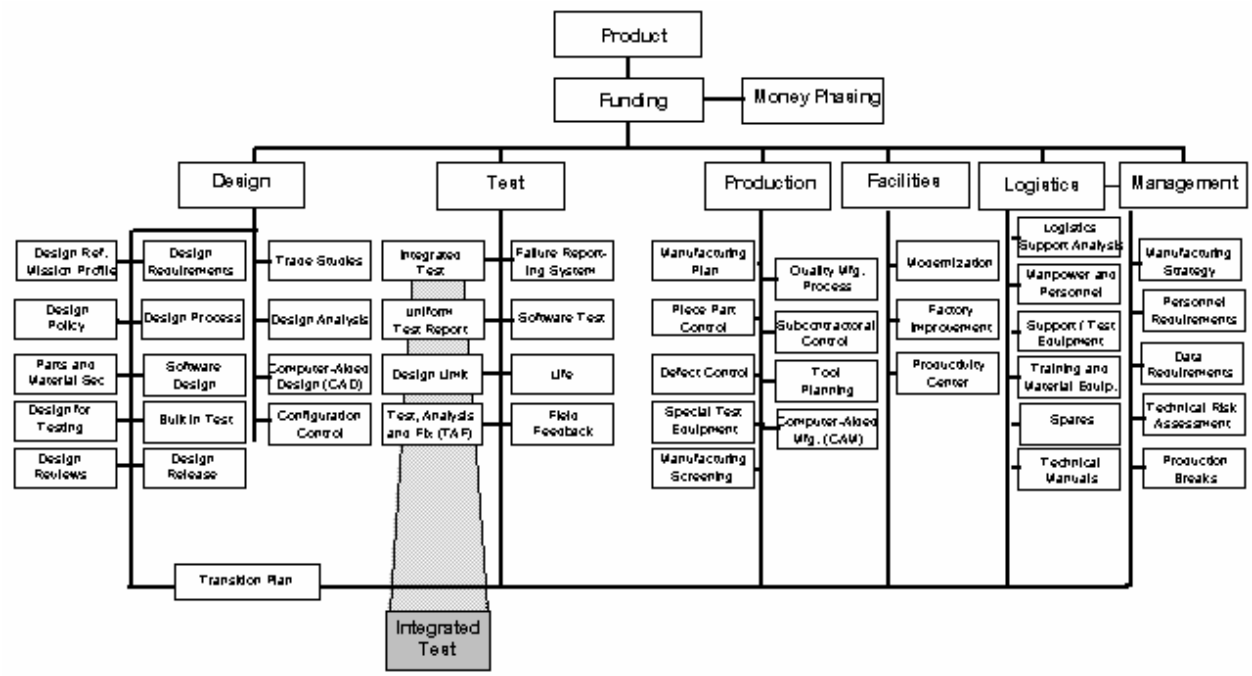
During the development cycle of a weapon system various tests are performed by subcontractors, prime contractors, and the Government. In the early stages of development, these tests are used in evaluating design approaches and selecting design solutions for further development. As the design matures, the tests become more complex in attempting to provide confidence that the weapon system will perform satisfactorily in the actual operational environment.

As weapon systems have become more sophisticated, test requirements have been added with little consideration being given to possible duplication of effort or the elimination nation of older tests that no longer are needed. Attempts also have been made to "standardize" test environments. In many instances, these "standard" environments have shown little relation to the actual operational environment, resulting in costly engineering changes to weapon systems, after initiation of production and deployment, in order to correct basic design deficiencies that would have been detected" before production had a proper environment been used.

The DSB task force reviewed the test and "evaluation experience of several major DoD programs and the contributions of the test programs towards reducing the risk of transition from development to production" on. Areas investigated included topics such as integrated test plans; operational test environments; reliability development tests; reliability demonstration tests; software tests; Government participation in full-scale engineering development tests; initial operational test and evacuation; application of the test, analyze, and fix (TAAF) philosophy during transition; and the feedback of information from initial field use of production weapon systems.

The issues and guidelines provided in this section represent the most significant areas requiring special management attention in order to reduce the risk of transition from development to production. The process to integrate and document test requirements for the end item begins with the preparation and generation of the test and evacuation master plan (TEMP).

B. -- Integrated Test



Area of Risk

Although every development program has a defined test plan, this plan usually specifies a series of standard tests that have not been integrated properly. Integration includes the careful accounting of objectives, environments, test article configurations, data requirements, and schedules. Recognizing that T& E is a major cost driver, the objectives of test integration are to minimize overlaps and gaps, to collect maximum intelligence from every test, and to ensure a smooth and effective test program at minimum cost. The absence of a carefully integrated test plan is a certain indicator of a high risk program.

Critical parameters and characteristics measured in production acceptance tests (PATs) do not give a sufficiently high level of confidence that the product meets its specification. Production configuration changes introduced without recertifying the validity of the PAT further increase product risk.

Outline for Reducing Risk

- Early in the program initiation phase an integrated test plan (ITP) is prepared by the prime contractor for Government approval that maximizes efficiency in testing, as follows:
  - Includes all development and qualification tests (prime contractor, subcontractors, and Government) at the system and subsystem levels.
  - Identifies duplicate test activities and missing test activities.
  - Provides for the most efficient use of test facilities and test resources.
- This ITP is updated periodically.

• Government participation in contractor testing of weapon systems includes operating the system a portion of the time during FSD.

• Initial operational test and evaluation (lOT& E) is conducted during the transition from development to production, using the latest available configuration, when possible.

• Qualification test articles are representative of production units.

• Production acceptance testing is conducted on all production items, to ensure the continuing effectiveness of the manufacturing processes, equipment, and procedures. This includes revalidation of acceptance test procedures. when significant changes occur in the configuration or the production processes.

• Ensure that test tolerances are funneled from component (most restrictive) to system (least restrictive) within system specification performance parameters.

• Reasonable probability that the product meets previously qualified performance requirements is demonstrated by the production acceptance test, in terms of both thoroughness and severity, as a prerequisite to product acceptance by the Government.

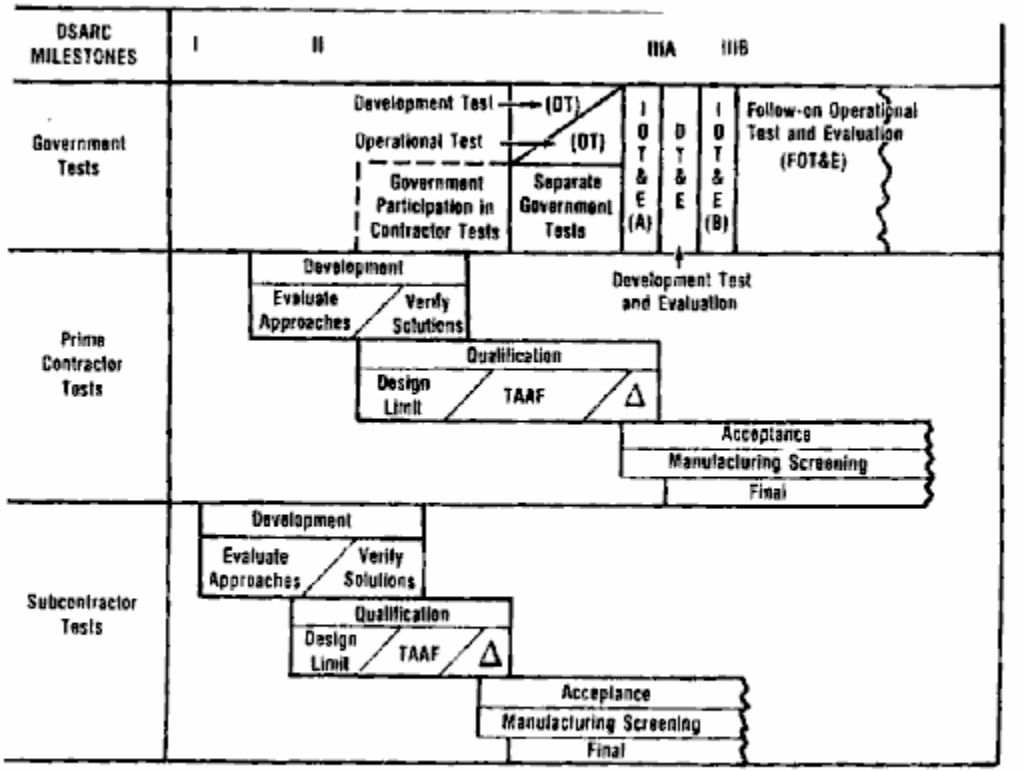
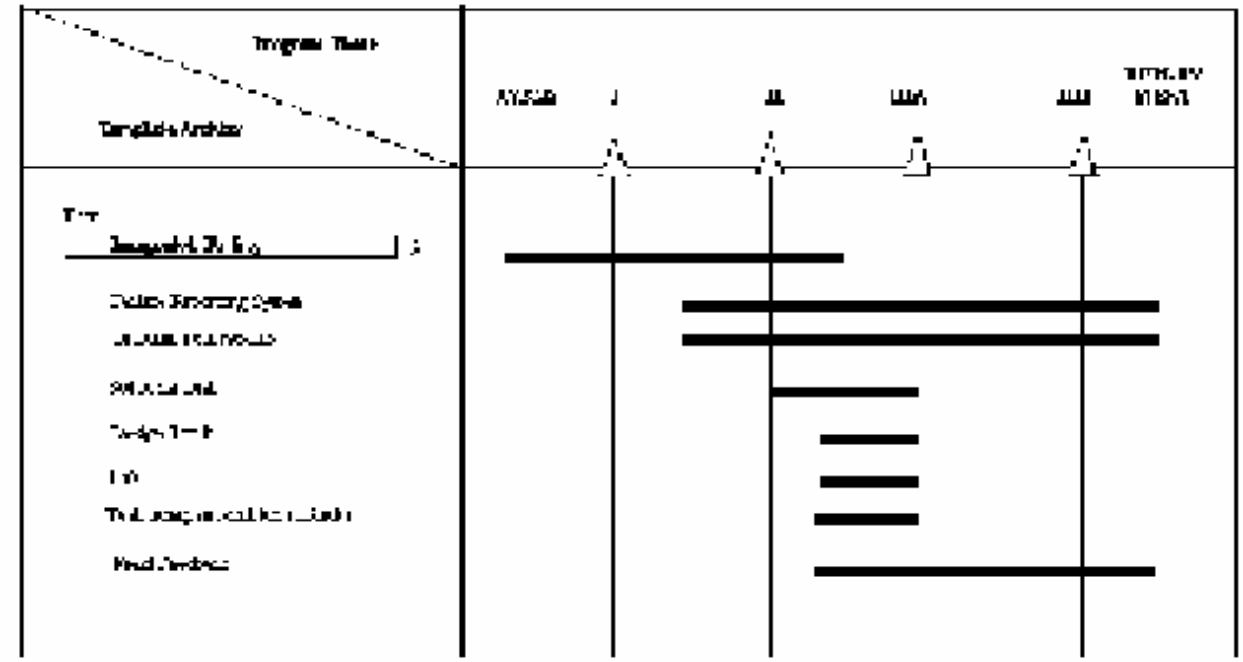


Figure 4-1. Integrated Test Plan

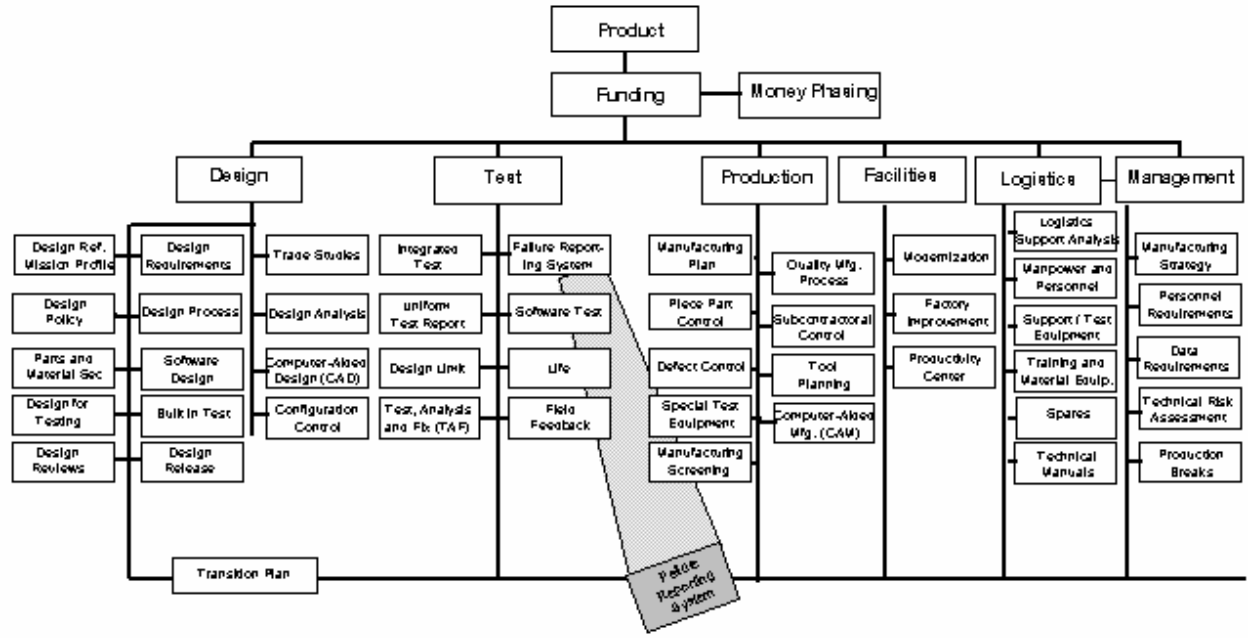
Δ = Additional Qualification Tests due to redesign resulting from Test, Analyze and Fix (TAAF)

• Figure 4-1. shows the essential elements of an ITP.

To ensure that all development tests are properly time phased, that adequate resources (for example, test articles, test facilities, funding, and manpower) are available, and that duplicative or redundant testing is eliminated, a properly integrated test program is required. This activity must start early in concept development to continue into FSD.

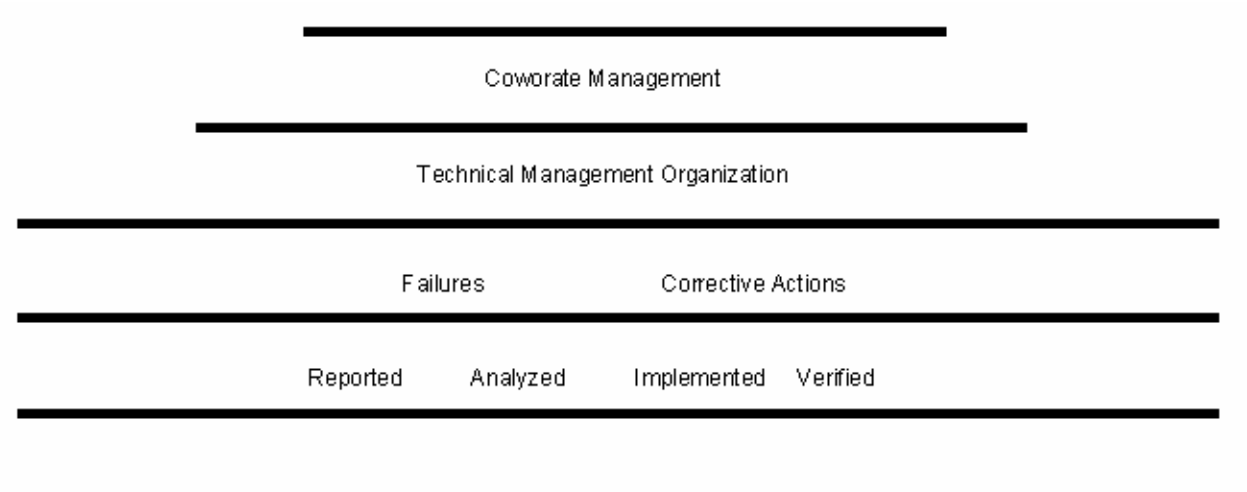


C. -- Failure Reporting System



Area of Risk

The ultimate objective of a failure "reporting, analysis, and corrective action system (FRACAS) is to devise corrective actions, which prevent failure recurrence, for incorporation into the system or equipment. Although there are several military standards, such as Military Standard (MIL-STD) 785B (reference (e)) and MIL-STD 781 C (reference (f)), that require FRACASS, the implementation of these requirements has been managed poorly, defined improperly, and undisciplined. The flow down of requirements from prime contractor to subcontractors has not been uniform, analysis of all failures has not been required, the timely close-out of failure reports has been overlooked, and systems for alerting higher management to problem areas have been missing.

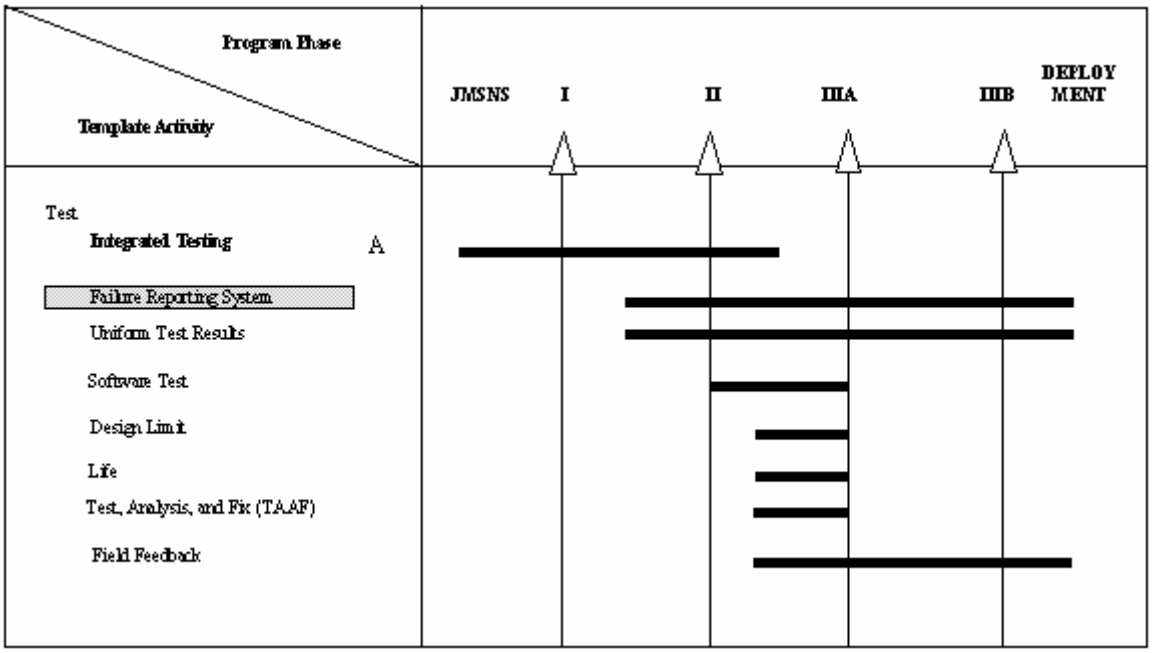


Outline for Reducing Risk

- A central technical organization is responsible for implementation and monitoring.
- A FRACAS is initiated at the piece pat level.
- Uniform requirements are imposed on subcontractors, prime contractors, and Government activities.
- All failures are reported.
- All failures are analyzed to sufficient depth to identify failure cause and necessary' corrective actions.
- All failure analysis reports are closed out within 30 days of failure occurrence, or rationale is provided for any extensions.
- Corporate management automatically is alerted to failures exceeding close-out criteria.
- Corporate management automatically is alerted to ineffective corrective actions.
- Small subcontractors lacking facilities for in-depth failure analysis arrange for the use of prime contractor, Government, or independent laboratory facilities to conduct such analyses.

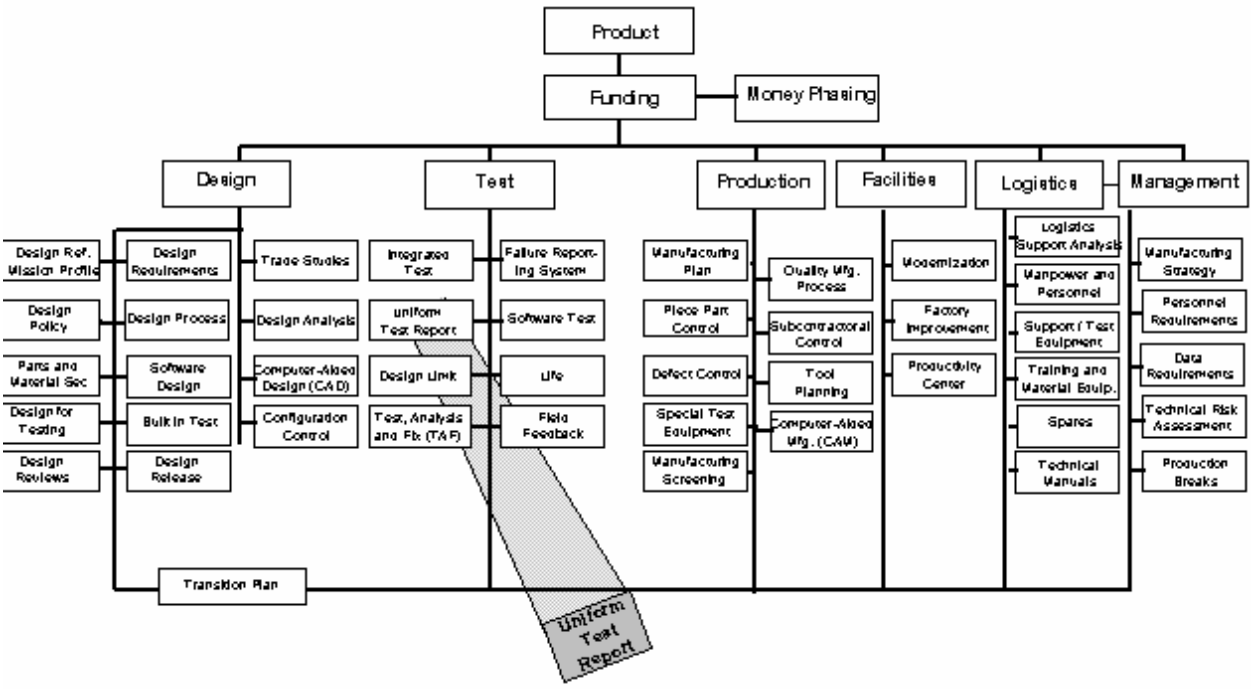
• Criticality of failures is prioritized in accordance with their individual impact on operational performance.

Timeline



A FRACAS will be effective only if the reported failure data is accurate. The failure reporting system is initiated with the start of the test program and continues through the early stages of development.

D. -- Uniform Test Report



Area of Risk

Formal reliability development tests using the TAAF methodology normally are performed for failure mode identification and elimination. During these tests, all results are reported in a format that provides acquisition managers with visibility of actual versus predicted reliability growth. Results from other tests being performed during the development and transition phases usually are reported in different formats. This change in format precludes merger of test results and prevents an overall assessment of design maturity by acquisition managers.

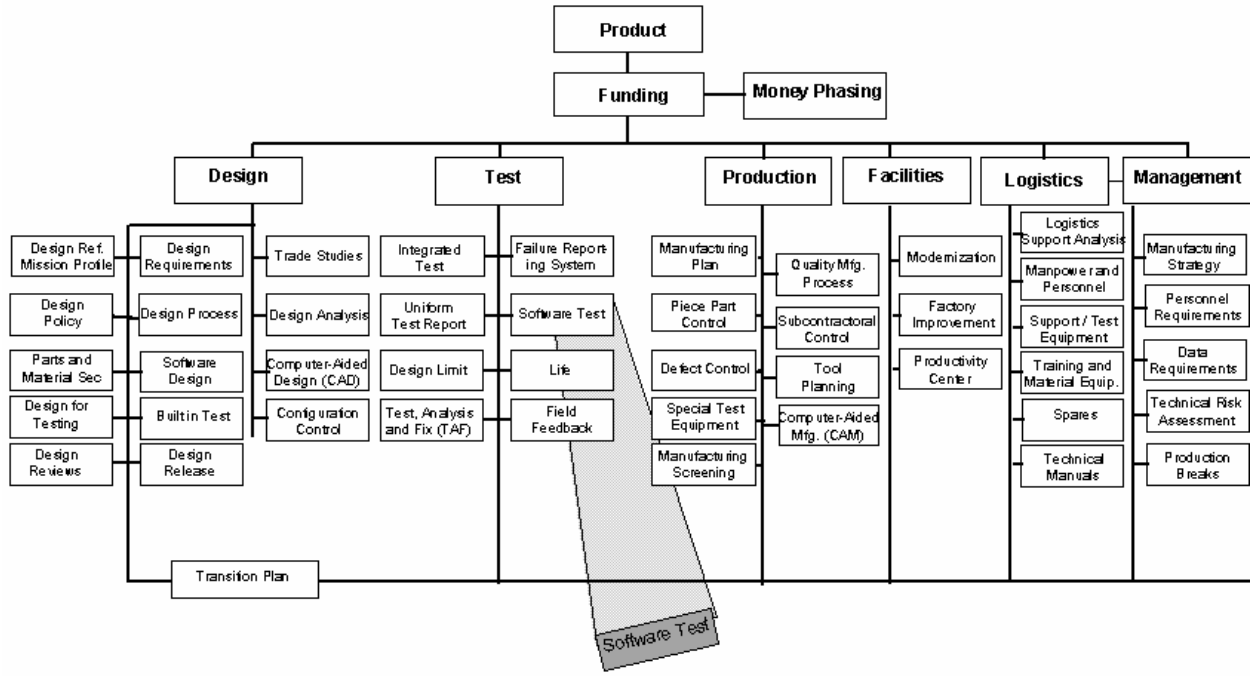
Outline for Reducing Risk

- All test results, including initial field operations, are reported using the TAAF format, an example of which is shown in figure 4-2.

- Plotted results are used to assess design maturity and readiness for transition from development to production.

All test data must be collected in the special TAAF format and analyzed to determine reliability growth. Reporting test results in the TAAF format begins with the earliest program testing and continues into service *use* to allow a uniform baseline to evaluate failures and corrective actions.

E. -- Software Test



Area of Risk

There is no way to test all possible paths during a development and acceptance test for a complex system involving immense logic complexity. Some of these paths eventually will be exercised after the system is deployed and some legitimate user interfaces will occur that were not tested specifically. These will result in software errors.

Many past studies on hardware illustrate how the cost of correcting a design error multiplies if the problem is not found until acceptance testing, production, or deployment. The same applies to software, but the cost for correcting software design errors after the design phase multiplies at a much greater rate.

Figure 4-3. is based on combined data from four major contractors and shows a multiple of 100:1 for cost to correct a design error after the system is operational.

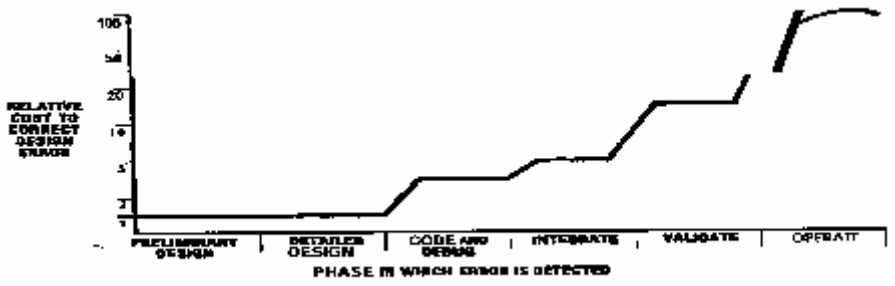


Figure 4-3. Relative Cost to Correct Design Error

Outline for Reducing Risk

- Up front money is available for testing software early in the design phase to prevent design and coding errors from being discovered after deployment.

- The software design allows the product to be testable. The test group is an active participant in software design reviews to ensure that the design is testable to the greatest degree.

- An independent test group is used to initiate the software test plan and to initiate testing at the functional module level early in the program.

- Test readiness reviews are used to ensure good software test planning.

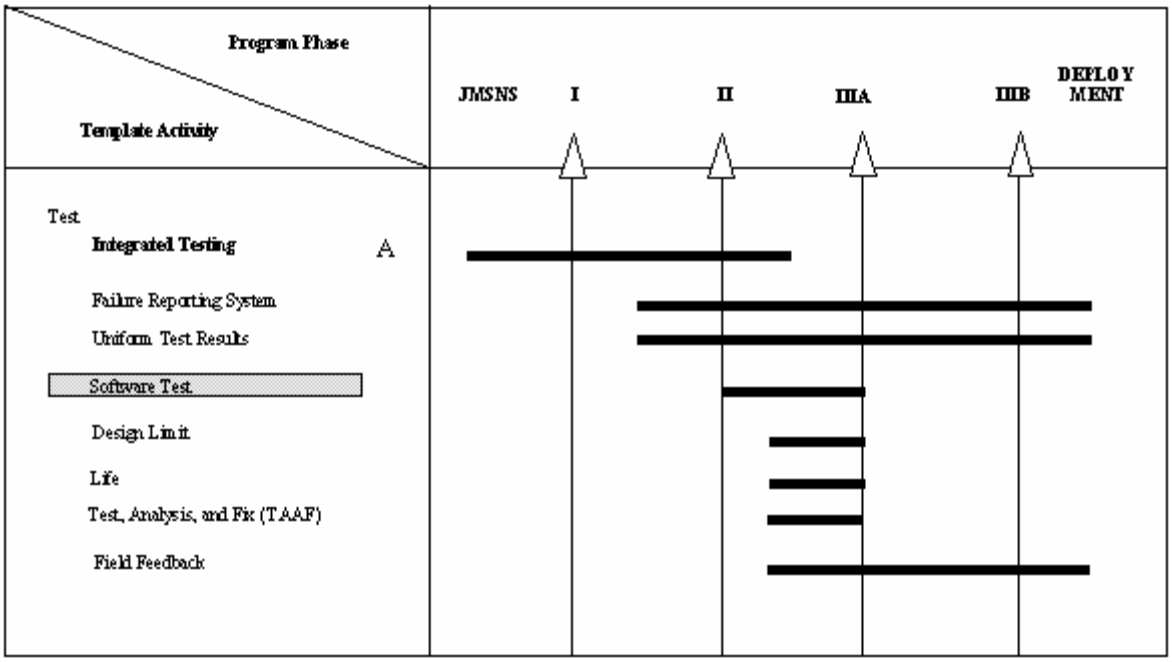
- For extremely high reliability requirements, the verification and validation approach is used. An independent test group is used to verify by analysis or test every important test action.

- Useful definitions of error and failure are developed and software reliability growth is tracked during all test phases using a closed loop failure reporting system. Every failure is analyzed placing special emphasis on resolving anomalies.

- Stress testing and “worst case” testing are utilized to ensure that adequate design margins exist in memory loading, data rates, port timing, and other critical parameters.

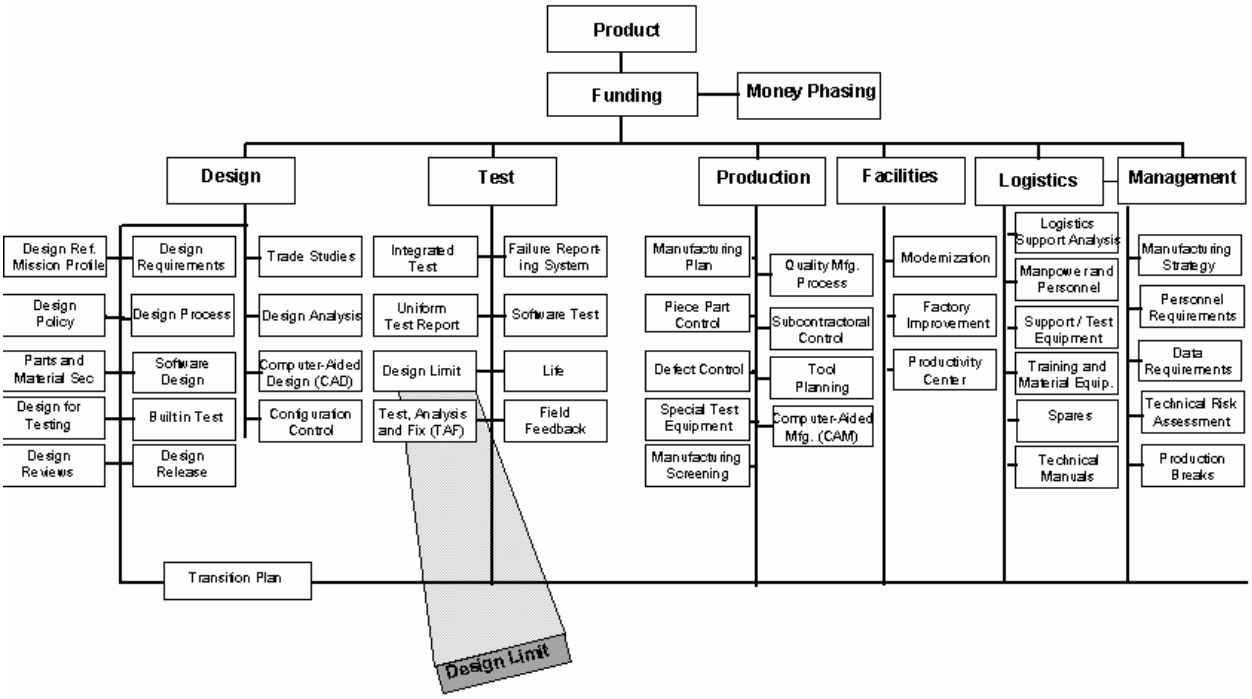
- Security requirements are considered during software testing.

Timeline



The best approach in testing software is through testing at each of the early stages of design and coding to reduce the probability of error escaping and surfacing during system integration tests and field use. Assurance of software/hardware interface compatibility is obtained by exhaustively testing the software in a total system, test bed.

F. -- Design Limit



Area of Risk

Design limit test are intended to ensure that system of subsystem designs are adequate to meet specified performance characteristics when exposed to "worst case" environmental conditions expected at the extremes of the operating envelope. Nevertheless, test environments often are not representative of the "worst case" operating environment, resulting in high risk of poor performance during operational use.

Outline for Reducing Risk

- One specific set of system-level test environments based on expected operational (mission profile) environments is used.
- System-level operational test environments are allocated to each subsystem and tailored to the expected operational environment for each subsystem.
- Design limit qualification test environments are based on the "worst case" conditions in the system and subsystem life cycle profiles.
- Contractors are provided with measured environmental data to use in developing test environments.
- Test environments are modified as additional environmental data become available.

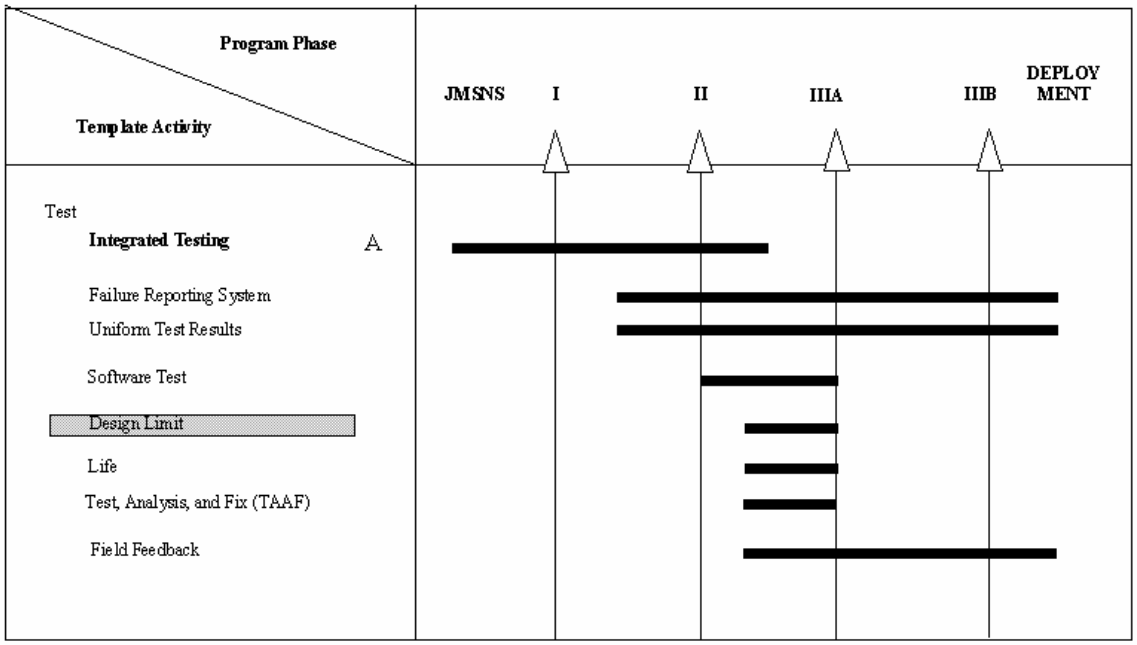
• Failures occurring during design limit qualification testing are investigated thoroughly to determine the mechanisms of failure, so that creative action can be initiated. Timeliness is important to ensure cost-effective design improvements.

• Design limit qualification testing is conducted on critical hardware at the lowest level of assembly.

• A test history file is maintained on design limit qualification tests for future use on the program and as a reference for new programs.

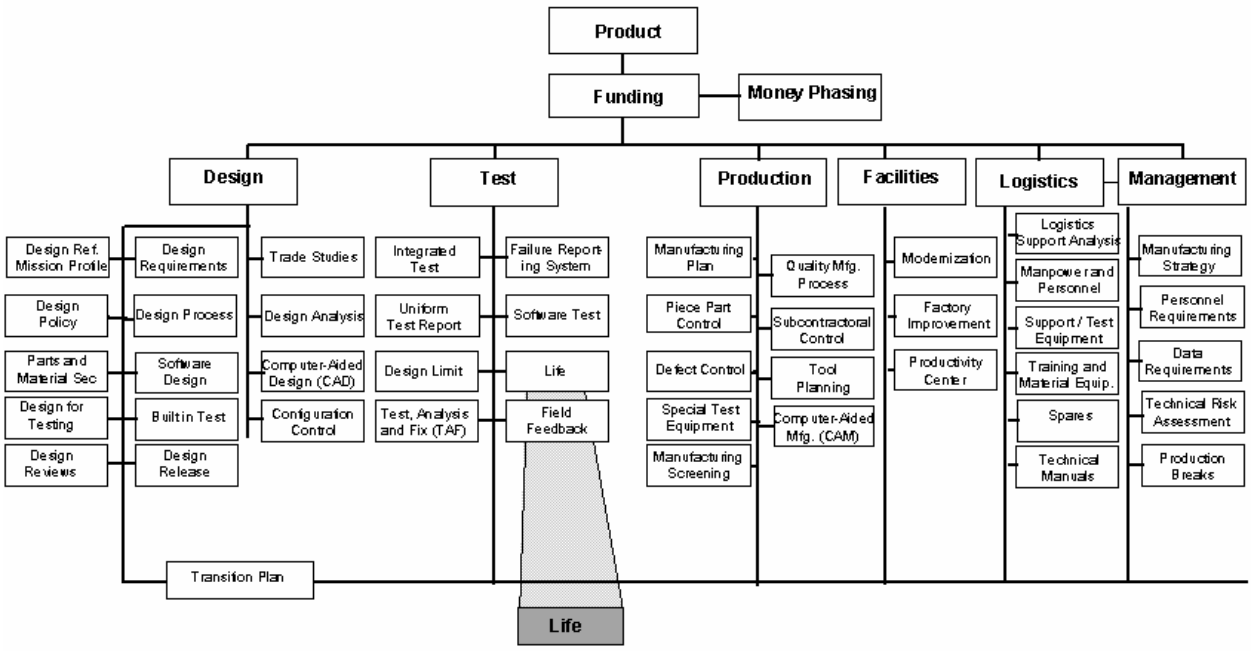
• Subsystem qualification tests are scheduled and conducted so that completion occur before the production decision.

Timeline



Design limit tests ensure that system or subsystem design meet performance requirements when exposed to environmental conditions expected at the extremes of the operating envelope the "worst case" environments of the mission profile.

G. -- Life



Area of Risk

Life tests are intended to assess the adequacy of a particular equipment design when subjected to long-term exposure to certain mission profile environments. Due to the time-consuming nature of these tests, various methods have been used to accelerate test times by exposure to more stringent environments than those expected in actual operational use. These methods may give misleading results due to a lack of understanding of the acceleration factors involved, for example, recent attempts to develop accelerated life tests to verify long-term dormant storage requirements for missiles.

Many weapon system programs are forced into conducting life tests after the systems are deployed and before reliability requirements are achieved. As a result, life tests are performed after the start of production and mostly engineering change proposals (ECPS), and retrofit programs must be initiated in an attempt to "get well" with less than optimum design solutions.

Outline for Reducing Risk

- Include life testing in tie overall system integrated test plan to ensure that testing is conducted in a cost-effective manner and to meet program schedules.

- Use test data from other phases of the test program to augment the system and subsystem life testing by reducing the time required to prove that reliability requirements are met.

- Use life-test data from similar equipment's operating in the same environment to augment the equipment life testing, in order to gain confidence in the design. For example, this technique is useful particularly when determining the long-term dormant life expectancy of a missile.

• Conduct early assessment of operational life expectancy through realistic life testing that will ensure timely feedback of test results to design activities.

• Develop realistic life test environments based on operational mission profile environments. Experience gained from previous programs is useful in developing life test parameters.

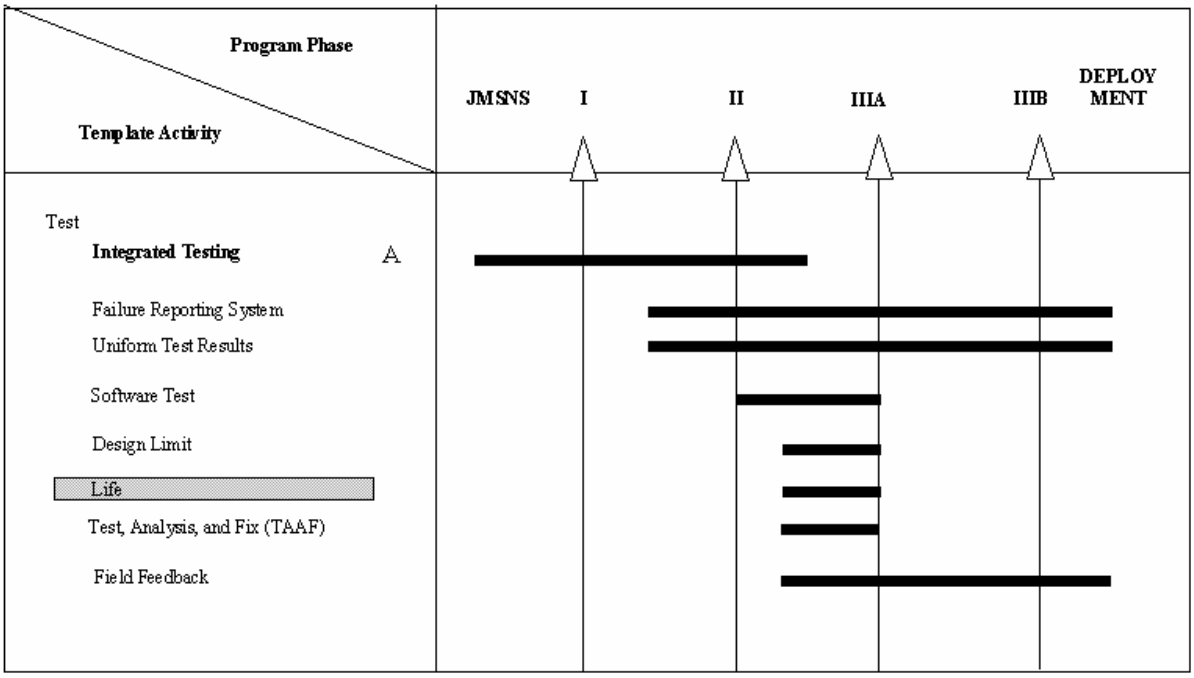
• Use only proven, well understood, accelerated testing techniques in the design of life tests.

• Analyze failure data originating from life tests in sufficient depth to identify the root cause of failure, so that the proper design correction can be implemented.

• A well designed life test is an excellent measure of the level of design maturity.

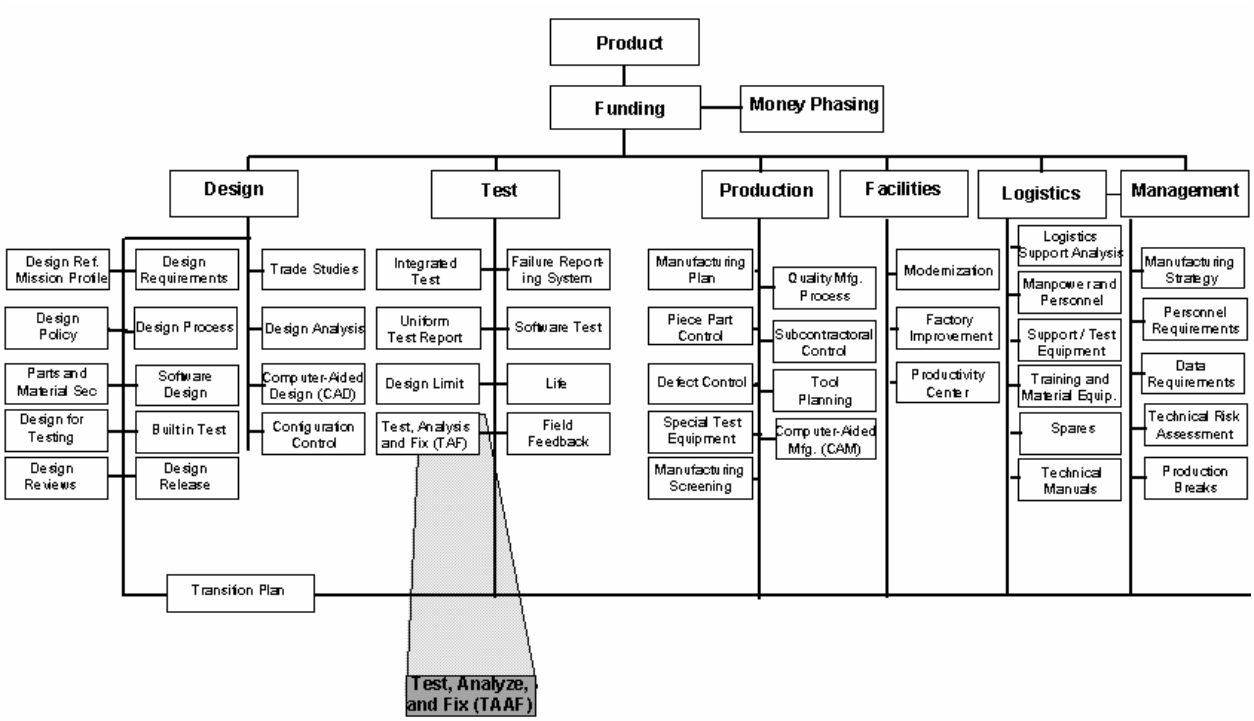
• Fatigue life tests should be conducted to loading spectra that will determine the inherent strength of the parts so that their lives can be recalculated should the operational mission profile be changed or revised test conditions differ from those calculated.

Timeline



A well-designed life test an excellent measure of the level of design maturity and is used to reestablish life characteristics. Life testing is integrated with other development test activities and is completed before design release.

H. -- Test, Analyze, and Fix (TAAF)



Area of Risk

Many past development contracts have not given proper emphasis to reliability development testing, utilizing the TAAF methodology. Instead, they limit their approach to a reliability test to demonstrate a numerical mean time between failure (MTBF) requirement. This latter approach has been ineffective in providing weapon systems with acceptable field reliability. Reliability development testing (TAAF) using simulated mission environments and emphasizing reliability growth has proven a more effective use of limited test resources' and has reduced the risk of allowing systems with poor reliability to transition from development to production. TAAF is consistent with the growth requirement of DoD Directive 5000.40 (reference (g).

Outline for Reducing Risk

- Reliability development tests are performed instead of reliability demonstration tests, which are nonproductive cost and schedule drivers.

- Reliability development test resources are directed to subsystems of low (predicted) reliability when improvement will have a significant influence on overall weapon system reliability.

- If subsystems of high (predicted) reliability exhibit reliability problems during other development tests, such subsystems are incorporated in the reliability development test program.

- For most efficient use of test resources, reliability development tests are integrated with other tests, such as environmental qualification tests, to avoid duplication.

- Reliability development tests use mission profile environments.

- The predicted MTBF is at least 1.25 times the required MTBF (see figure 4-4.).

- An initial MTBF estimate of 30 percent of the predicted MTBF should be used for low risk programs. A substantially lower estimate, as low as 10 percent in some cases, should be used for high risk programs.

- A growth slope of 0.5 can be achieved by a well-executed program.

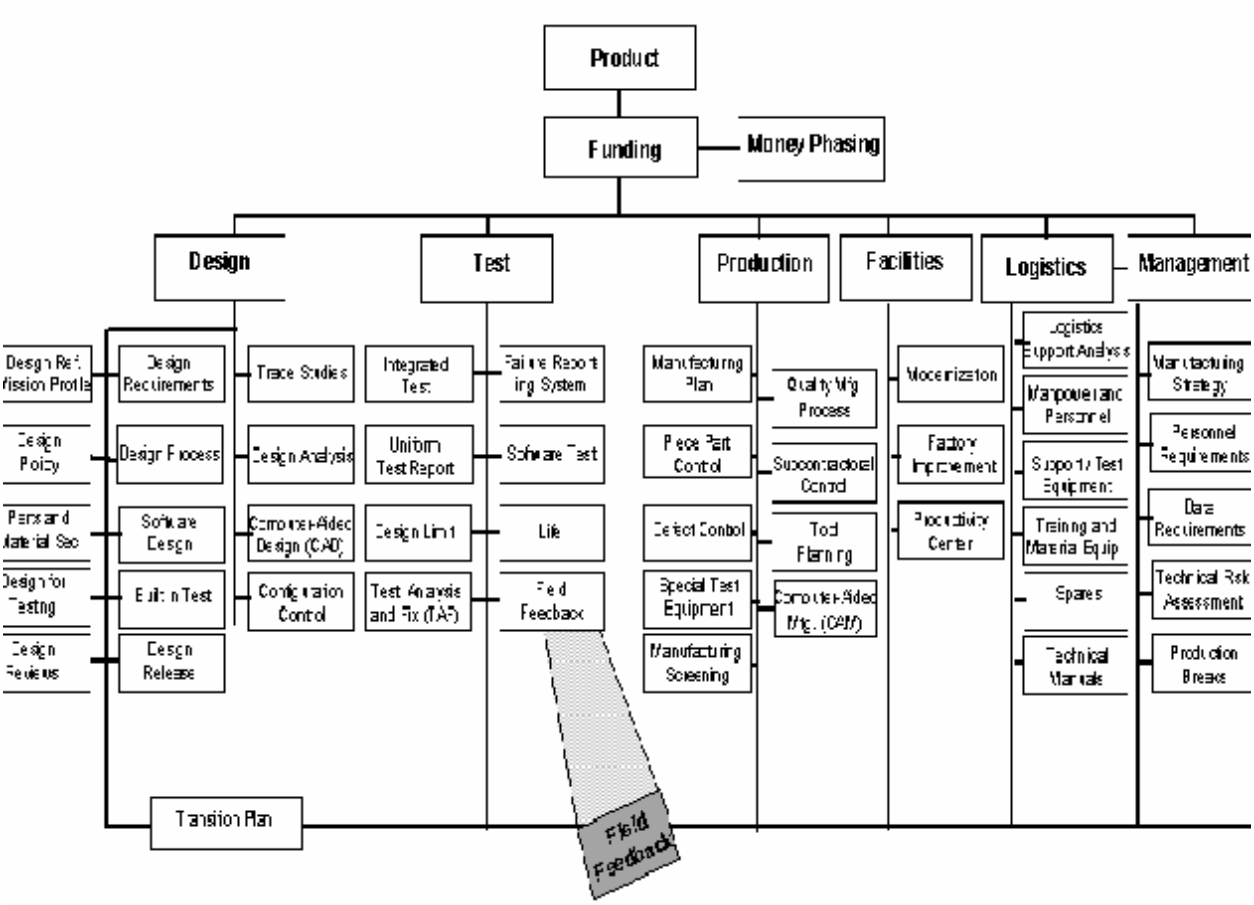
- There are no random failures -- all failures require analysis and implementation of corrective action to prevent their recurrence.

- Results of reliability development tests and other development and operational tests are used to assess reliability.

- Reliability development tests are terminated when further tests produce insignificant improvements.

- A typical reliability development test example is shown in figure 4-4. for both low risk and high risk programs.

TAAF tests are implemented during FSD, to ensure the early incorporation of corrective action necessary for continuous reliability growth. TAAF tests are integrated with other test activities and are completed before the initial production decision.



I. -- Field Feedback

Area of Risk

Early feedback of problems occurring during initial use of weapon systems is essential for the elimination of unforeseen design defects and correction of problems. Feedback of field problems, however, is slow and inadequate, and failed parts are not returned for analysis in a timely manner. Onsite engineering teams can provide adequate reporting and return of-parts, but the usual contractual approach to the use of the teams is to address implementation at contractors; facilities only and not to include provisions for service use at remote sites.

Outline for Reducing Risk

- Weapon systems' contracts provide for an onsite engineering team to observe initial operation, help in identifying problems, provide early feedback of field problems, and provide sufficient data to allow design changes or improvements to the manufacturing process. The duration of this service is established during contract negotiations.

  - The types of problems encountered in initial service operation of new weapon systems require engineering solutions.

- Solutions are enhanced significantly by onsite engineering analysis.

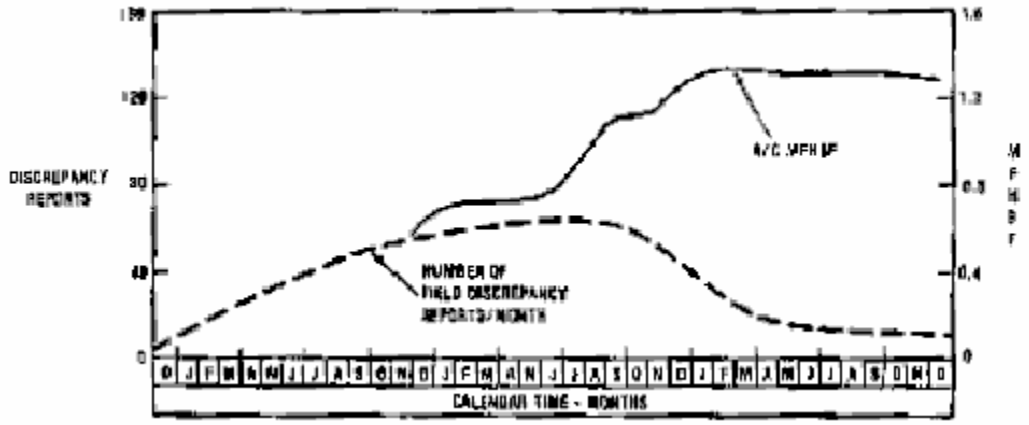
- Experience has demonstrated the effectiveness of the onsite analysis process in improving field reliability of weapon systems.

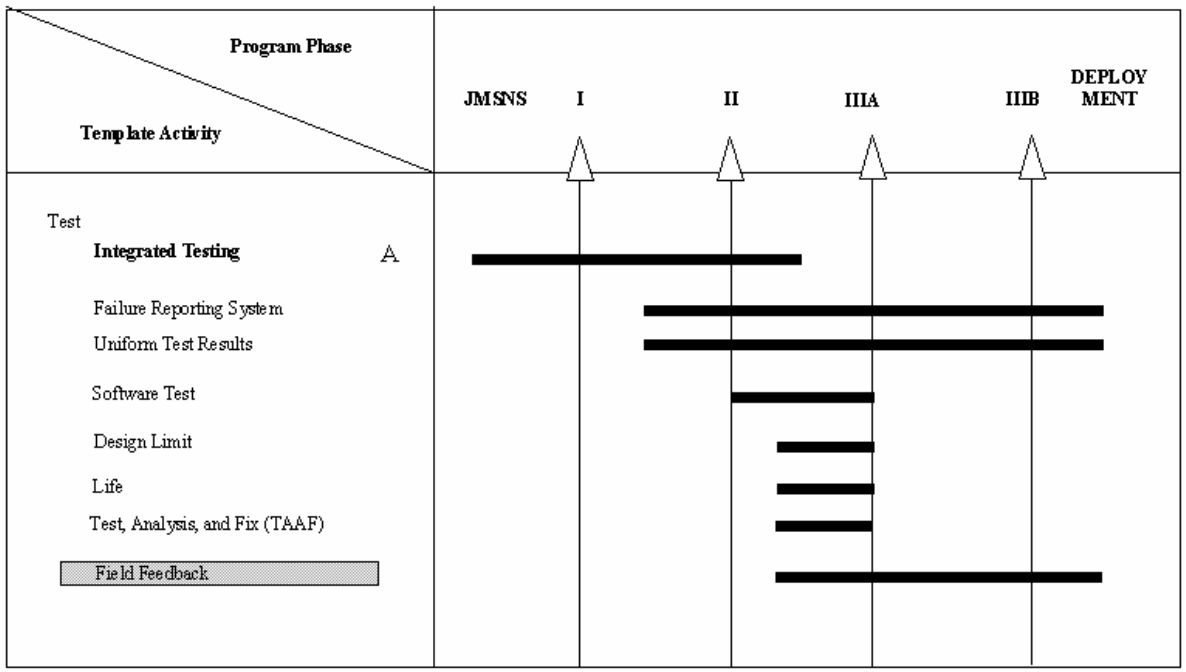
- The final payoff of the onsite engineering team is the improved reliability of the system during service operation. This is illustrated in figure 4-5. for a recent fighter aircraft program. The reliability problems identified in service use contributed the major part of the observed improvement in mean flight hours between failure (MFHBF) and reduction in discrepancy reports.

  – The onsite team is trained adequately.

  – Direct communication link is maintained with the design team.

• Onsite engineering teams are not used on small programs where the risk is low. Judgment is required for effective use.





Early feedback of problems occurring during initial use of weapon systems is essential for elimination of unforeseen design defects and correction of problems caused by the transition to full rate production and tooling. Onsite engineering teams are used as soon as field operations begin and continue through service use to improve the accuracy, quantity, and speed of reporting of field failures and corrective actions.

Next Section

Previous Section

Chapter 5 -- Production

A. -- Introduction for Production Critical Path Templates

Solving the manufacturing portion of the equation is a major factor in reducing the risk of transition from development to production. The history of military procurements chronicle again and again the scenario of proven functional designs being introduced into the manufacturing process, only to complete that process as end products that cannot support their mission requirements.

The DSB task force investigated transition matters related to preparation for and management of the manufacturing process. More specifically, it dealt with issues in such areas as part quality and management; the cause and relation of workmanship defects; the vendor impact on quality, cost, and schedule; the recipes for successful transition to production; and the associated transition management techniques. The task force agreed that within industry today there exists the experience, wisdom, tools, and techniques to successfully manage the transition process. However, based on past transition experience, the issues outlined in this section represent those that have been especially troublesome and require special initiatives and discipline to manage effectively. Consequently, the implementation of the concepts, techniques, and procedures specified in this section will reduce significantly, the risk of transition from development to production.

B. -- Manufacturing Plan

Previous Section

Chapter 6 -- Transition Plan

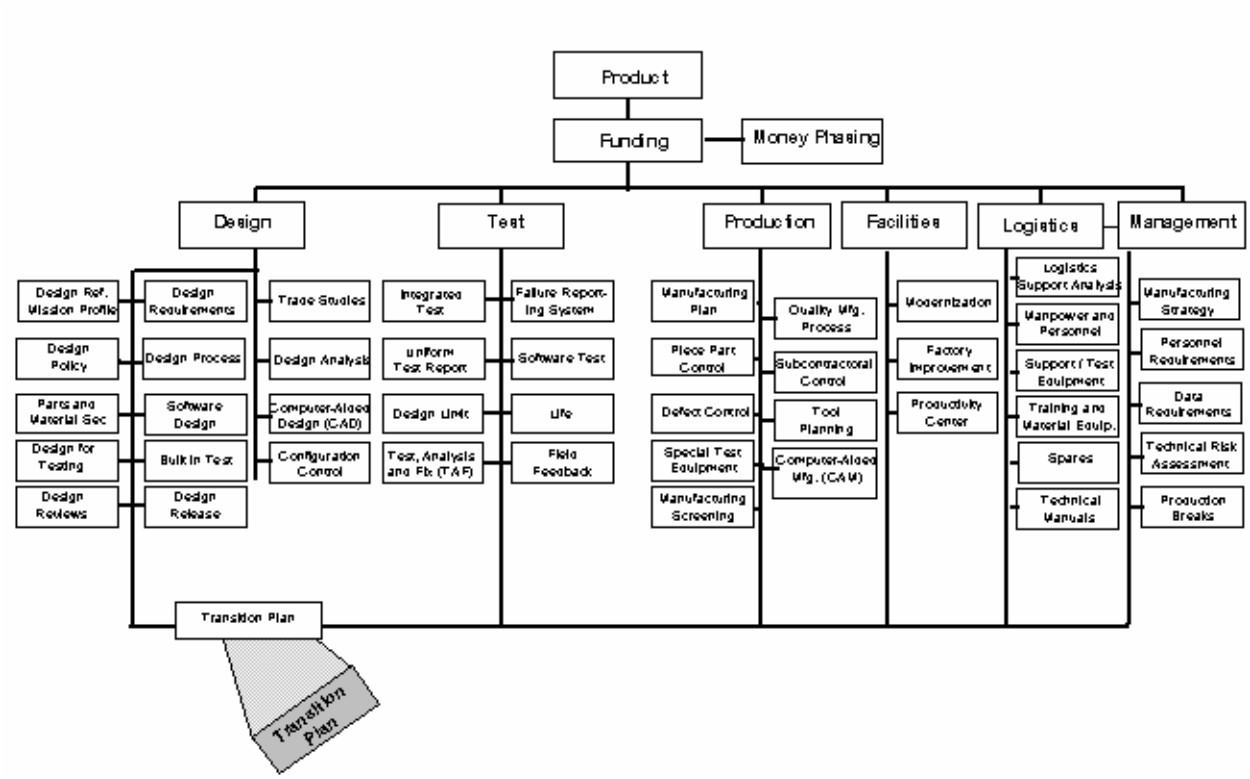
A. -- Introduction for Transition Plan Critical Path Template

The fundamental purpose of the transition plan is to provide the integration methodology that will tie together the application of templates within the context of the industrial process. To this end, it should be viewed not as a management procedure but as a technical evaluation tool.

This evaluation process begins first by comprehending fully the technical requirements of the product and, with that understanding, preparing a contractor transition plan (Government-required and-funded) at the start of engineering development. The outlines for reducing risk, contained in the preceding templates, form the basis upon which the transition plan is developed along with the means by which design readiness and maturity, test readiness and maturity, and manufacturing readiness and maturity are assessed continuously for the build-up of risk.

An additional ingredient of the transition plan is provision of the means and explanation of the procedures that clearly delineate the timing of the engineering disciplines, criteria that are to be satisfied while carrying out each discipline, data required to assess the criteria, and the significant risk-driving relationships between the templates contained in this document.

The final objective of the transition plan is to provide visibility on how well the template generated actions for reducing risk are being executed. Therefore, progress reports should be compared regularly against the transition plan.



Area of Risk

In the past, a lack of formal transition planning has contributed significantly to the problems encountered in the transition from development to production. One of the major causes has been a Government/industry attitude that the performance parameters must be achieved during engineering development before expending funds to achieve production objectives. While there were a number of milestone-oriented Government requirements during the development phase and before the. start of production, these were really stand-alone requirements generally used to verify the design's performance goals or as negotiation materials not having a smooth transition as an end objective.

Outline for Reducing Risk

- Formal Government policies and specified contractual requirements that lay the groundwork for planning, programming, and executing specific actions during the development phase to ensure a smooth and successful transition to production are set forth in DoD Directive 4245.6 (reference (h)) and DoD Directive 4245.7 (reference (i)).

- The Government program manager is required to fund and execute a contractor-developed transition plan, initially prepared no later than the start of engineering development and continually updated until rate production is achieved.

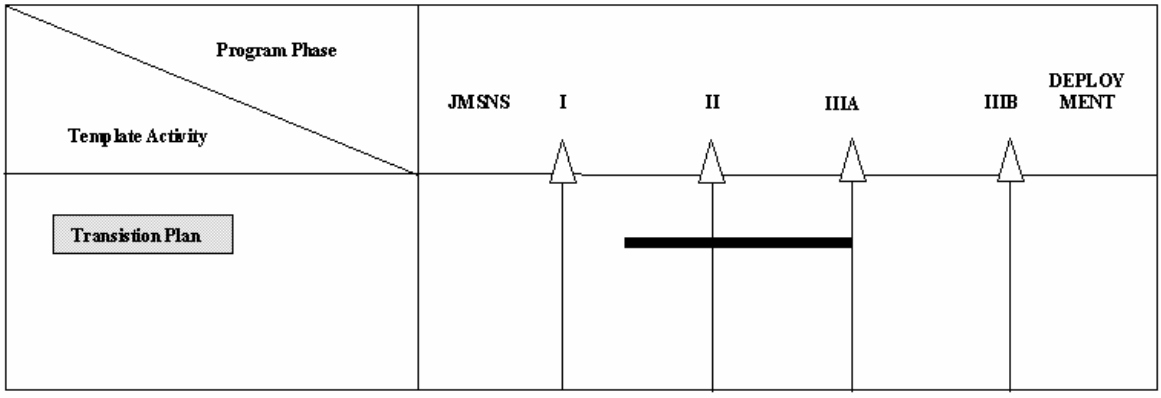
- A sample transition plan outline includes, but is not limited to, consideration of all templates in this Manual. The transition plan integrates the design, test, and manufacturing activities in order to reduce data requirements, duplication of effort, costs, and schedule. It

identifies, for example, test and manufacturing issues that impact design, and design issues that affect test and manufacturing. The transition plan is a major means of implementing the manufacturing strategy described in one of the management templates.

• Development contracts contain the requirement for a formal design-to-unit production cost program and provisions for proof of manufacturing methods and processes. Funding is provided to the contractors for these areas of activity.

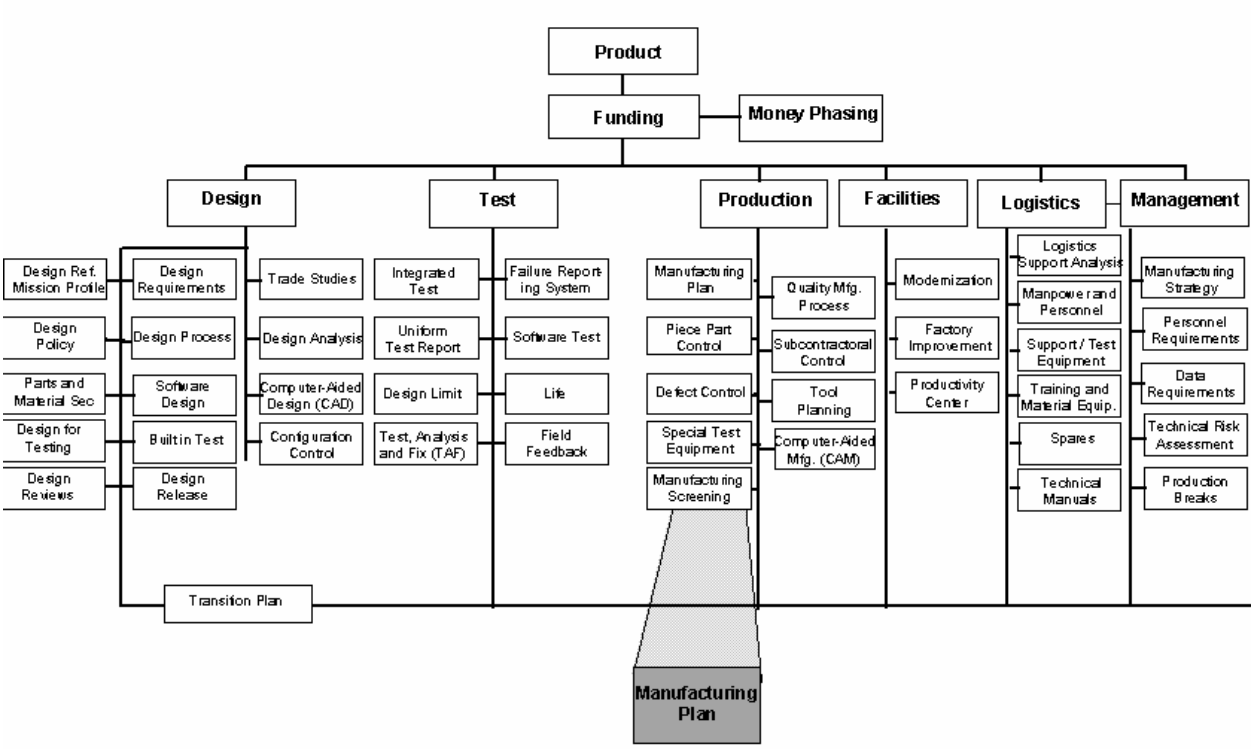
• The contractor's approach to obtaining both producibility in the design and an effective transition from development to production is solicited in the RFP and weighted heavily in source selection.

• Formal production readiness reviews (PRRs) are conducted jointly by the customer and the contractor during the development effort and completed before the production decision. Participants in these reviews are qualified and experienced both in technical aspects of the product and the manufacturing processes proposed to produce it. PRRs, properly staffed and conducted, will result in both Government and contractor benefits. Government policy and procedures on conducting PRRs are contained in DoD Instruction 5000.38 (reference (j)).



A transition plan, which is a comprehensive management plan describing all production-related activities that must be accomplished during design, test, and low rate initial production, is needed to ensure a smooth transition from development to full rate production. To be effective, the transition plan should be available before the start of FSD and updated regularly so that low rate production can be initiated at minimal risk.

Next Section



Area of Risk

Involvement of production and manufacturing engineering only after the design process has been completed is a fundamental error and a major transition risk. Consequences of late involvement are (1) an extended development effort required for redesign and retest of the end item for compatibility with the processes and procedures necessary to produce the item, and (2) lower and inefficient rates of production due to excessive changes in the product configuration introduced on the factory floor. Increased acquisition costs and schedule delays are the result of this approach.

Outline for Reducing Risk

- Documented early planning that focuses on the specifics of the fabrication practices and processes required to build the end item is initiated while the design is fluid and completed before the start of rate production. Documenting this process constitutes a manufacturing plan.

- The following represent the key elements of a manufacturing plan:

  – Master delivery schedule that identifies by each major subassembly the time spans, riced dates, and who is responsible.

  – Durable tooling requirements to meet increased production rates as the program progresses.

  – Special tools.

- Special test equipment.
- Assembly flowcharts.
- Test flowchart.
- Receiving inspection requirements and yield thresholds.
- Production yield thresholds.
- Producibility studies.
- Critical processes.
- Cost and schedule reports.
- Trend reports.
- Inspection requirements.
- Quality plan.
- Fabrication plans.
- Design release plan.
- Surge and mobilization planning.
- Critical and strategic materials.
- Labor relations.
- Manpower loading.
- Training.
- Training facility loading.
- Production facility loading and capacity.
- Machine loading.
- Capital investment planning.
- Make or buy criteria.
- Subcontractor and vendor delivery schedules.
- Government-furnished material demand dates.

- Work measurement planning.
- Energy management audits.

• The following elements also may be considered when generating a manufacturing plan. They usually are influenced by unique aspects of the acquisition, capabilities of the contractor, or initiatives of the military procurement agency.

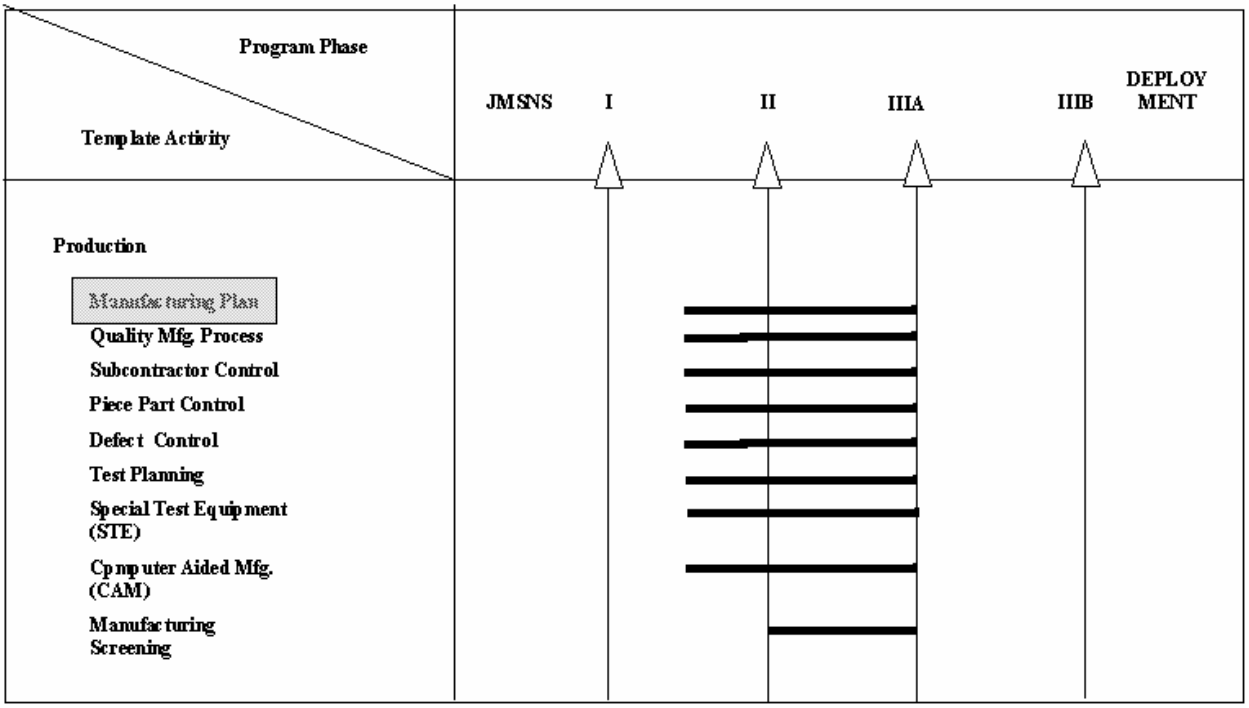
- Project and functional personnel in manufacturing are collocated.
- Engineering and manufacturing test equipment are built alike.
- Assembly planning is verified before rate production.
- Specify that a part of design engineers' time be spent on the factory floor.
- Assembly, inspection, test, and rework are combined in unit work cells, when appropriate.
- Development hardware is inspected by production line inspectors.
- Production personnel participate in building development hardware.

• The overall manufacturing strategy developed earlier in the acquisition cycle is implemented by production planning activities.

• The manufacturing plan is verified and progress against the plan is monitored by a series of contractual and internal production readiness reviews.

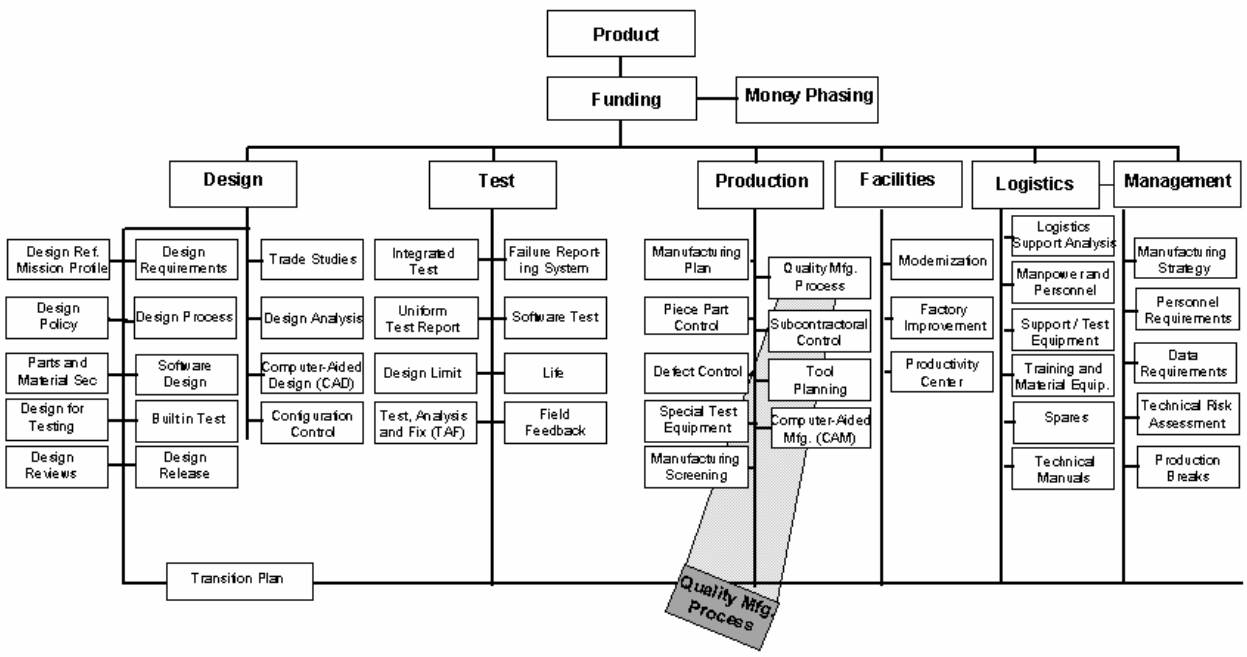
- Reviews include both prime contractor and subcontractor. It is the prime contractor's responsibility to ensure that production readiness reviews are conducted at the subcontractor's facility.
- These reviews are staffed with knowledgeable personnel (that is, a mixture of manufacturing and design engineering people from outside the line organization doing the work).
- The depth of these reviews is similar to that of the design reviews with participation by a similar level of qualified people in the areas of design and manufacturing engineering.

Timeline



The manufacturing plan identifies the approach for effective fabrication of the product design. Manufacturing planning activities, concurrent with development activities, are essential.

C. -- Qualify Manufacturing Process



Area of Risk

The introduction of a recently developed item to the production line brings new processes and procedures to the factory floor. Changes in hardware or workflow through the manufacturing facility increase the possibility of work stoppage during rate production. Failure to qualify the manufacturing process before rate production with the same emphasis as design qualification-to confirm the adequacy of the production planning, tool design, manufacturing process, and procedures-can result in increased unit costs, schedule slippage, and degraded product performance.

Outline for Reducing Risk

- The work breakdown structure, production statement of work (as identified in the contract), and transition and production plans do not contain any conflicting approaches. Any discrepancies among these documents are identified and resolved before production is started.

- A single shift, 8-hour day, 5-day workweek operation is planned for all production schedules during initial startup. Subsequent manpower scheduling is adjusted to manufacturing capability and capacity consistent with rate production agreements.

- The drawing release system is controlled and disciplined.

  – Manufacturing has the necessary released drawings to start production.

  – No surge in engineering change proposal (ECP) traffic from design or producibility changes occurs.

  – "Block changes" to the production configuration are minimized. (A consistent configuration that does not need any block changes is an indication of low risk.)

- The manufacturing flow minimizes tooling changes and machine adjustments and ensures that alternate flow plans have been developed.

- A mechanism is established that ensures the delivery of critical, long lead time items 4 to 6 weeks before required.

- All new equipment or processes that will be used to produce the item are identified.

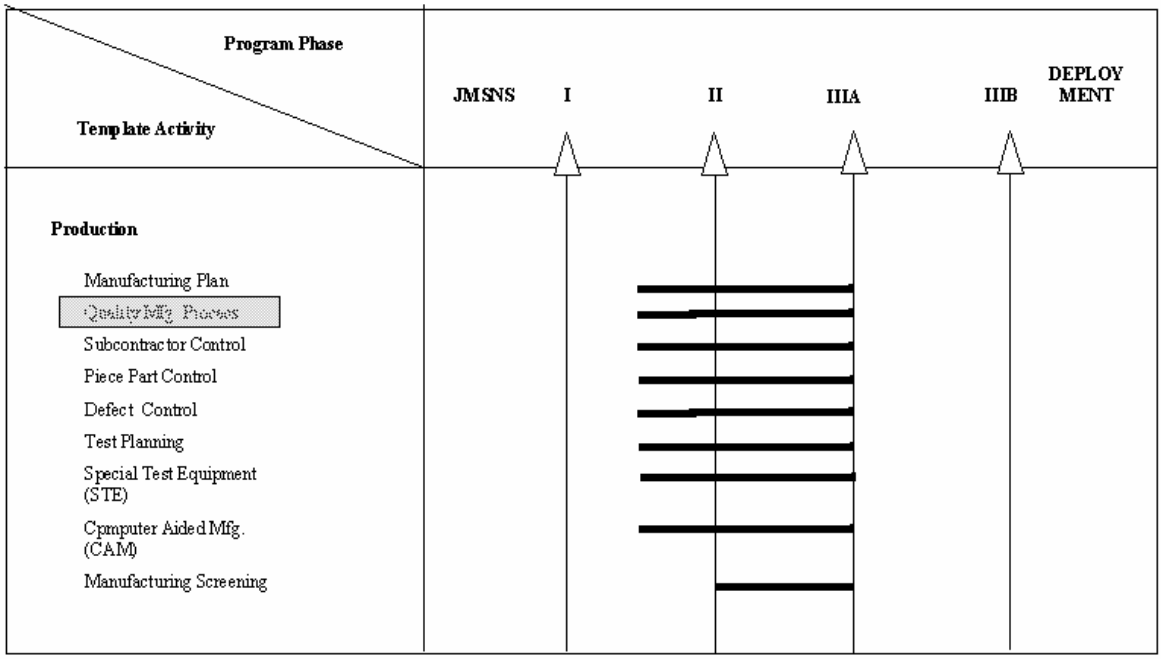
  – Qualified/trained personnel are assigned to operate the new equipment and processes.

  – "Hands on" training is accomplished with representative equipment and work instructions. (See Productivity Center template.)

- Hardware and other resources are allocated to "proof of design" models for data package validation, and to "proof of manufacturing" models for implementation prove-out and production equipment troubleshooting. Quantities of the "proof of" models are decided jointly by the customer and contractor depending on the nature and complexity of the program.

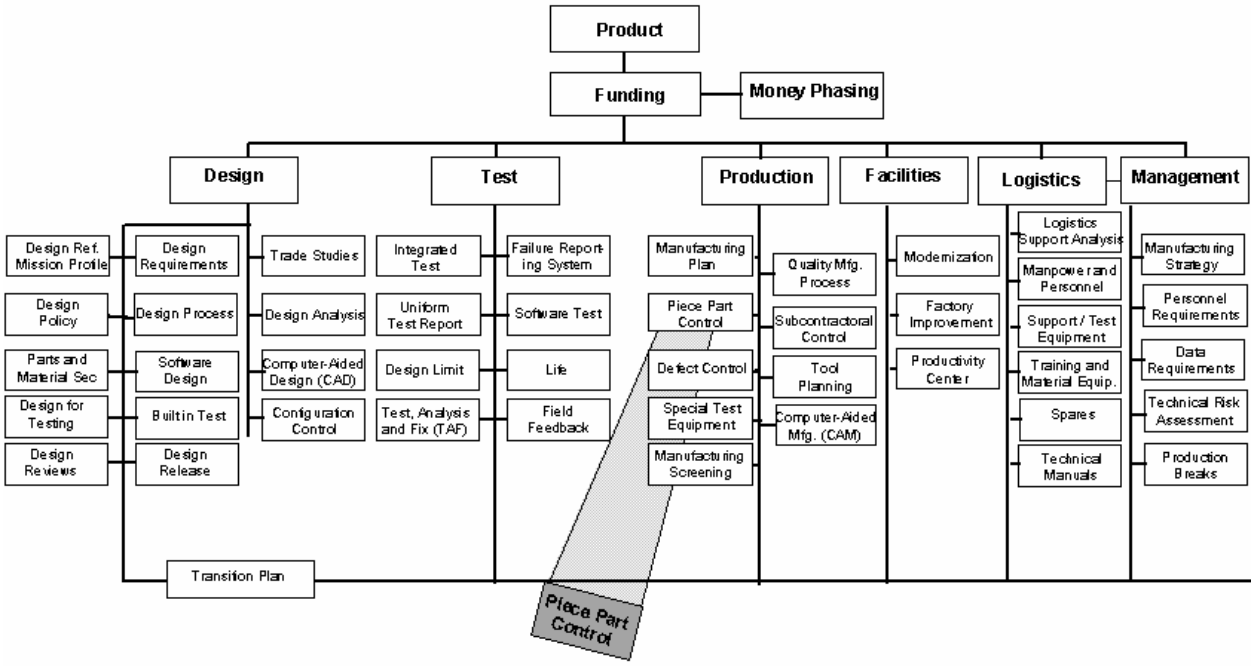
- The manufacturing process is qualified both at prime contractors and all major subcontractors.

Timeline



The manufacturing process required to produce an item significantly influences the design approach and product configuration. Therefore, the manufacturing process is qualified with enough time for design or configuration changes to be introduced in the baseline product configuration before low rate production commences.

D. -- Piece Part Control



Area of Risk

Most military programs require MIL-STD parts in weapon and support systems. This practice has left much to be desired in its ability to ensure delivery of high quality, reliable parts to contractors. In self-protection, users must conduct intensive screening and inspection at their own facilities, to provide an acceptable product to the production line. Semiconductors in particular have played a major role in increasing the cost and risk of producing a reliable product, in some cases showing defect rates of 3 to 12 percent during user rescreening.

Outline for Reducing Risk

- Receiving inspection is more effective than source inspection:

  – Suppliers tend to ship better quality products to customers performing receiving inspection rather than source inspection.

  – Receiving inspection costs typically are less than source inspection.

  – Typically, more lots per man-hour can be inspected at receiving than at source inspection.

- One hundred percent rescreening of semiconductors reduces risk and usually is cost-effective. Departures from 100 percent rescreening are appropriate, provided they are supported by sound technical and cost rationale. Factors influencing a departure might include the use of mature technology parts, demonstrated ability of the supplier to deliver consistently quality products, and test and failure cost data.

The following represents a minimal baseline program to be conducted at the user's facility:

– Perform particle induced noise (PIN) testing, at a minimum, on all hybrids and preferably on all semiconductors with cavities when used in critical applications.

– Perform electrical test at – 55" C, + 25YC, and + 125" C.

Typical costs (1982 dollars) for the above tests:

– Transistor/transistor logic (lTL) integrated circuits	$.68
– Complimentary metal oxide semiconductor (CMOS) logic integrated circuits	.81
– Linear integrated circuits	1.04
– Memories/microprocessors	1.45
– Transistors/diodes	.74

Typical costs (1982 dollars) for parts replacement if the defect is found at a higher level of assembly:

– Printed wiring assembly	$ 50
– Line replaceable unit	500
– System	1 .500
– Field	15,000

• Performing destructive physical analysis (DPA) at the user's facility also can detect faulty parts, can verify suppliers' processes, and is a good adjunct to the rescreening program.

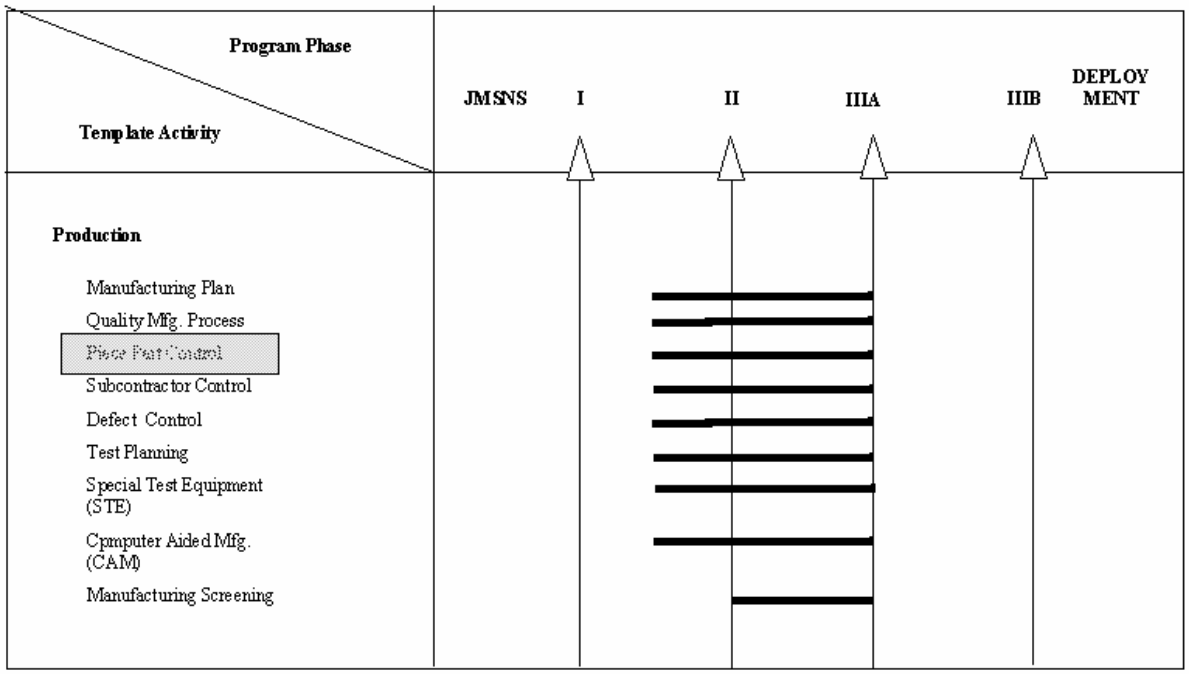
• Small users can use an independent test laboratory to conduct rescreening if they lack the necessary test equipment. Costs to conduct this screening are similar to those quoted above.

• Receiving inspection and rescreening exert contractual leverage on part suppliers to improve overafl quality of the product and ultimately to reduce the cost of parts to the user.

• Pretin component leads and conduct a solderability test at incoming inspection.

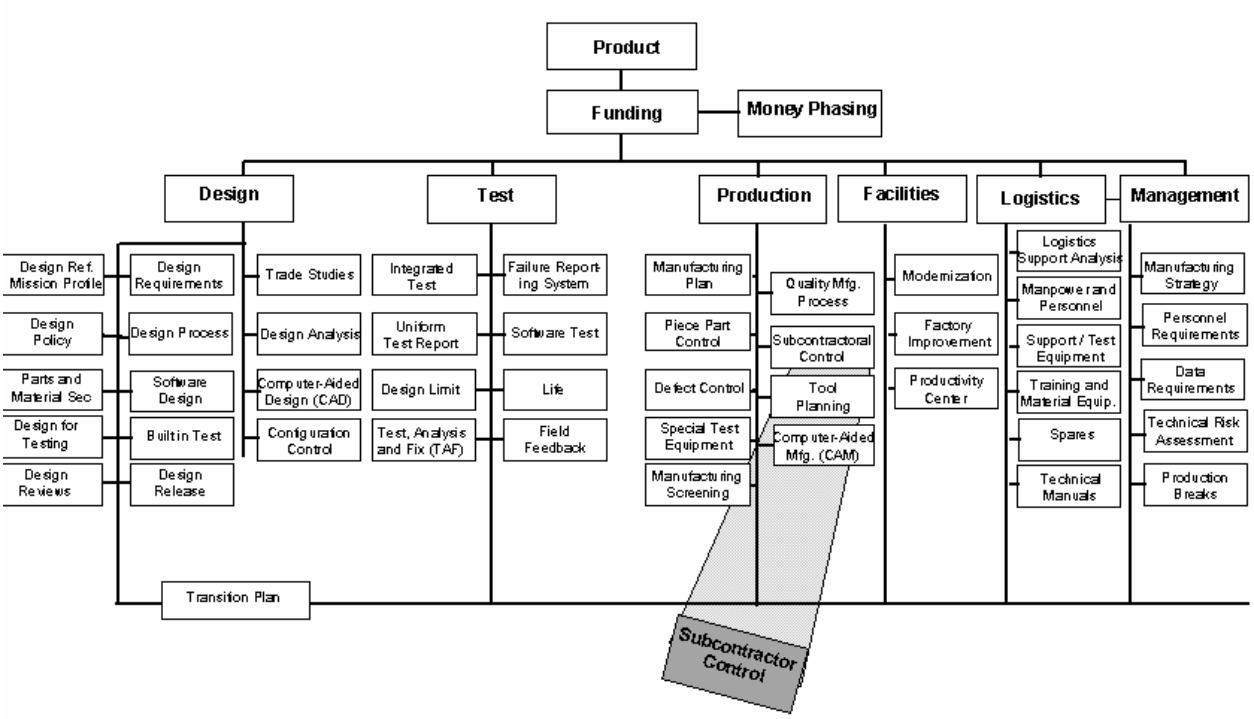
• Piece part control includes provisions for screening of parts (especially mechanical and electrical components, as well as electronic devices), to ensure proper identification and use of standard items already in the Military Service logistics system.

Timeline



A key element of parts control is an established policy that ensures that certain steps are taken early in the buildup of the first hardware items to control part quality (both electrical and mechanical).

E. -- Subcontractor Control



Area of Risk

Over the years, the percentage of major weapon systems that are subcontracted has grown, reaching as much as 80 percent in some cases. Hence, reliance on subcontractors and upon the skills of prime contractors to manage their subcontractors and suppliers has increased. An informal poll of ten prime contractors averaging about ten major programs each resulted in statements that nearly half their programs were in schedule or cost trouble because of major subcontractor problems. Clearly, the effective management of subcontractors needs more emphasis within industry and in the Government's management of prime contractors if there is to be a smooth transition to production.

Outline for Reducing Risk

- Request for proposals (RFPs) for prime contractors require responses from bidders with equitable emphasis on subcontractor management planning versus in-house management. Responses include the following:

  – Prime contractor's organization for managing subcontractors. .

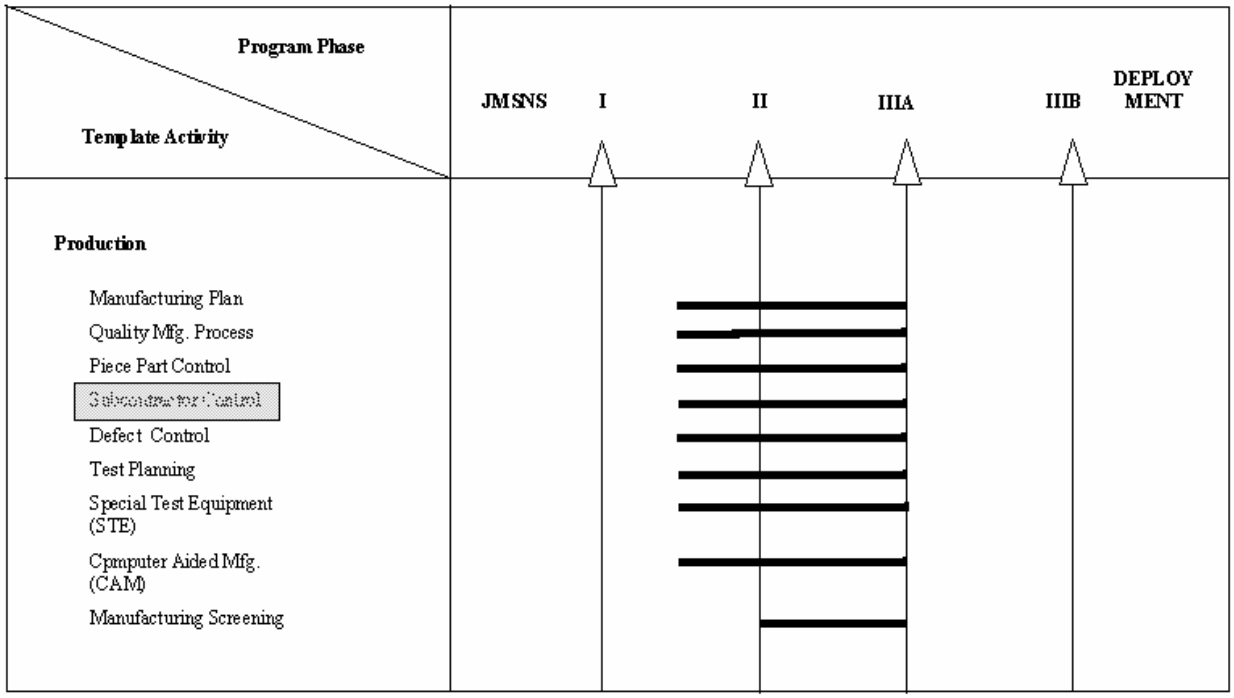
  – Plans for onsite evaluation of potential subcontractors before source selection.

  – Tasks and associated payment plans to ensure that required up-front subcontractor activities are visible.

  – Plans for program reviews, vendor audits, and production readiness reviews.

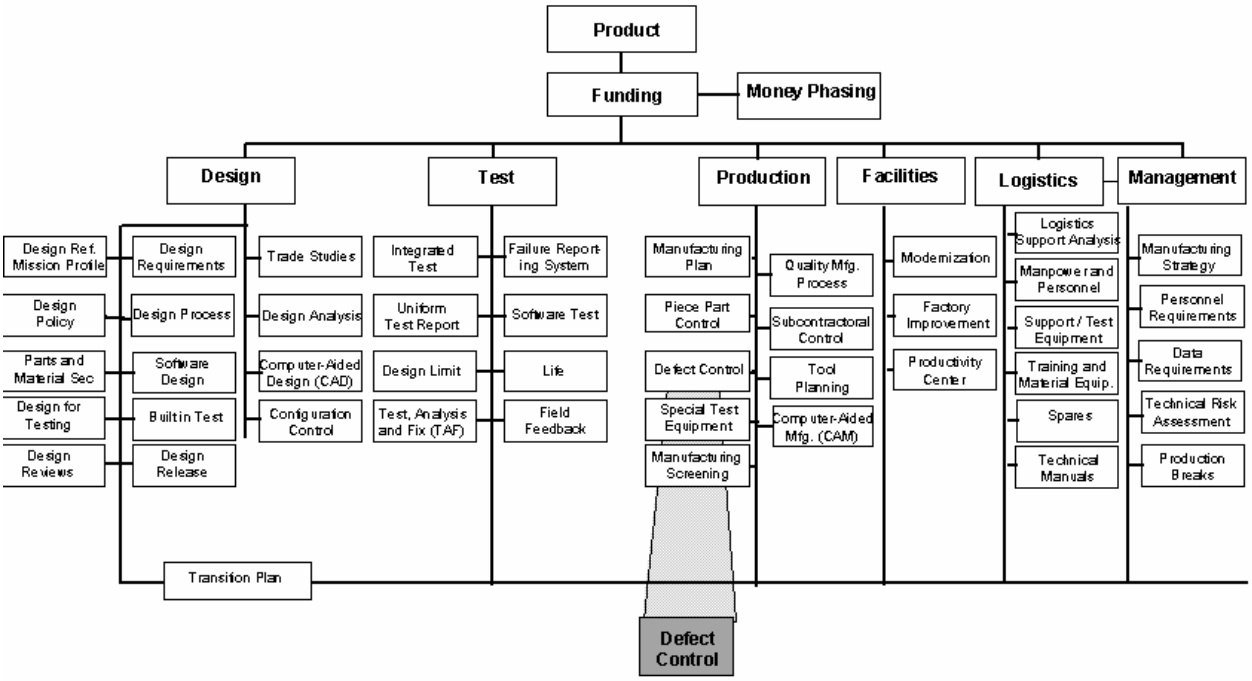
- Military program managers and prime contractors conduct vendor conferences that address the following:
  - Educate each subcontractor thoroughly on the requirements in his or her contract, as well as the key elements of the prime contract.
  - Communicate to the subcontractors what is required of them.
  - Provide an awareness of their role in the total weapon system acquisition.
  - Allocate resources to do the job right.
  - Recognize and (when appropriate) reward good performance.
- prime contractors establish resident interface at critical subcontractors before production start.
- prime contractors maintain a roster of "subcontractor assist" personnel for surprise problems.
- Budget for both resident and "subcontractor assist" teams to be available on demand with well-qualified technical, process, manufacturing, and procurement people.
- Proper funding is committed to conduct the above guidelines during the early design phases, to ensure adequate support to procurement. An estimate for an 80 percent subcontracted' program amounts to 3 to 4 percent of full-scale engineering development costs.

Timeline



Informal and formal program reviews are an essential ingredient of effective subcontractor control during the development process. The prime contractor shall, on a regular basis, evaluate the "real" progress made by the subcontractor through such reviews.

F. -- Defect Control



Area of Risk

High defect rates in a manufacturing process drive up production costs because of higher rework and scrap costs. Product quality is a function of the variability of defects, that is, the higher the number of defect types, the lower the quality and vice versa. Lack of an effective defect information and tracking system not only increases production costs but also degrades the product's performance in the field.

Outline for Reducing Risk

- Types of assembly defects are identified in terms of specific data categories and priorities for corrective action. (See figure 5-1., which applies to electronic parts. Similar figures are derived for other categories of component parts.)

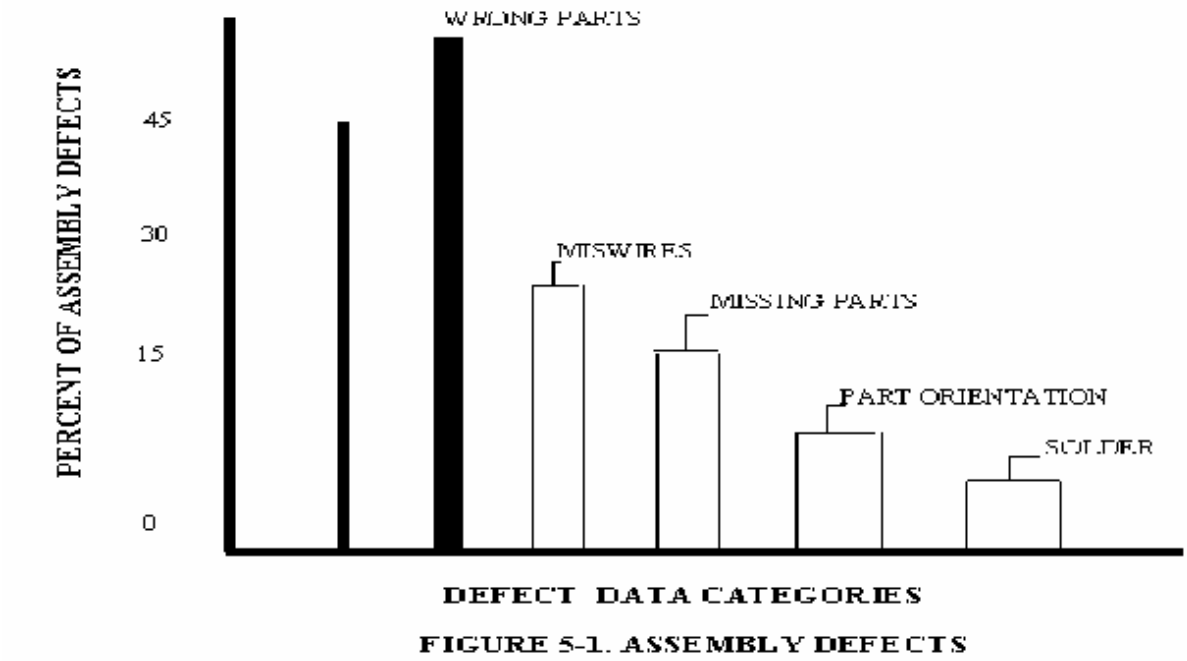


Figure 5-1. -- Assembly Defects

- Effectiveness of a time-phased corrective action program is tracked (see figure 5-2)

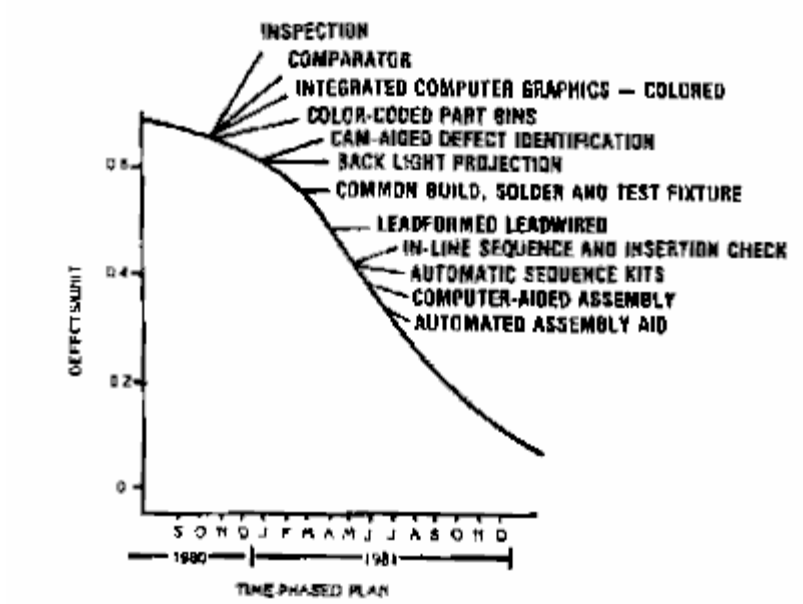


Figure 5-2. – Corrective Action Program

- Inspection and test yields and hardware throughputs are monitored continuously with predetermined action thresholds (see figure 5-3).

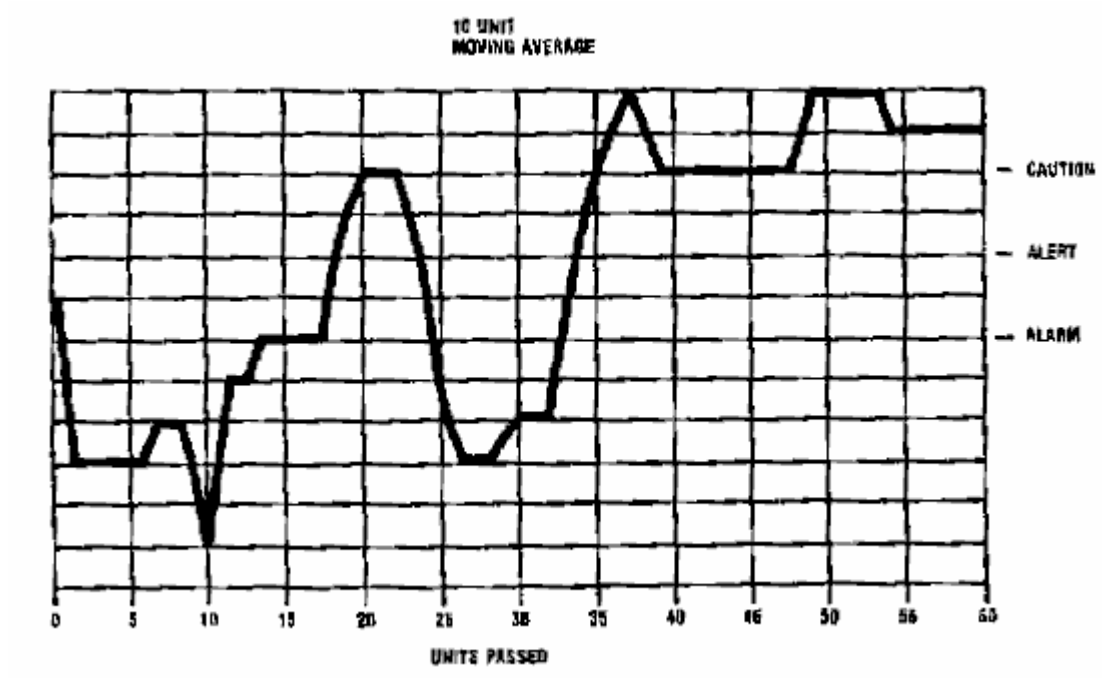


Figure 5-3. – Performance Threshold Tracking

– Caution threshold requires engineering action:

-- Seventy-two-hour maximum response time.

- Daily reporting to program management until caution thresholds are exceeded.

– Alert threshold requires functional-level management action:

- Seventy-two-hour maximum response time.
- Daily progress reports to program management until all thresholds are exceeded.

– Alarm threshold requires full-time team action:

- Program manager constitutes team within 24 hours.
- Action is implemented and reported to program management within 72 hours.
- Daily reports to program management until thresholds are exceeded.
- A feedback system to factory personnel and manufacturing supervisors is established.

• Factory policy adequately reflects the criticality of its defect information and tracking system.

• Critical Process yields are monitored and tracked to ensure consistency of performance (see-figure 5-4.)

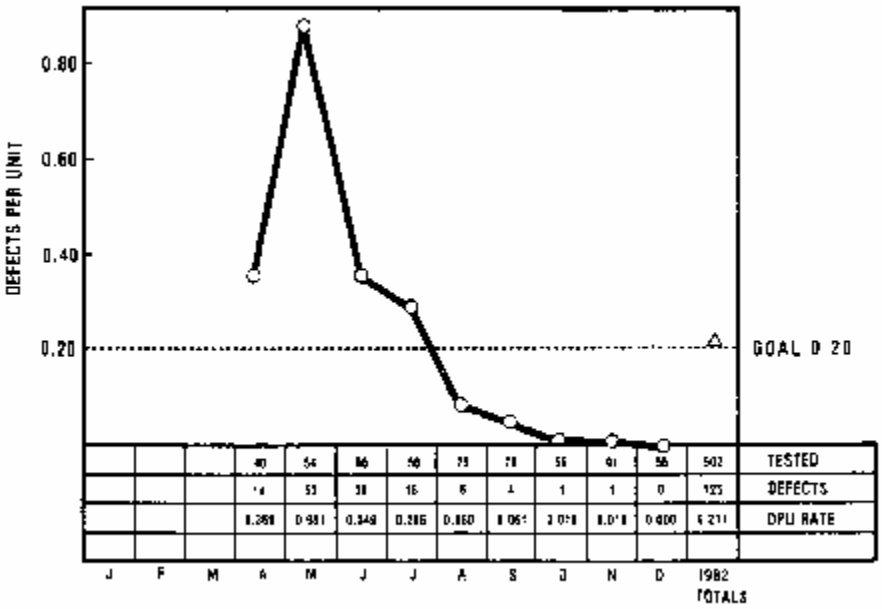
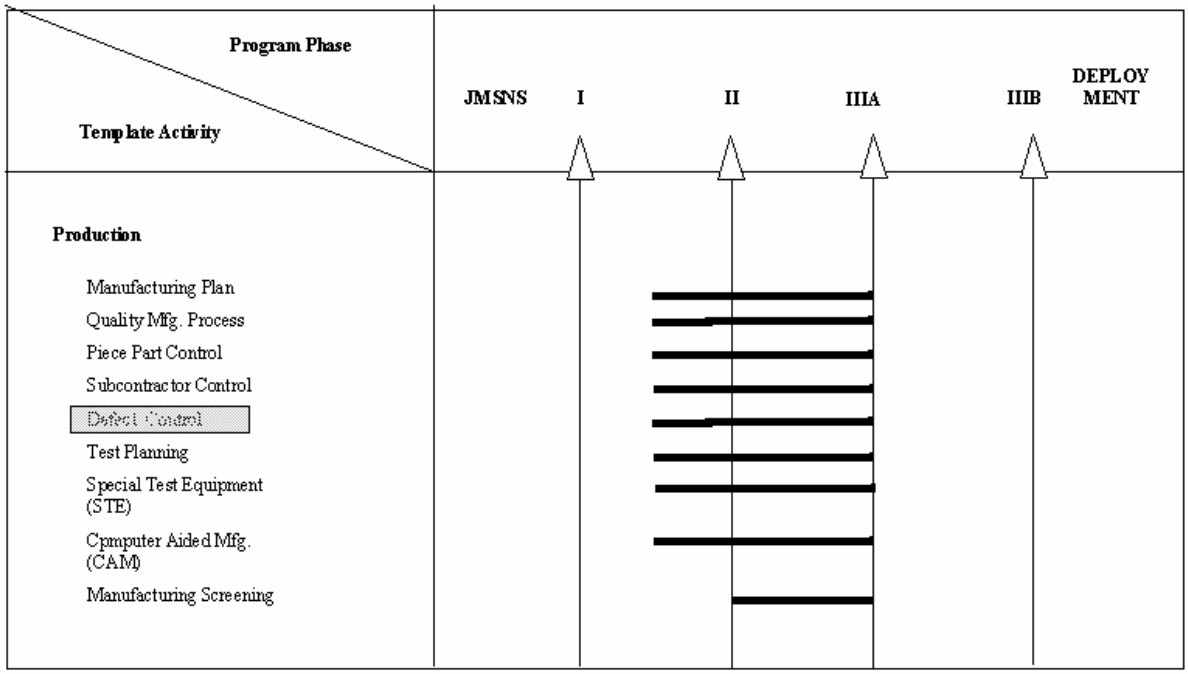


Figure 5-4. Production "Rate Test" Defects

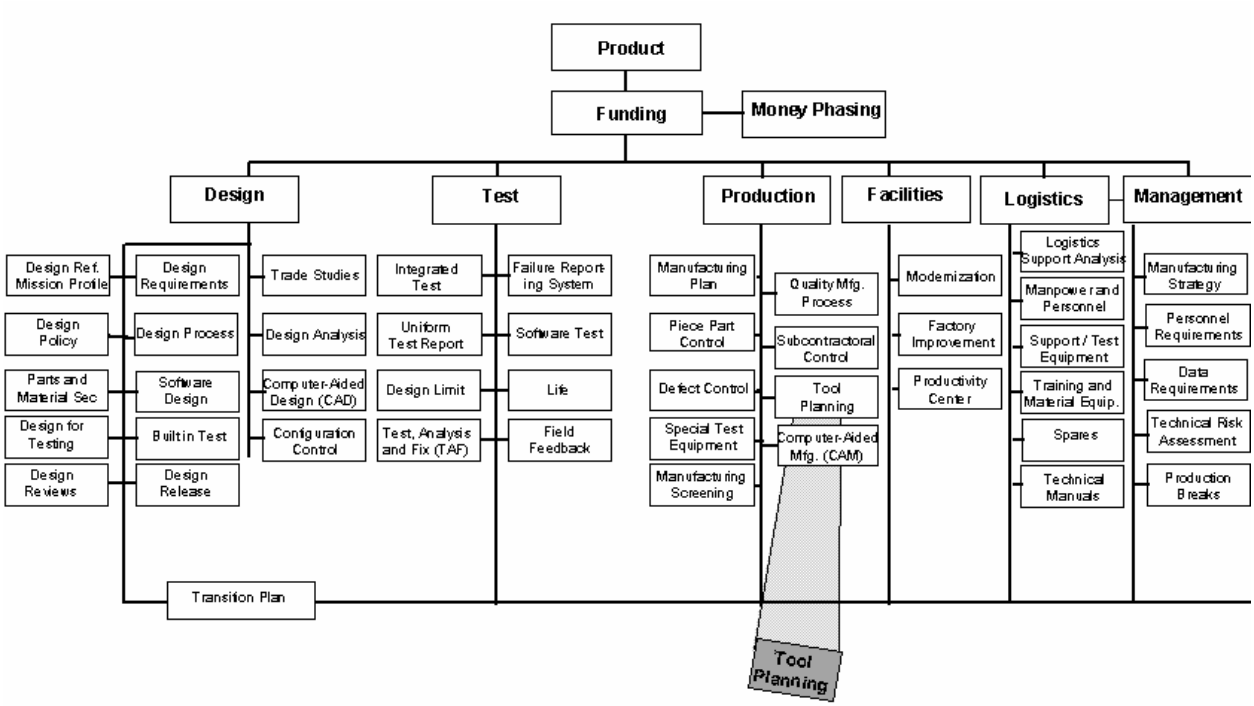
Figure 5-4. -- Production "Rate Test" Defects

Timeline



A management commitment to defect "prevention" is the prime ingredient of a sound defect control program. A management policy on defect control is established during the development phase. This policy will require management involvement in the review of defect analyses and an emphasis on defect "prevention" that is flowed down to all subcontractors.

G. -- Tool Planning



Area of Risk

Tools are auxiliary devices and aids used to assist in the manufacturing and test processes. They range from special handling devices to ensure personnel and equipment safety, to equipment required for methods planning to achieve the designed quality, rate, and cost. The risks associated with improper tool planning and proofing affect cost, quality, and ability to meet schedules. Improper tools prevent workers from achieving desired production rates, fail to prevent or perhaps even contribute to errors in the build process, and cause more man-hours of labor to be expended in accomplishing a task than were planned.

Outline for Reducing Risk

- A tooling philosophy is documented as a part of the early manufacturing planning process and concurrent with production design.

- A detailed tooling plan is developed that defines the types “hard” or “soft,”, and quantities required for each manufacturing step and process.

- A requirement is included for a similar plan for each subcontractor and its implementation is disciplined.

- Each tool is proofed rigorously before its initiation into the manufacturing process to verify performance and compatibility with its specification.

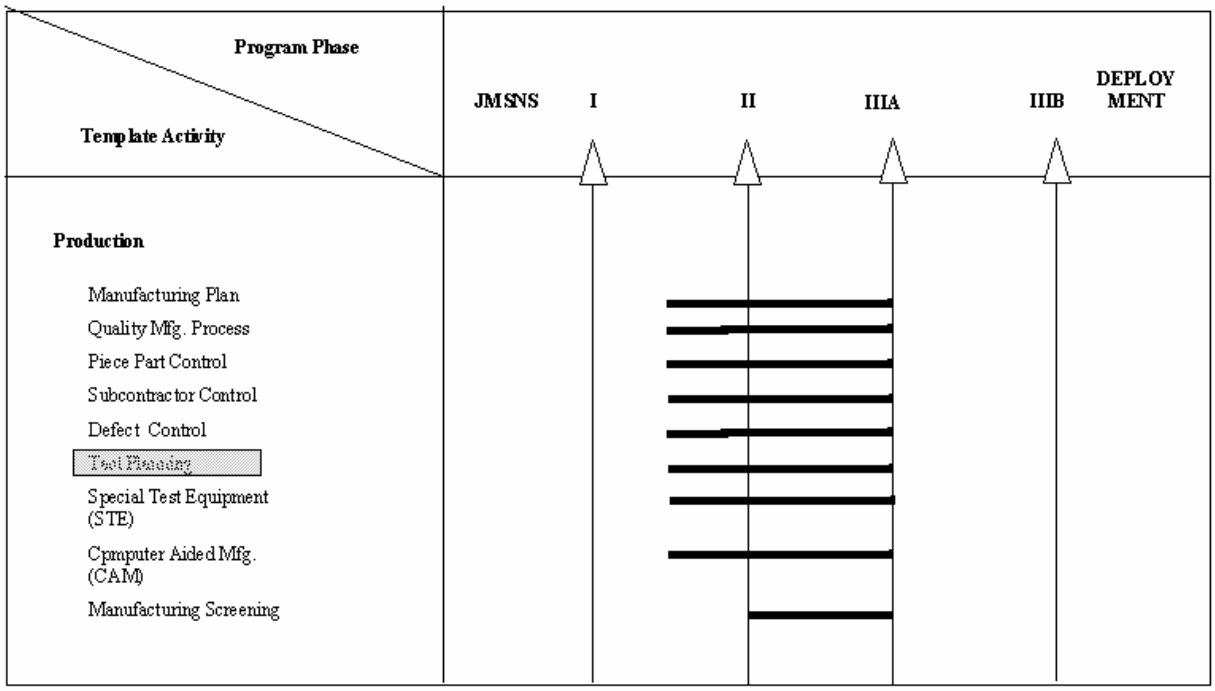
- Strict tool configuration management is maintained.

• An effective tooling inventory control system is established and maintained to facilitate continuous accountability and location control.

• A routine maintenance and calibration program is established and conducted to maintain tool serviceability.

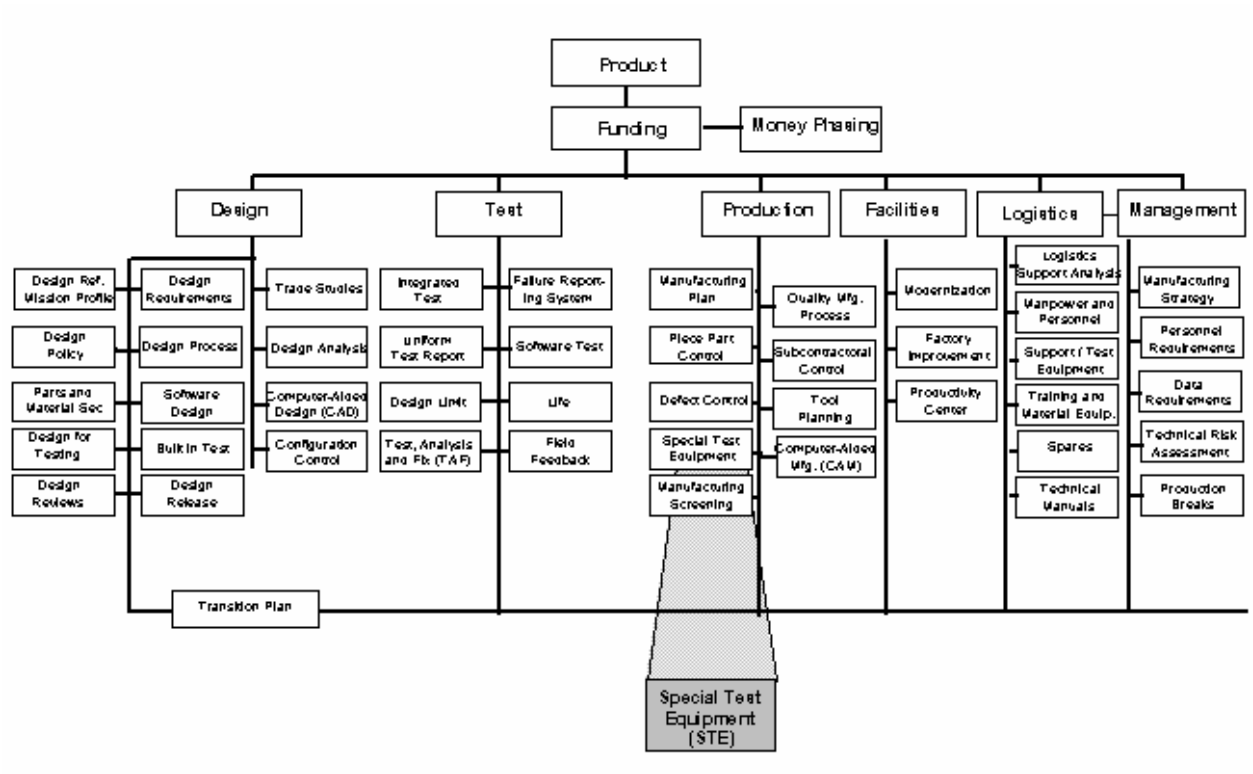
• Manufacturing engineering and tool designers are collocated with design engineers when practical, and CAD/CAM systems are used in tool design and fabrication.

Timeline



Tool planning encompasses those activities associated with establishing a detailed comprehensive plan for the design, development, implementation, and certification of program tooling. Tool planning and design activities start early in the development phase.

H. -- Special Test Equipment (STE)



Area of Risk

Special Test Equipment (STE) is a key element of the manufacturing process. It is STE that tests an article (or final product) for performance after it has completed in-process tests and inspections, final assembly, and final visual inspection. Late STE design activities and the lack of the availability of qualified STE on the factory floor create unique technical risks. These risks include inconsistent final test measurements (when compared to test procedures used during the successful development program), false alarm rates that result in needless troubleshooting and rework of production hardware, and poor tolerance funneling that causes either rejection of good hardware or the acceptance of hardware with inadequate performance. Program consequences in this situation are schedule delays, increased unit costs, and poor field performance of delivered hardware.

Outline for Risk Reduction

- A thorough factory test plan is developed before detailed design of prime equipment.
- Adequate prime equipment designer input and concurrence on test requirements and test approach is required.
- Test equipment engineers and maintainability engineers participate in prime equipment design and partitioning, test point selection, built-in test design, and design for test and maintenance as well as function.
- Prime and STE systems design personnel are collocated when practical.

- The test approach for completeness of test is analyzed, and a feedback loop to correct test escapes is provided.

- Test tolerance strategy is employed to catch problems at the lowest level, but does not cause excessive rejection of an adequate product. Tolerance incompatibility with higher-level test is corrected.

- The capabilities of the prime equipment are understood and utilized fully to achieve simplifications in STE.

- Design strategies are used in test equipment that simplify tolerance changes and enable tests to be readily added and deleted. "Go/no go" tests are minimized.

- Manual intervention capability is provided in automated test equipment so that the equipment can be used while final software debugging is in process (this also can aid in debugging).

- Brassboard prime equipment is used, when appropriate, to begin debugging test equipment (this can enhance test equipment schedules).

- Prime equipment design personnel are assigned' as part of the test equipment integration and verification effort.

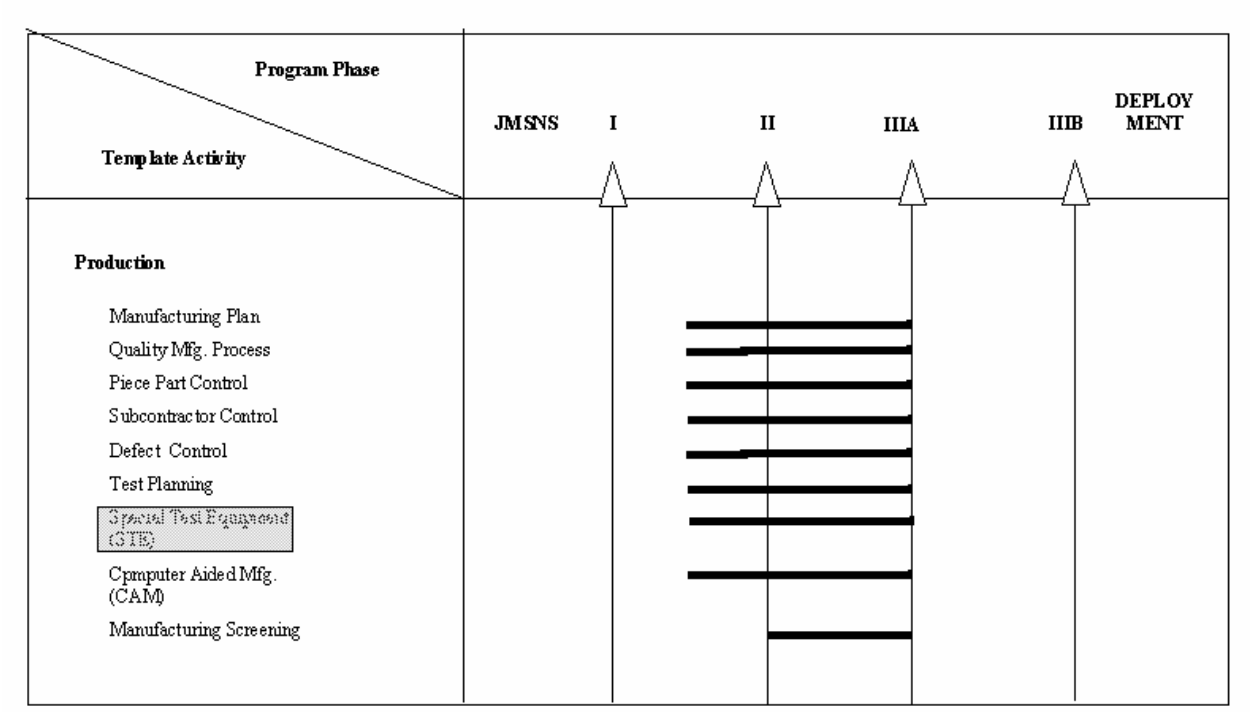
- Adequate time is allotted for test equipment software debugging and compatibility verification.

- Government certification of factory test equipment is required, as well as re-certification if significant product and test equipment changes occur.

- A thorough and realistic rate analysis is performed to avoid shortages of test equipment (or overbuying). Considered in this analysis are the number of expected failures in prime and test equipment in various phases of the program, and equipment requirements to support qualification test, TAAF, engineering problem-solving, and overhaul and repair.

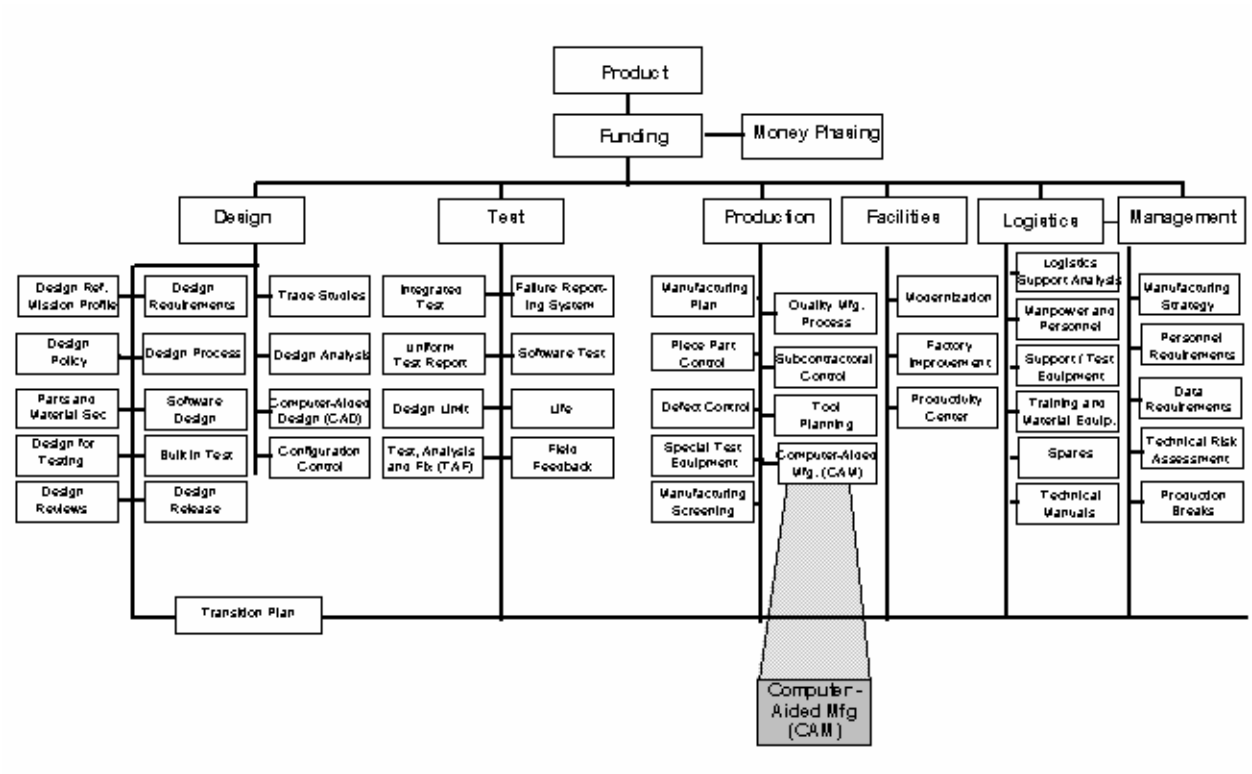
- Automated test techniques are used when rate requirements on the program warrant the investment.

Timeline



STE should be designed, qualified, and used as early as possible to ensure a uniform final product test from development through production transition. The STE design should commence during the late phases of advanced development (that is, before Milestone II) and STE should be qualified before rate production.

I. -- Computer-Aided Manufacturing (CAM)



Area of Risk

The transition of a qualified design to the manufacturing process historically has been accomplished via a "drawing package, "including not only drawings but also a large number of related documents, truly a massive amount of paperwork. Generation of this paper lengthens the period of transition, impedes rapid and accurate communication between the design and manufacturing functions during this highly volatile period, and introduces numerous errors via the drawing package. Even some facilities that have invested heavily in CAD continue to transfer their designs to the factory on paper. Once the drawing package is available, many production facilities continue to utilize outdated high risk manual operations both to duplicate the design ("build to print") in rate production and to manage the manufacturing process.

Outline for Reducing Risk

- The development of software tools for common use by industry is supported by the Department of Defense with appropriate resources and coordination efforts.

- A common data base between the design and manufacturing functions has inherent technical problems but has the highest potential payoff in product quality and productivity.

- Implementing automated manufacturing and control functions can reduce transition time by 50 percent.

• Using computers to control manufacturing operations (fabrication, assembly, test, and inspection) and to collect shop floor data can increase productivity, can reduce required shop floor space, and can improve product quality.

• Use of computers to control material flow and maintain inventory and in-process data significantly reduces inventory investments and storage space.

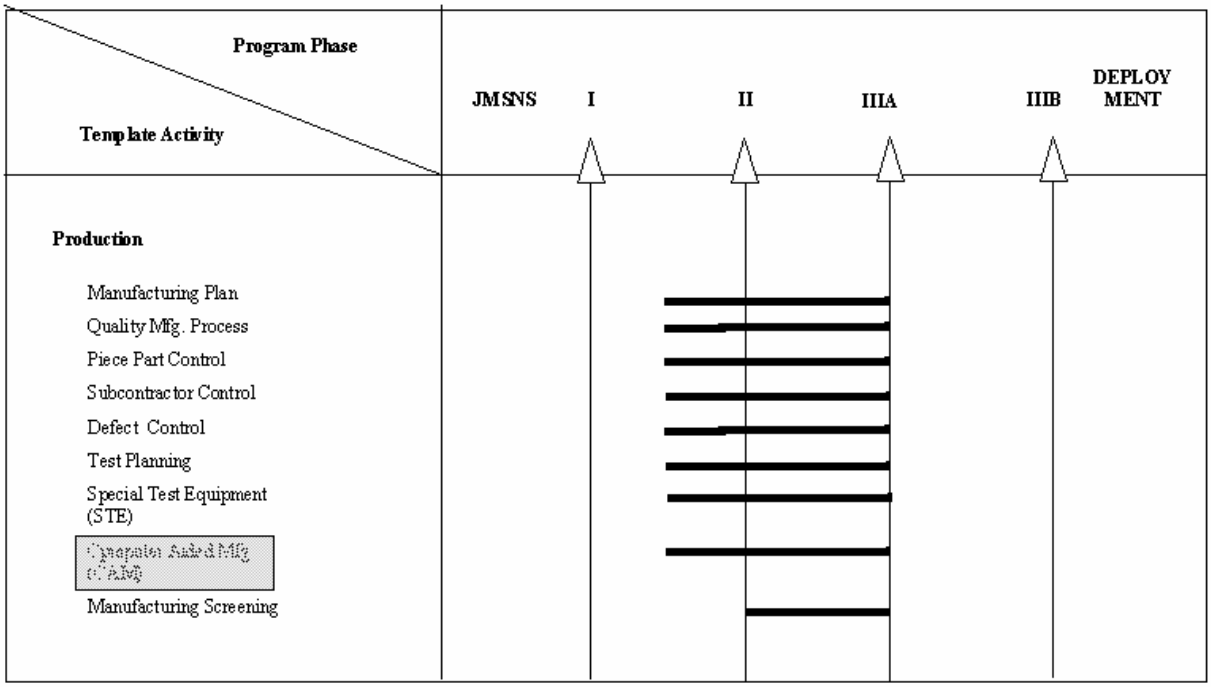
• Tooling redesign occurs when product design changes. Using CAD reduces these design iterations. Therefore, using CAD for the product design and the additional use of CAD for tool design can reduce tooling costs by 50 percent.

• Top-down strategy for implementing CAM usually increases return on investment (as opposed to replacing in-kind capability, or bottom-up).

• Training and retraining plans to maintain employee morale and productivity are included in a company's strategy.

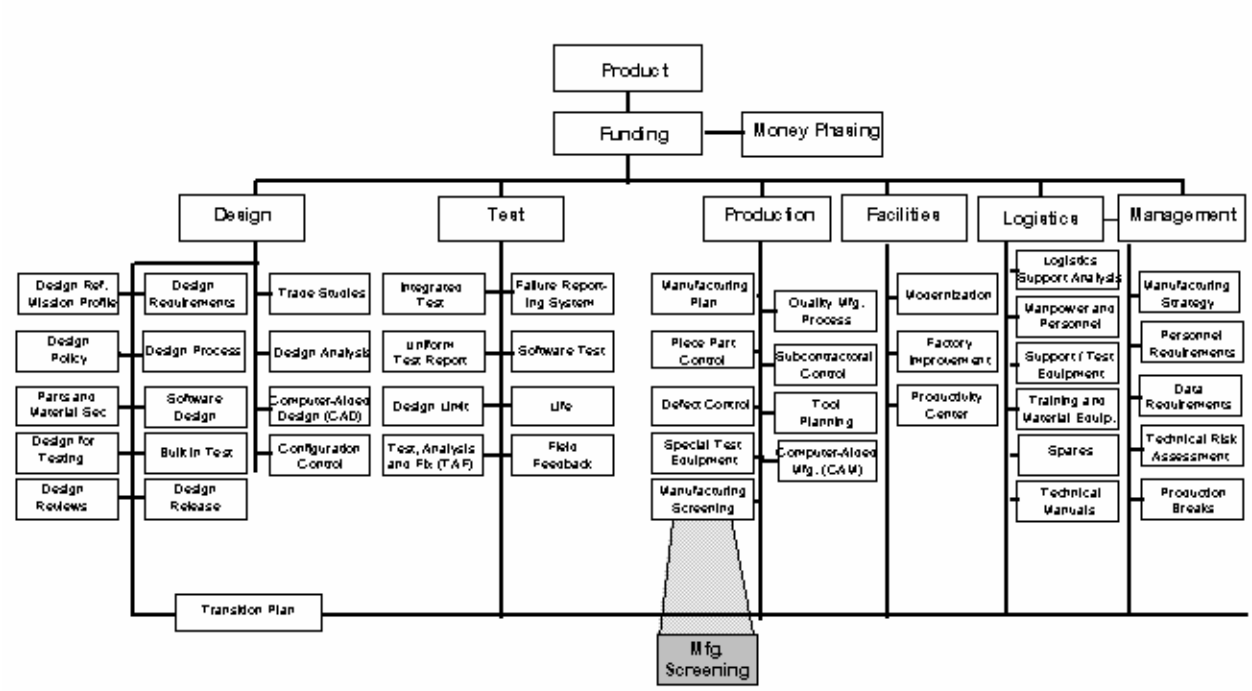
• See template on CAD.

Timeline



Contractors using CAM integrated with CAD are experiencing improved productivity. With manufacturing personnel involved in the design process, a common CAD/CAM data base can be established resulting in reduced risk in the transition from development to production.

J. -- Manufacturing Screening



Area of Risk

Environmental stress screening (ESS) is a manufacturing process for stimulating parts and workmanship defects in electronic assemblies and units. Although ESS has been proven to reduce field failure rates by 20 to 90 percent (reducing life cycle costs) and to reduce in-plant failure rates by as much as 75 percent (reducing production costs), its use is still not accepted universally by many contractors as a standard part of their manufacturing process. When ESS also is performed during development, it helps to ensure that the electronics hardware performs on demand, that the most effective screening levels are determined before high rate production, and that possible part type and vendor problems are discovered early. Analysis of failures experienced on unscreened developmental systems has indicated that 60 percent are due to workmanship, 30 percent are due to bad parts, and only 10 percent are design problems. ESS should not be confused with environmental qualification testing (which is designed to demonstrate design maturity).

Outline for Reducing Risk

- ESS procedures are established during development.
- Temperature cycling and random vibration are effective" environmental stress screens and are performed on 100 percent of electronic products (it is not done on a sampling basis).
- The predominant factors in temperature cycling are:
  - Rate of change of temperature.
  - Minimum and maximum range of temperature.

- Number of cycles.
- Level of assembly on which performed.

• The predominant factors in random vibration are:

- Spectral density.
- Lower and upper frequency limits.
- Axis of stimulation.
- Level of assembly.
- Duration of screen.

• Random vibration stimulates more defects than fixed or swept sine vibration of similar levels of excitation.

• There are many technical and cost benefit tradeoffs to be made in designing an ESS program. A particularly useful document in making tradeoff decisions is the Environmental Stress Screening Guidelines for Assemblies. l A screening guidelines document for parts will be published by the IES in late 1985.

• Recommended starting conditions are:

- Random Vibration
  - Spectral density: 6g rms
  - Frequency limits: 100-1000Hz l
  - Axis: 3
  - Duration: 10 min.
- Temperature Cycling:
  - Rate: 10” C/minute
  - Range: – 40” C to 60* C
  - Number of cycles: 15 (last must be failure free)
  - Power: On (except cool down)

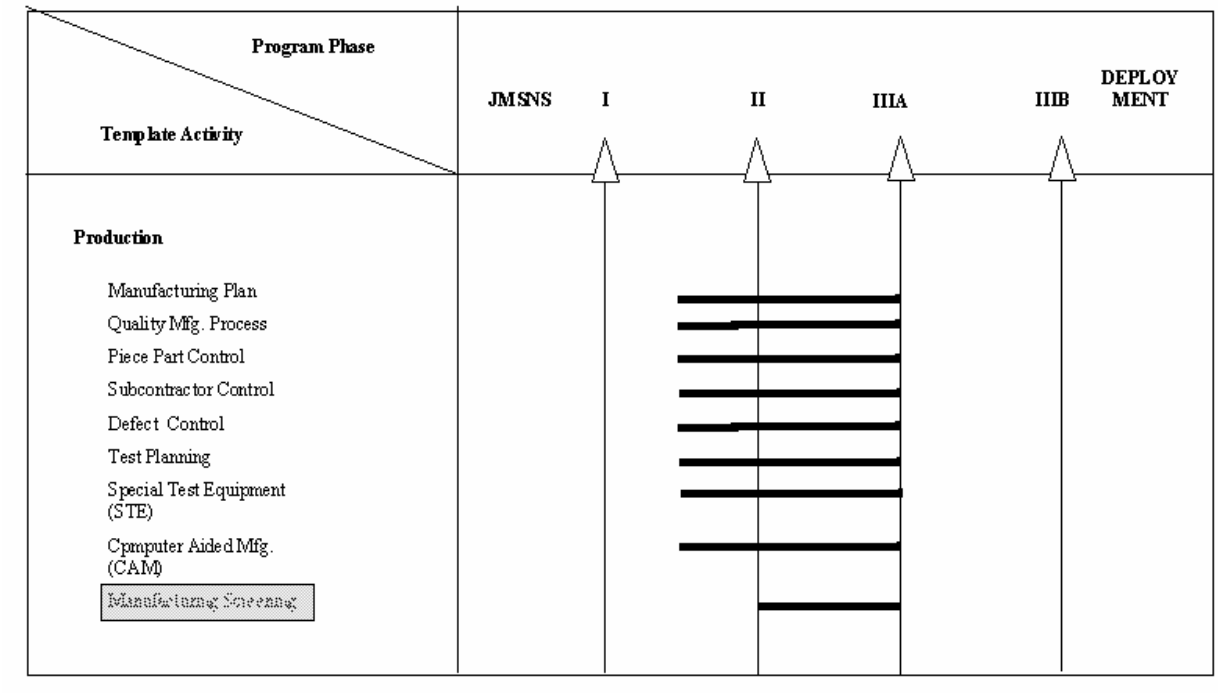
• For greatest return on investment, vigorous corrective actions are made to’ adjust manufacturing process to minimize recurrence of defects.

• The ESS program is a dynamic one. Procedures are adjusted, as indicated by screening results, to maximize finding defects efficiently.

• Objective of ESS is not to find design defects, although such may be a by-product.

• Appropriate screening for manufacturing defects, as an acceptance test, is developed electrical and electronic products.

Timeline



ESS techniques precipitate assembly and workmanship defects, such as poor soldering or weak wire bonds during the assembly process.

Note: ***Sponsored by the Institute of Environmental Sciences (IES), September 19S4.***

Next Section

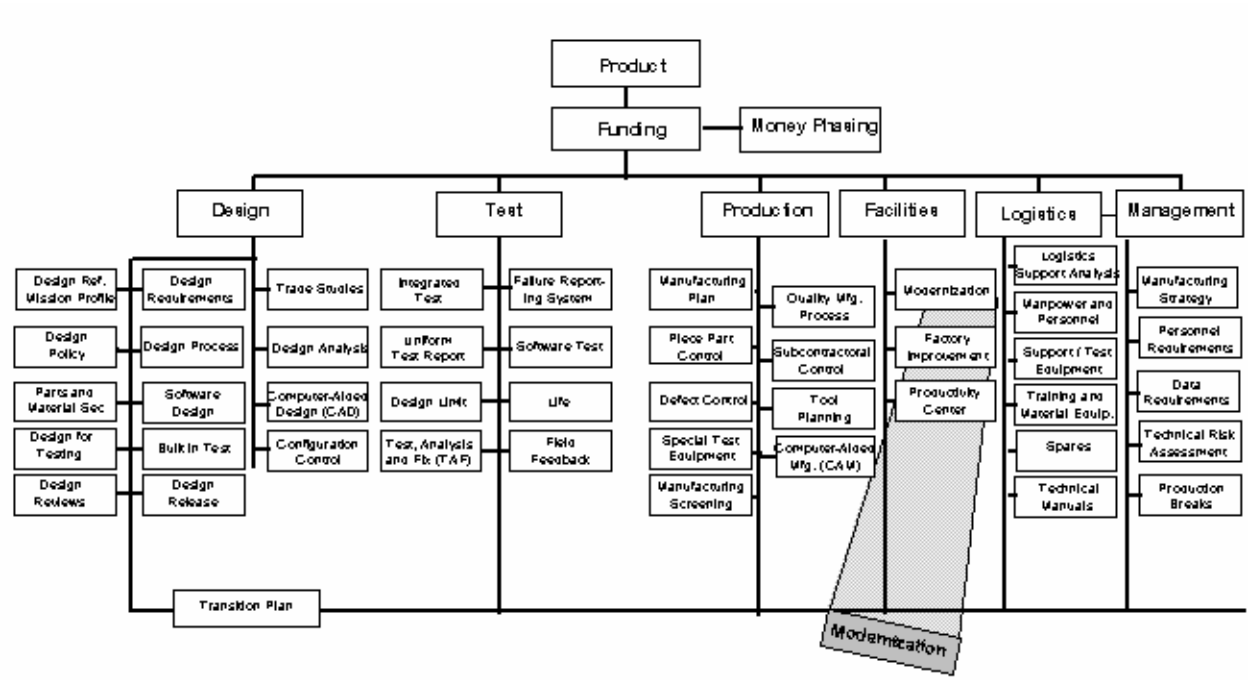
Previous Section

Chapter 7 -- Facilities

A. -- Introduction for Facilities and Capital Investment Critical Path Templates

Three templates are provided in this section. The first, Modernization, is based on DoD's new Industrial Modernization Incentive Program (IMIP) that permits profits to increase as modernization activities reduce costs to produce. The second, Factory Improvements, is an outline of an electronics factory that contains the equipment required to implement a low risk manufacturing operation. The third, Productivity Center, is a method for upgrading the skills of personnel using the new equipment and processes on the factory floor.

B. -- Modernization



Area of Risk

Current approaches to Government contracting fundamentally inhibit industry investments to modernize. Why? Profits are a fixed percent of the cost to produce. See figure 7-1. The rate of modernization is low because profits go down as costs to produce go down. The capital to invest in modernization activities is not available in Government business. Why modernize? Increased productivity reduces costs to produce. The defense industrial base surge capability is improved. U.S. industry's position in the international marketplace has improved. The increased market improves the U.S. balance of payments and produces more jobs. Automation improves quality. The talent, material, and computer software required to implement the design and manufacturing

fundamentals for reliable products are made possible by increased capital, and reduce the risk of transitioning from development into production.

Outline for Reducing Risk

- The DoD IMIP permits profits to increase as costs to produce decrease. This provides additional capital that is available to increase the rate of modernization that increases productivity and further reduces production costs, and thus overall costs to acquire defense material. See figure 7-2. The objective is to increase the rate of modernization.

- Single product incentives are considered, when appropriate. These incentives result in contractor proposals for major productivity enhancements, limited overall factory modernization, and large unit cost savings. Unit cost savings examples (using 1982 dollars) are as follows:

Item	Investment	Savings To Date	EST.Total Savings
Cross Field Amplifier	$256,000		$22,300,000
Radome	116,000	$350,000 (1982)	4,000,000
Torpedo Propeller	286,000		15,500,000

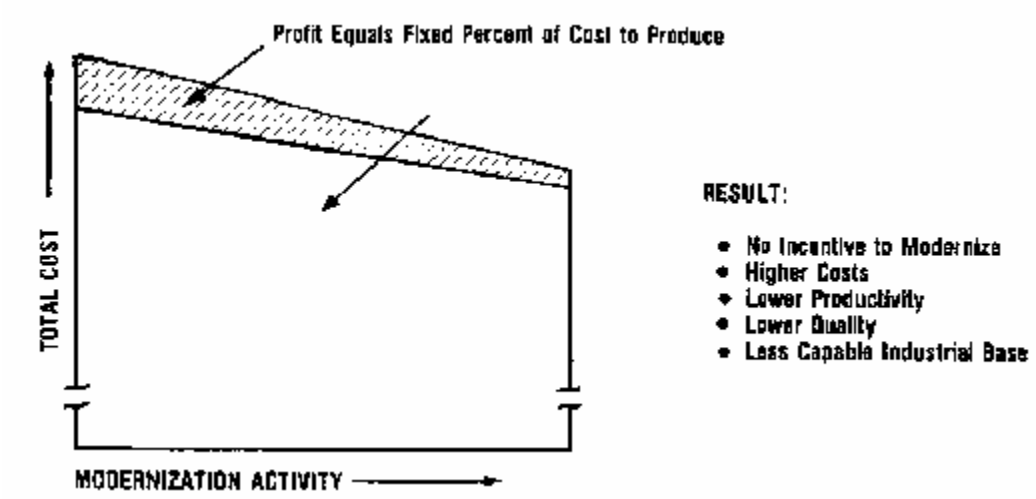


Figure 7-1. -- The Old Approach

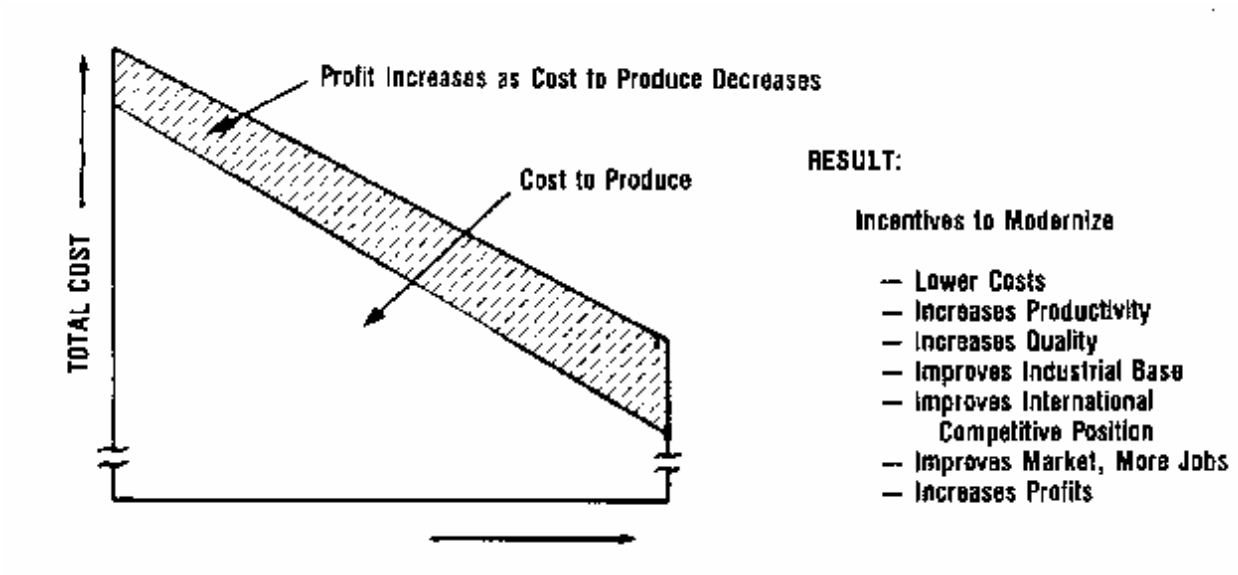


Figure 7-2. -- The New Approach (IMIP)

• Multiple product incentives are considered, when appropriate. These incentives result in contractor proposals for major product-oriented productivity enhancements and factory modernization improvements. An example of results:

– Savings: initial investment = $70,000,000 estimated savings = 430,000,000

– Modernization improvements: automated material handling, automated assembly of cables and harnesses, and automated printed wiring assembly station.

• The multiple product, . single DoD focal point concept is utilized. When a factory deals with a single DoD focal point as the customer for all its products and profits increase as costs to produce decrease, modernization of the DoD industrial base may take care of itself.

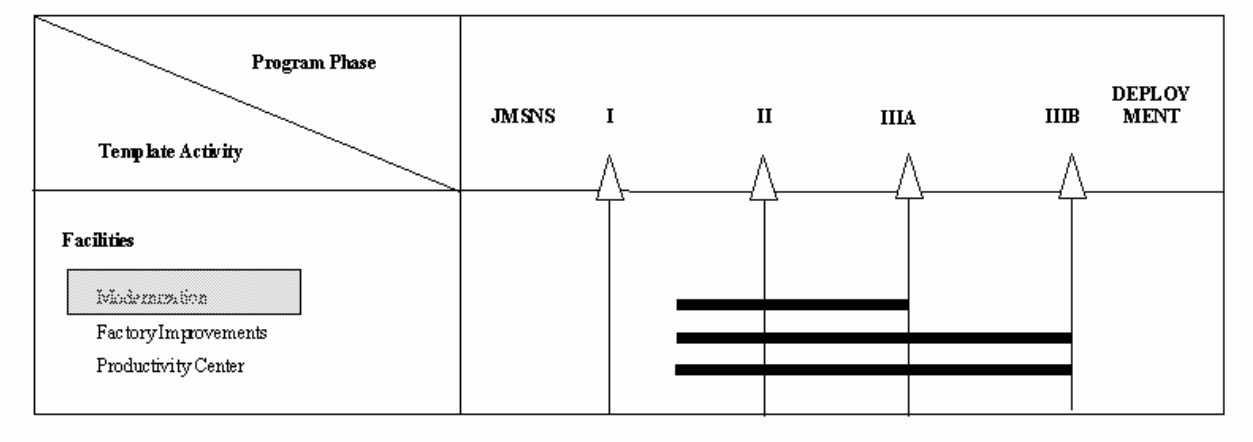
• Modernization activities are checked carefully against their impact on life cycle Cost, i.e., product quality.

• Contractor funding of modernization activities is preferred by the Government, and resultant savings are shared by the contractor and the Government. The contractor's investments are guaranteed by the Government, when appropriate.

• Modernization activities are flowed down to subcontractors and suppliers, to accrue the greatest benefits.

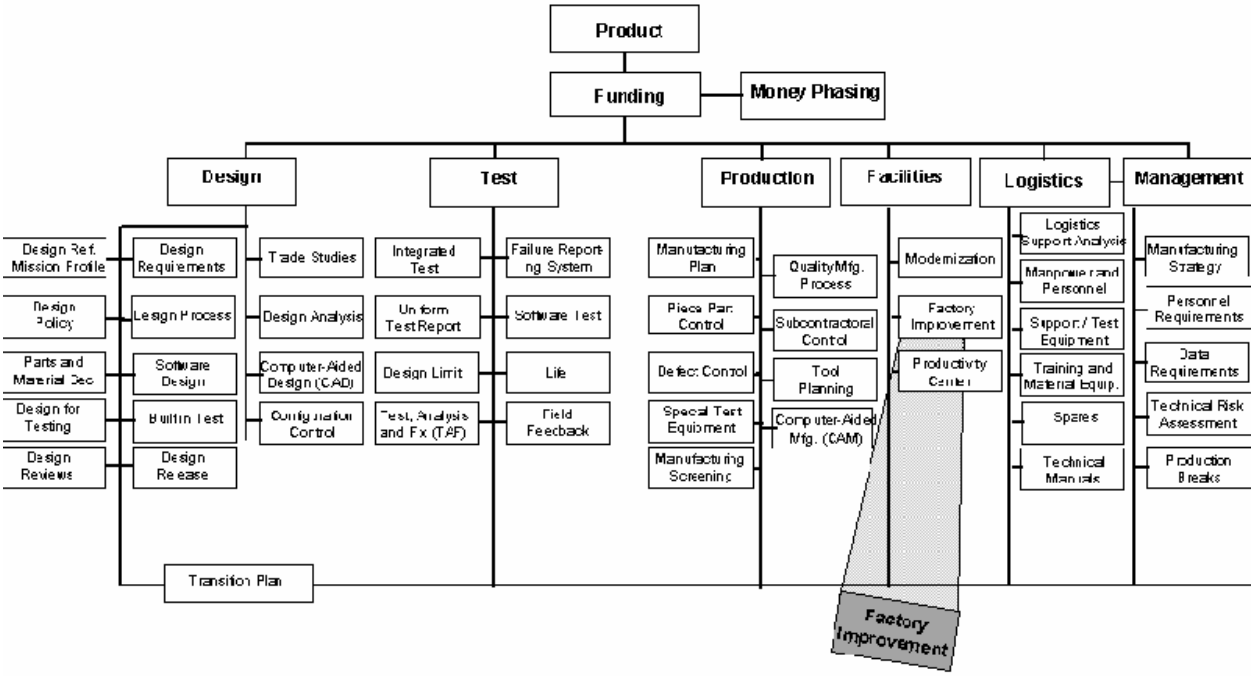
• All defense materials, not just weapon systems, are considered candidates for modernization activities.

Timeline



Factory modernization is essential to cost-effective production of today's sophisticated weapon systems. Modernization activities primarily are oriented to support ail of the factory's product lines. However, there may be program-related activities. In these cases, detailed planning is done early enough to influence the design, as appropriate and required.

C. -- Factory Improvements



Area of Risk

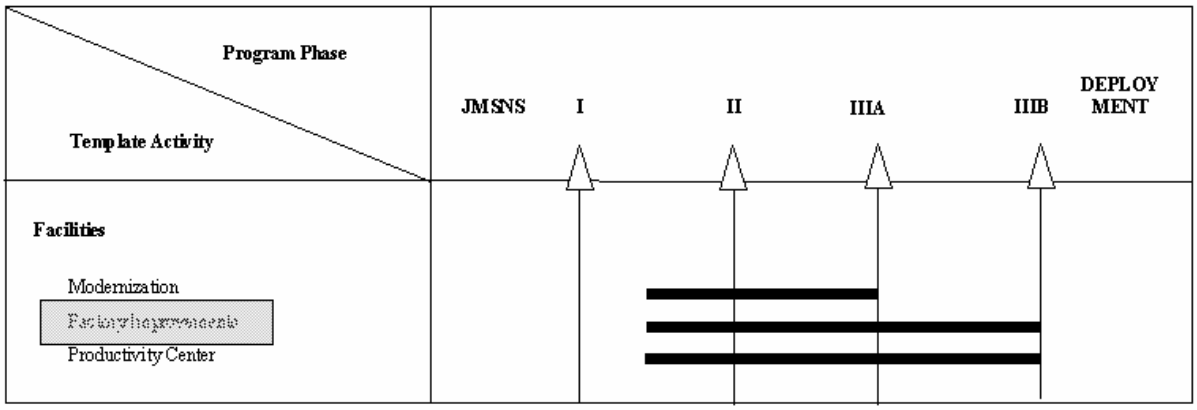
Many equipment failures in the field can be attributed to excessive manual assembly and test operations in the manufacture of assemblies. In-plant failures from manual errors in assembly and test contribute to excessive rework and repair costs (i.e., "the hidden factory"). These risk areas increase production and life cycle costs and result in major schedule risks. These risks are acute particularly during the transition from development to production. The use of

semiautomatic equipment in electronics manufacturing is essential in reducing these risks. This template illustrates an optimum facility for electronics assembly and test using available "off-the-shelf" electronics manufacturing equipment.

Outline for Reducing Risk

- Incoming inspection and automatic kit preparation ensure that high quality and correct components are used on the assembly line.
  - Typically, an 80 percent reduction in component defects can be achieved.
  - Exhibit 7-1. generically illustrates an example of incoming inspection and kit preparation areas.
- Semiautomatic and fully automated circuit board assembly techniques increase productivity and minimize assembly and workmanship defects.
  - Typically, a 2:1 reduction in defect rates can be achieved.
  - Exhibit 7-2. generically illustrates an example of a circuit board assembly and test area.
- Semiautomatic assembly and test techniques maximize productivity and minimize workmanship defects on electronic assemblies.
  - Typically, a 3:1 improvement in productivity can be achieved.
  - Exhibit 7-3. generically illustrates an example of an electronics subassembly and test area.
- One hundred percent piece part inspection of electronic parts reduces risk, is cost-effective, and should be a routine operation in incoming inspection.
- A productivity center for personnel training and development of any equipment integration minimizes the risk of unforeseen throughput problems.
- Computer-assisted functions include a data interface between the design and operations management functions.
- Each assembly, test, and inspection station should have computer-aided data entry capability.

Timeline

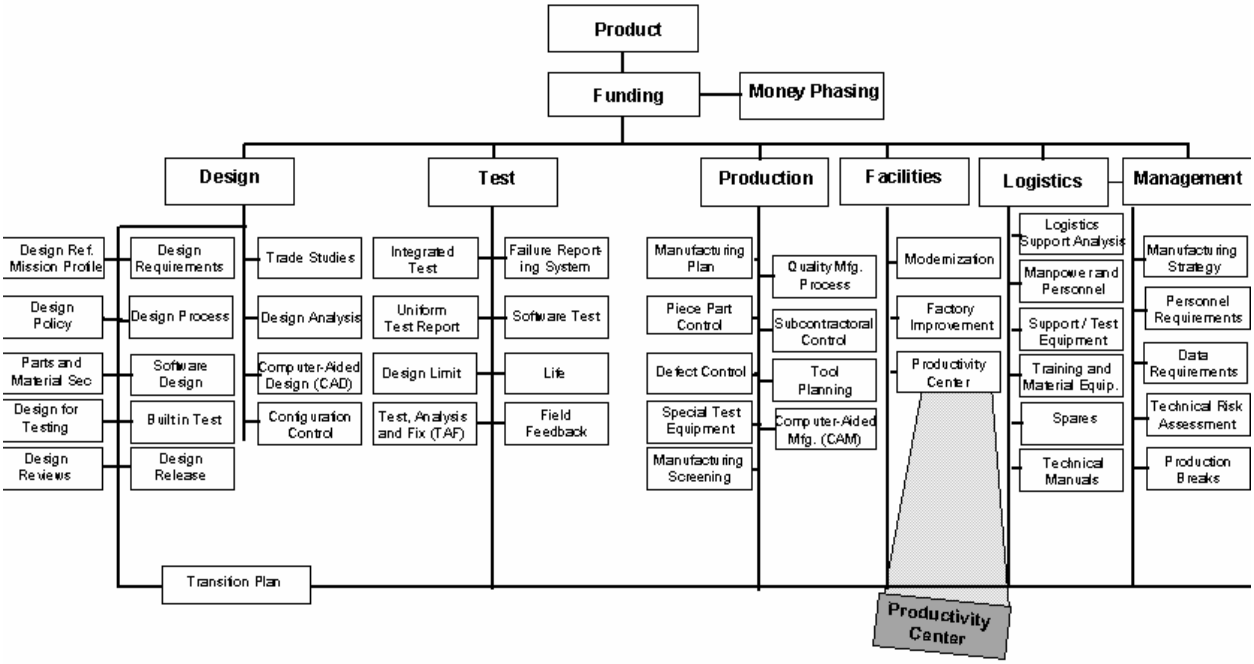


The use of state-of-the-art factory equipment can prevent many common workmanship errors. The type of facility planned for the manufacture of the end item product should be identified during engineering development, and should be evaluated periodically from development until full rate production is achieved.

Note:

1. ***Exhibit 7-1. -- Incoming Inspection and Kitting (Not applicable under this formate.)***
2. ***Exhibit 7-2. -- Printed Circuit Board Assembly and Test (Not applicable under this formate.)***
3. ***Exhibit 7-3. -- Electronics Assembly and Test (Not applicable under this formate.)***

D. -- Productivity Center



Area of Risk

The use of changing technology on the factory floor without qualified personnel can be counterproductive, lowering or eliminating the productivity gains anticipated from the capital investment in modernization and factory improvement. Thus, maintaining a stable labor force as new technology is introduced on the factory floor is a risk area. This risk area is amplified with the introduction of new "state-of-the-art" products that are typical of today's military weapon systems. Training and maintaining the skill of the labor force, therefore, presents a significant risk in the transition to production. A productivity center that updates the skills of the work force and provides orientation training for new product lines is a catalyst for maintaining a well-trained labor force. This template provides a framework for an effective productivity center.

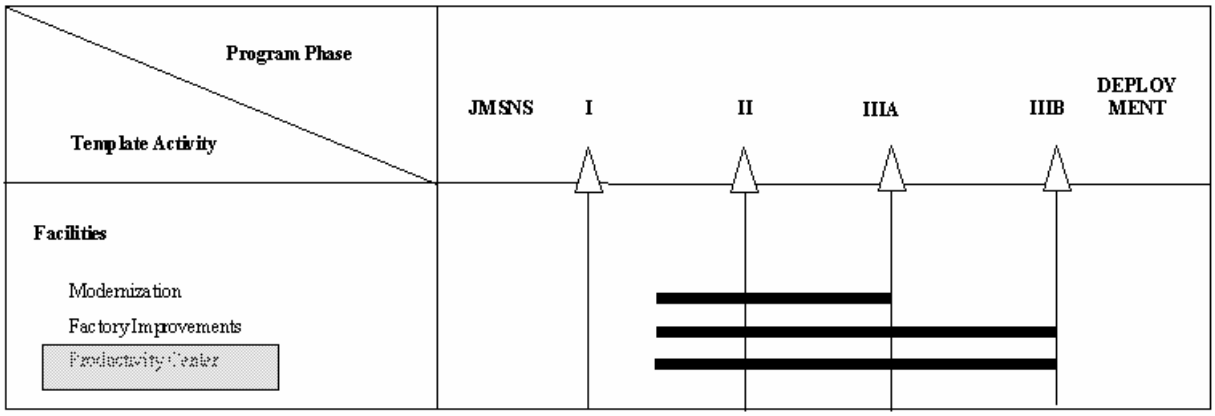
Outline for Reducing Risk

- productivity center includes an apparatus lab that contains the equipment and technologies that represent the actual facility producing a product.
  - Use of the apparatus lab includes simulation of production equipment hardware and end item defects.
  - The apparatus lab evaluates new processes or process changes before introduction at the main facility. This technique ensures that any change to existing procedures will not affect adversely normal production flow.
- Productivity center includes a learning center for classroom instruction for updating the skills of manufacturing personnel.
- Training system is flexible and individual performance oriented.
  - Sixty percent is "hands on" training in apparatus lab.
  - Forty percent is formal classroom instruction.
  - Attention is given to skill assessment and the motivation aspects of worker retraining.
- Typical training courses include the following:
  - Product orientation.
  - Manufacturing facility orientation.
  - Electronics manufacturing and test operations and procedures.
  - Numerical control machine operations.
  - CAM.
  - Diagnostics for troubleshooting and repair (system level).

– Microprocessor troubleshooting techniques.

– Computer technology.

Timeline



A productivity center provides an "off-line" capability to evaluate manufacturing techniques for worker retraining for production line improvements. As new technology, equipment, manufacturing processes, or test procedures are identified for the efficient production of a specific product, personnel must be trained to perform these new tasks. Manufacturing engineering concurrent with design engineering will identify these tasks during development, and additional tasks will be identified until rate production has been achieved.

Next Section

Previous Section

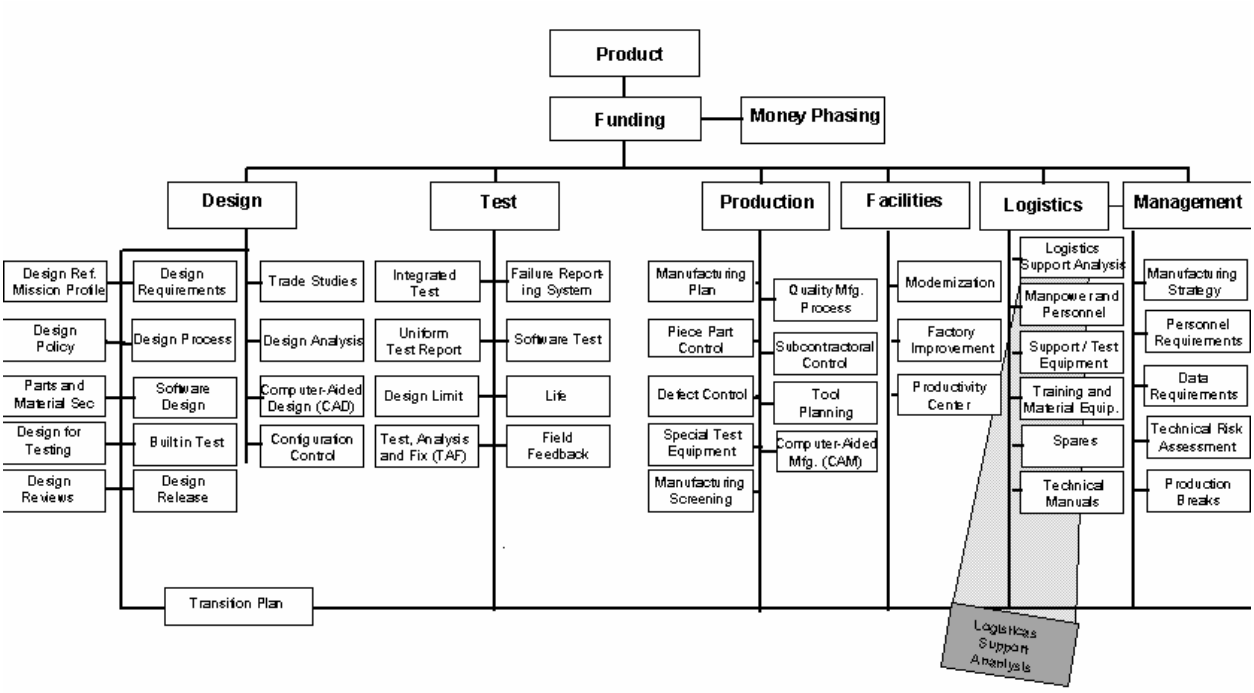
Chapter 8 -- Logistics

A. -- Introduction for Logistics Critical Path Templates

The primary purpose of the acquisition process is to field weapon systems and equipment that not only perform their intended functions, but are ready to perform these functions when called on, and to do so over and over again without unplanned maintenance and logistics efforts. However, numerous examples abound when new systems, when fielded, do not achieve readiness levels to meet service needs, necessitating engineering and manufacturing changes as well as additional equipment, spares, and maintenance resources, all of which increase cost as well as production and deployment risk.

The templates in this section address logistics and supportability issues that contribute to the risk of transition from development to production. Accordingly, they do not explicitly refer to all integrated logistics support (ILS) elements or outline a total strategy for I LS planning and management in the acquisition process. These elements and strategy are covered in DoD Directive 5000.39 (reference (k)) and Military Service implementing documents. As specified in reference (k), the acquisition manager is required to develop an ILS plan that successfully coordinates the areas addressed in this logistics section. The logistics elements and supportability issues and their requirements, outlined in this section, represent those that have been particularly difficult and destabilizing, and require special attention. Therefore, the implementation of the concepts, procedures, and techniques discussed in this section will reduce significantly the risk of transition from development to production and deployment.

B. -- Logistics Support Analysis



Area of Risk

Logistics Support Analysis (LSA) is used throughout the acquisition process to evaluate design approaches and alternative support concepts to achieve system readiness and support objectives, and to develop detailed design of the support system and requirements. Weapon system programs that have either delayed the application of LSA or have not integrated it effectively into the design analysis process are headed for trouble. The result is supportability deficiencies that increase costs and require additional engineering changes to correct these deficiencies late in the development and production process.

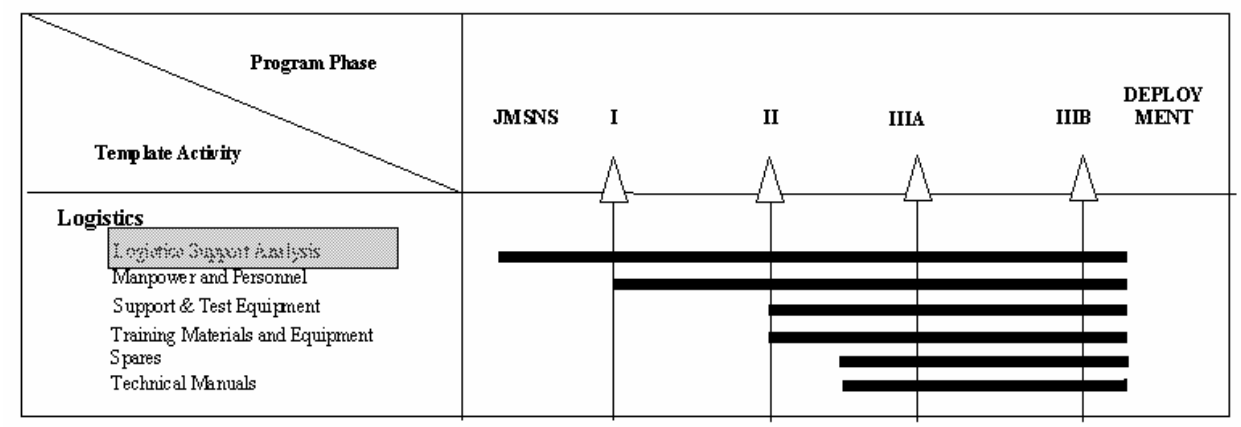
Outline for Reducing Risk

- Design objectives and development of design options to achieve readiness and supportability objectives are required by the engineering statement of work (SOW).
- LSA is integrated into the design process to determine design impact on support.
- The LSA process has identified high leverage subsystem and component reliability and maintainability efforts needed to achieve readiness and deployment objectives.
- Quantitative logistics and supportability requirements are given explicit weight in source selection.
- LSA data is derived from the same source data used by design and test engineering.
- The engineering disciplines have an “agreed to” methodology for quantifying readiness and supportability design impacts.

- Disposition of LSA-identified cost and performance drivers are coordinated with the users to permit meaningful tradeoffs.

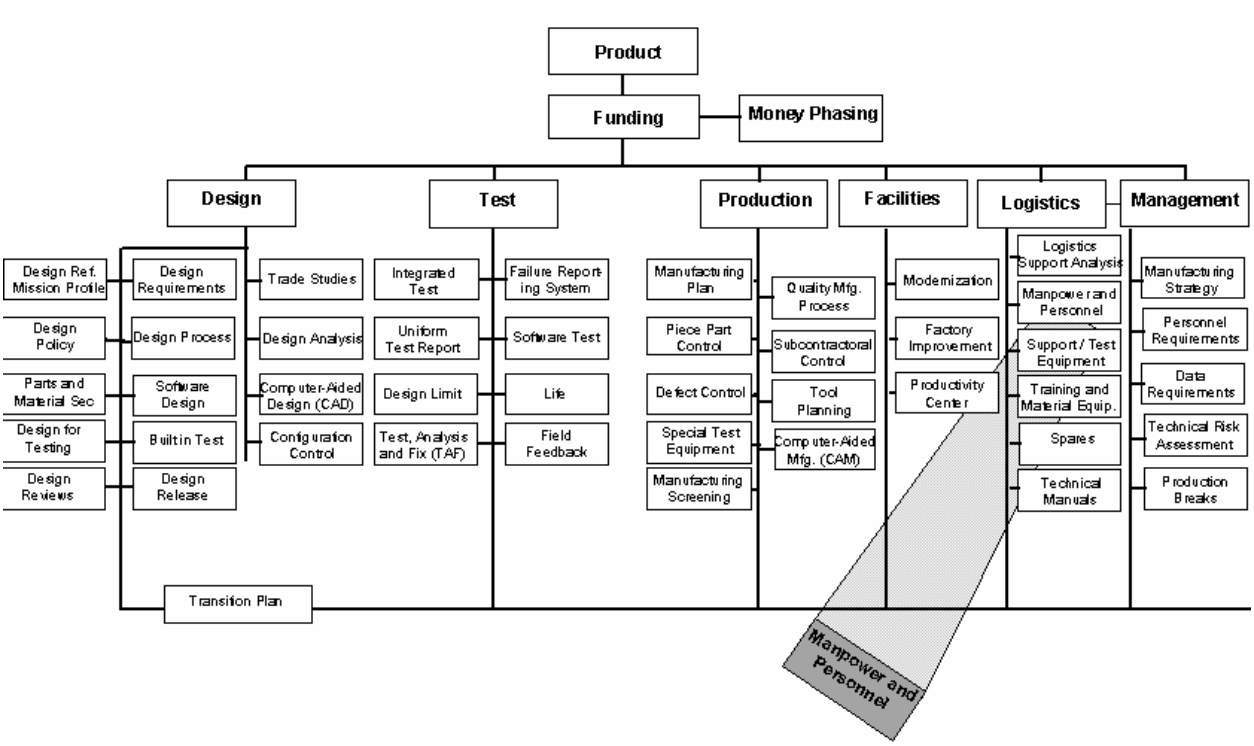
- Adequate funding and technical manpower are programmed to perform LSA analyses required during the concept demonstration and validation phase and follow-up.

Timeline



The LSA is begun early in the development process to explicitly address supportability and support requirements throughout the design, development, and production process.

C. -- Manpower and Personnel



Figure

Area of Risk

Weapon systems and support systems must be designed with as complete an understanding as possible of user manpower and personnel skill profiles. A mismatch yields reduced field reliability, increased equipment training, technical manual costs, and redesign as problems in these areas are discovered during demonstration tests and early fielding. Discovery of increased skill and training requirements late in the acquisition process creates a difficult catch-up problem and often leads to poor system performance.

Outline for Reducing Risk

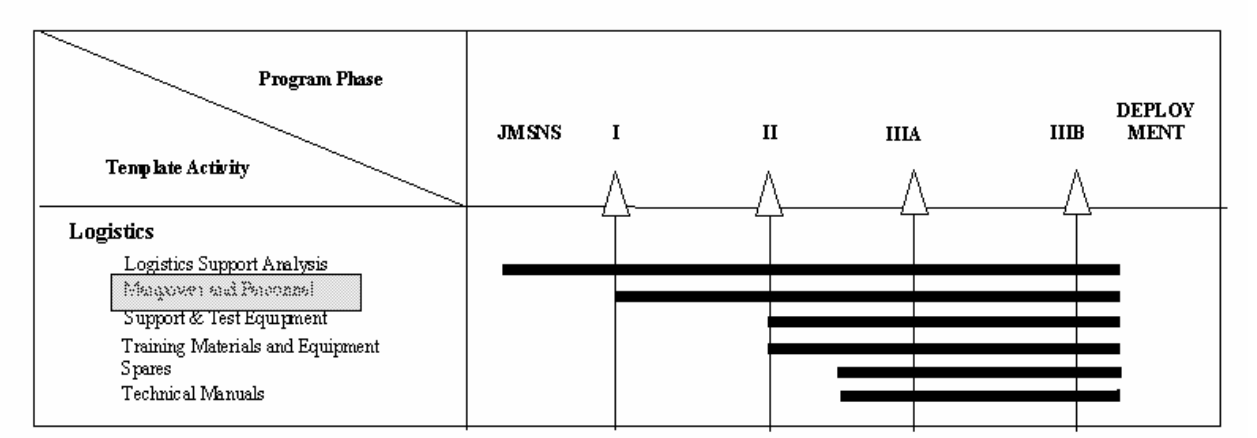
- Manpower and skill requirements are based on formal analysis of previous experience on comparable systems and maintenance concepts. This is done under contract during the preconceptual through validation phase.

- RFPs reflect the required priority for reducing manpower quantities or skill requirements. l% is backed up by detailed descriptions of current and projected manpower skill resources and shortfalls. This data includes specific information on current maintenance and operator performance and realistic manpower costs on similar fielded systems.

- Arrangements are made for the contractor to observe maintenance in the field to gain appreciation for capabilities and constraints.

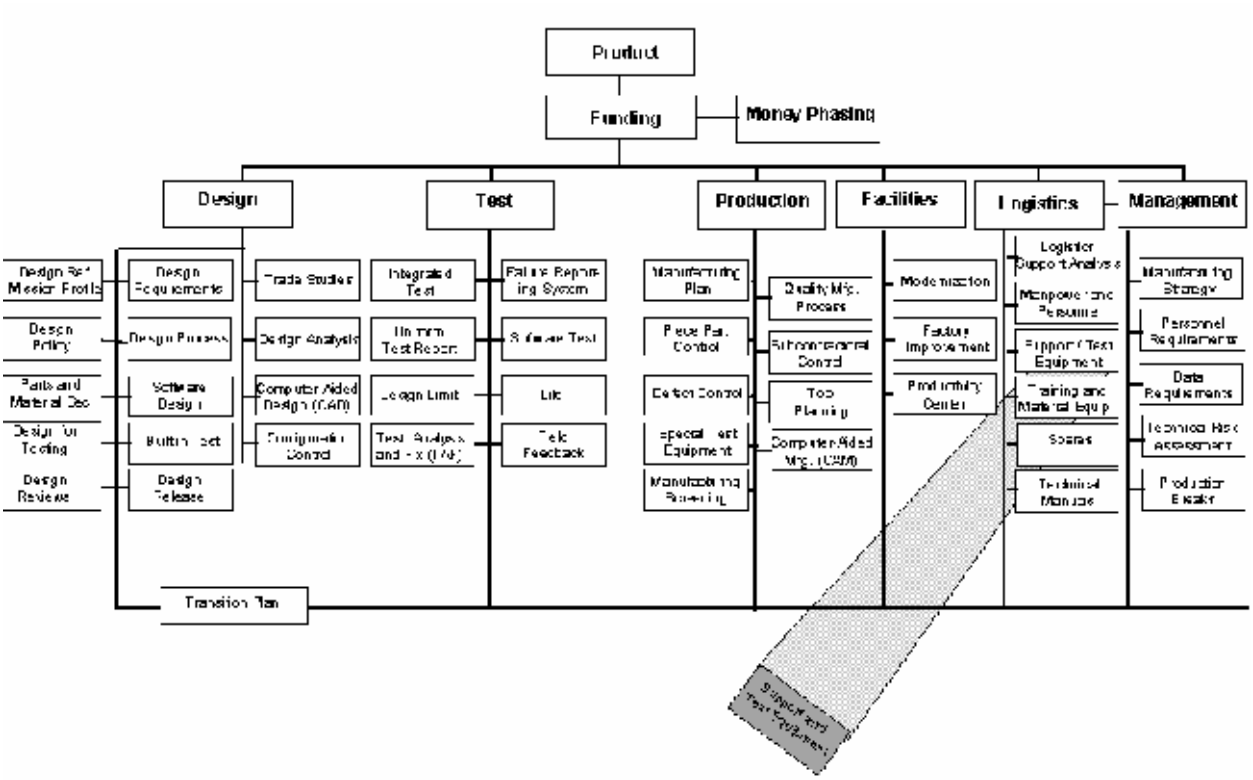
- Manpower cost factors used in design and support tradeoff analyses take into account costs to train or replace experienced personnel, as well as billet and true overhead costs.

Timeline



Manpower and skill requirements are established early in the conceptual phase and are considered as prime design considerations during development. They are addressed specifically during LSA, and tradeoffs in design are made to minimize their requirements.

D. -- Support and Test Equipment



Area of Risk

Weapon system supportability is dependent on reliable and maintainable support and test equipment that can be deployed with the prime system. However, the development, production, and fielding of this equipment have been a common source of risks in terms of increased costs, schedule delays, and poor performance and readiness for fielded systems. The more significant causes of this risk are: (1) delayed identification of support equipment requirements; (2) design and development of software intensive support equipment before design stability of the system it supports; (3) underestimation of software requirements and development costs; and (4) failure to apply sound engineering, manufacturing, and management disciplines to the design, development, test, and production of support and test equipment.

Outline for Reducing Risk

- Identification of support equipment needs, as part of the LSA process, is initiated as early in development as prime system concept permits.

- Test equipment performance specifications include criteria for fault detection, isolation, and false indications.

- Phased contractor support is utilized to allow for design instability.

• Test equipment performance, procedures, and software verification and validation are completed before contractor support termination.

• Upward compatibility is specified between BIT and intermediate, depot, and factory-levels of support equipment.

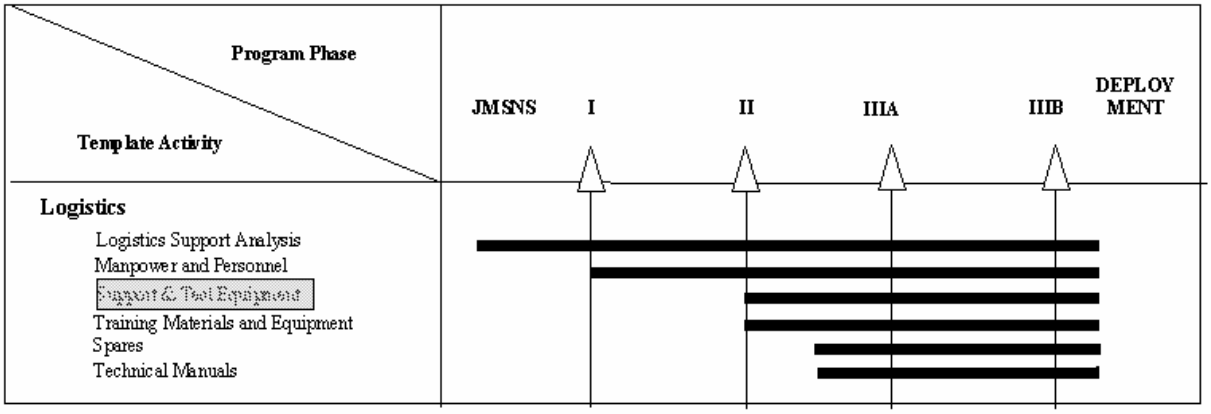
• Support and calibration requirements for test equipment are included in development and production contracts.

• Estimated costs of test program set (TPS) development are based on comparable equipment development and are funded fully.

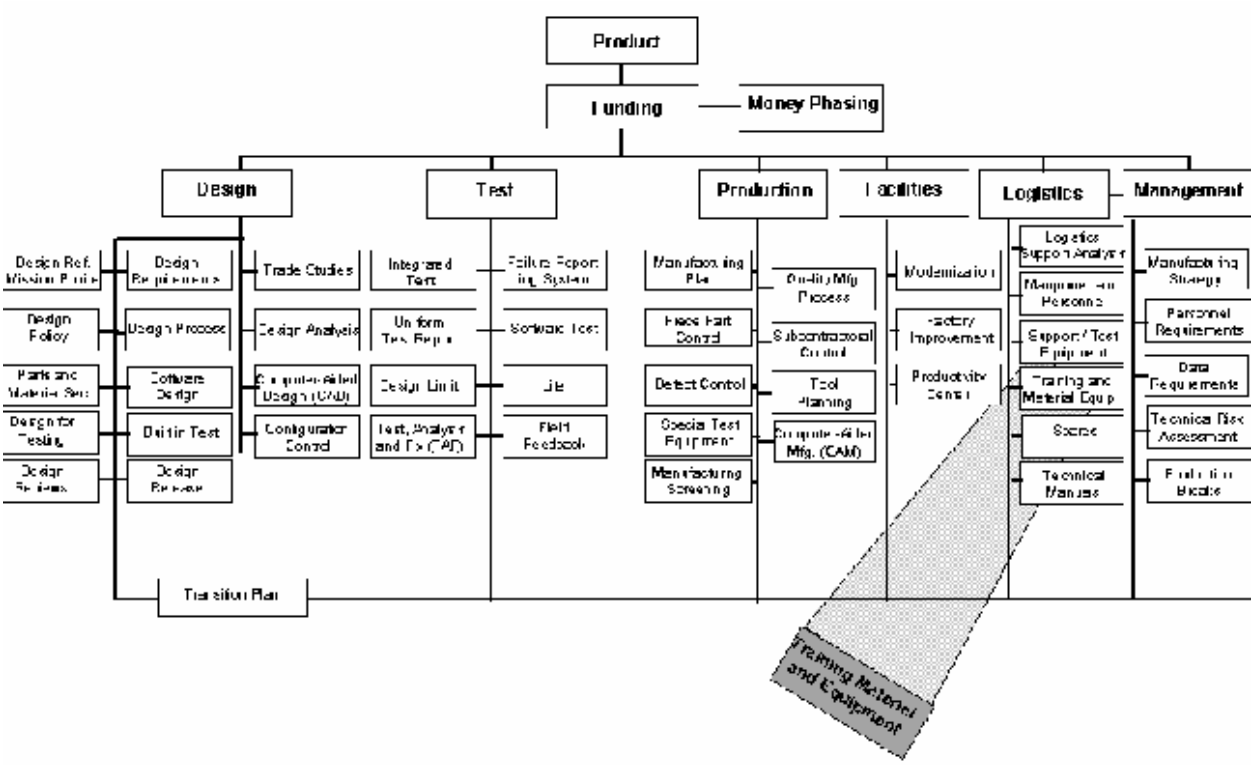
• Support and test equipment is evaluated during formal contractor maintainability demonstrations and "in" operational tests.

• Support and test equipment design, test, production, and supportability follow the same processes outlined in this Manual for the prime equipment.

Timeline



E. -- Training Materials and Equipment



Area of Risk

On some programs, training requirements are not addressed adequately, resulting in great difficulty in operation and support of the hardware. Training programs, materials, and equipment such as simulators may be more complex and costly than the hardware they support. Delivery of effective training materials and equipment depends on the understanding of final production design configuration, maintenance concepts, and skill levels of personnel to be trained. On many programs, training materials and equipment delivery schedules are overly ambitious. The results include poor training, inaccuracies in technical content of materials, and costly redesign and modification of training equipment.

Outline for Reducing Risk

- Contractors are provided with clear descriptions of user personnel qualifications and current training programs of comparable systems, to be used in prime hardware and training systems design and development.

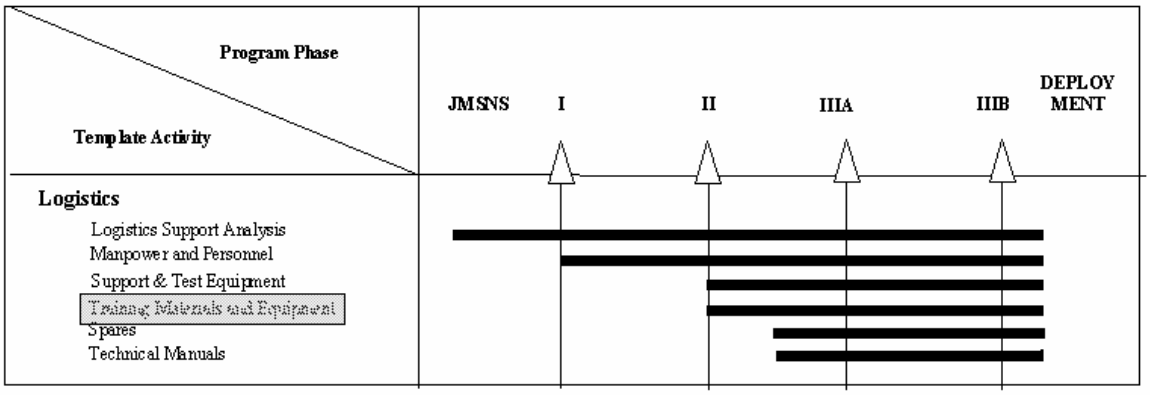
- Maintenance tasks identified through LSA provide the data base used in comprehensive training program development systems (such as instructional systems development (lSD)).

- Computer-aided techniques are used for configuration control to ensure consistency between training materials and equipment and the systems they support.

- On-the-job training capability is incorporated in the prime equipment design as a method to reduce the need for additional training equipment.

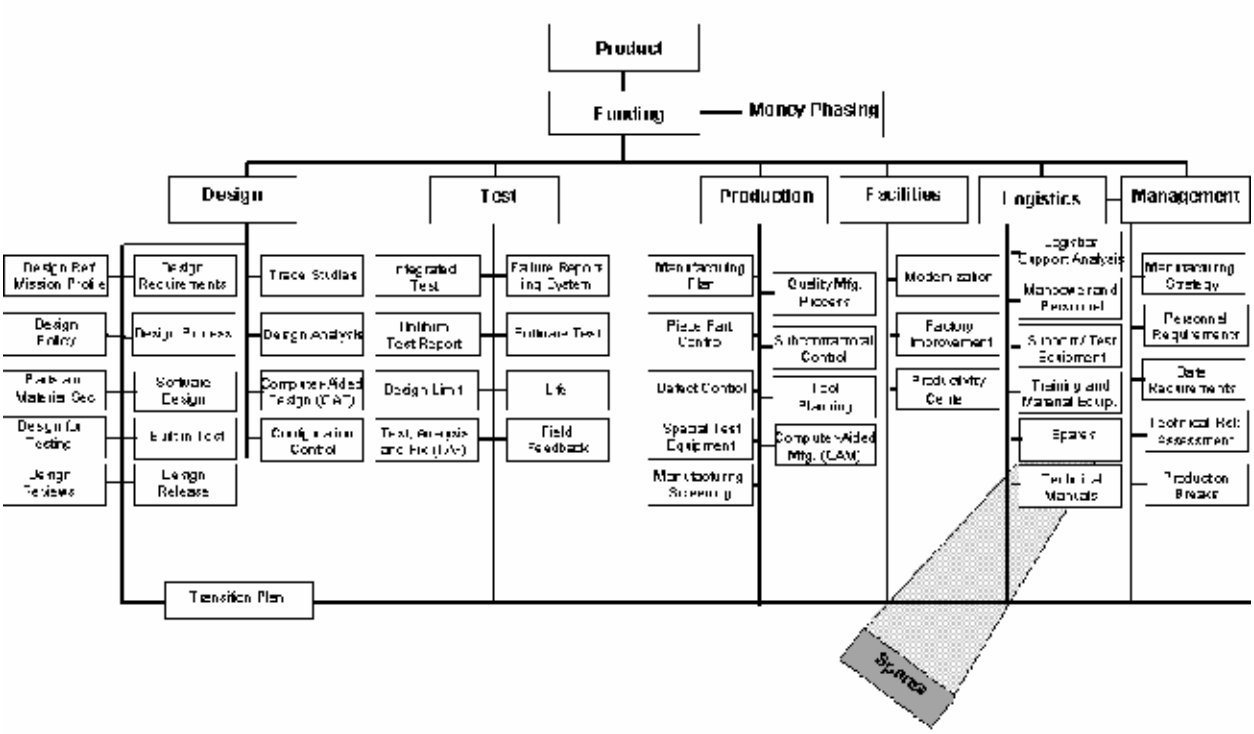
- Complex and costly training equipment, such as simulators, is scheduled to be produced after design freeze of the prime equipment.

Timeline



Training materials and equipment must match maintenance plans. Equipment built-in training features must be established early in the design phase, and the training device design must reflect stable prime equipment design.

F. -- Spares



Area of Risk

Spares are a troublesome area in the production and deployment of weapon systems. Spares and repair parts often do not meet the same quality and reliability levels as the prime hardware. Full spares provisioning too early in the development cycle, when there are large uncertainties in the predicted failure rates and design stability, results in the procurement of unneeded or unusable spares. inadequate technical and reprocurement data frequently limits competition, acquisition flexibility, and spares manufacturing throughout the life cycle of the prime systems. Spares thus present a major risk of increased acquisition and support costs and reduced readiness of fielded systems.

Outline for Reducing Risk

- A spares acquisition strategy is developed early in FSD to identify least cost options, including combining spares procurement with production. This strategy addresses spares requirements to meet FSD testing as well as production and deployment.

- The same quality manufacturing standards and risk reduction techniques used for the prime hardware are used in the spares manufacturing and repair process.

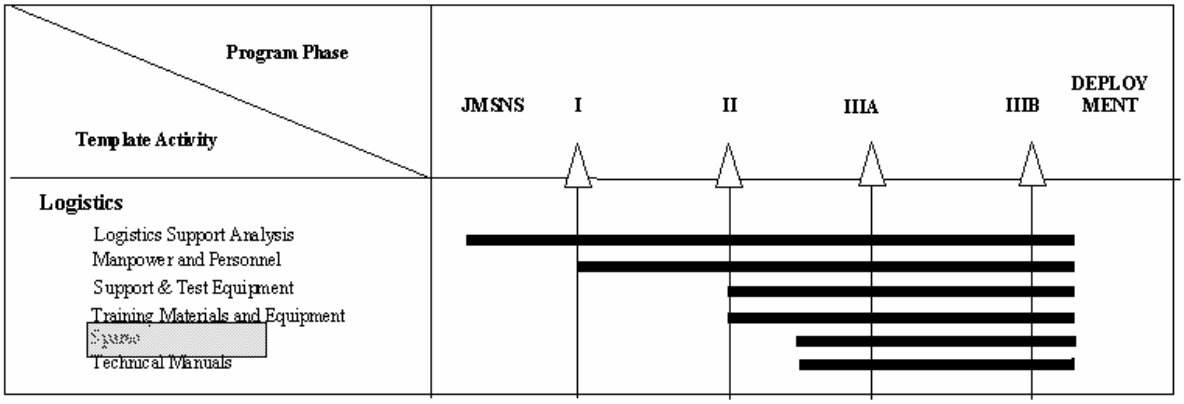
- Transition from contractor to Government spares support is planned on a phased subsystem-by-subsystem basis.

- Initial spares demand factors are based on conservative engineering reliability estimates of failure rates (derived from comparability analysis) and sparing to availability analytical models. These factors are checked for reasonableness at the system or major subsystem level against laboratory and field test results and documented in the logistics support analysis data base.

- Technical and reprocurement data is validated by analysis and, when possible, by "proof models," to ensure the quality of the spares and repair parts production process.

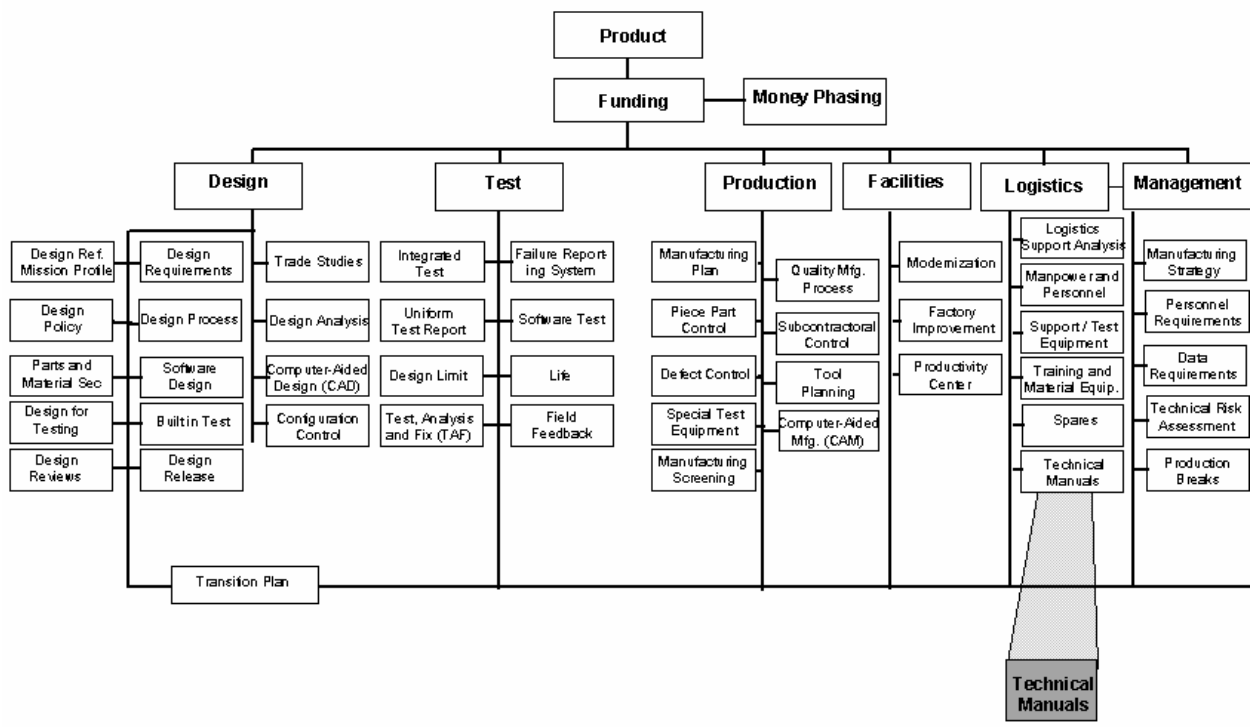
- Plans for developing spares procurement and manufacturing options to sustain the system until phaseout are considered in the production decision. These plans include responsibilities and funding for configuration management, engineering support, supplier identification, and configuration updates of factory test equipment to the current fielded configuration of the produced item.

Timeline



Key factors in the risk equation are operational utilization, spares provisioning, design stability, adequacy of technical and reprocurement data, and quality of spares manufacturing and repair process.

G. -- Technical Manuals



Area of Risk

Technical manuals frequently do not match the production configuration of the equipment supported. The manuals are difficult to read and understand. These deficiencies cause delays in

operational testing, low readiness rates, increased revisions change activity, and increased spares and data costs.

Outline for Reducing Risk

- A clear delineation of Government and contractor responsibilities in the development, verification, validation, and publication of technical manuals is outlined in the ILS plan.

- Automated processes (such as the use of computer-aided engineering drawings as illustrations) are used in technical manual preparation. These processes are encouraged by RFP requirements and evaluations during source selection.

- The LSA process analyzes technical options for portraying information including embedded and paperless delivery.

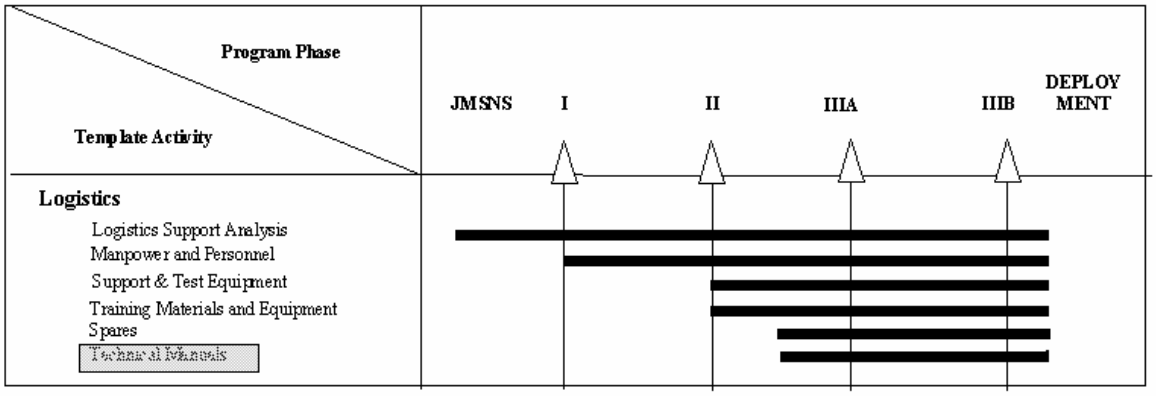
- Maintenance tasks identified through the LSA process provide the data base used in technical manual development.

- Draft manuals are validated and verified before final preparation and publication. Equipment availability to be used in verification and validation is specified in the contract.

- Automated readability analyses are used to verify that the level of the document matches the level specified.

- The milestone schedule includes interim manuals for initial training.

Timeline



The development of technical manuals must be keyed to support of training requirements, engineering development models, equipment evaluation, initial production units, and update programs.

Next Section

Previous Section

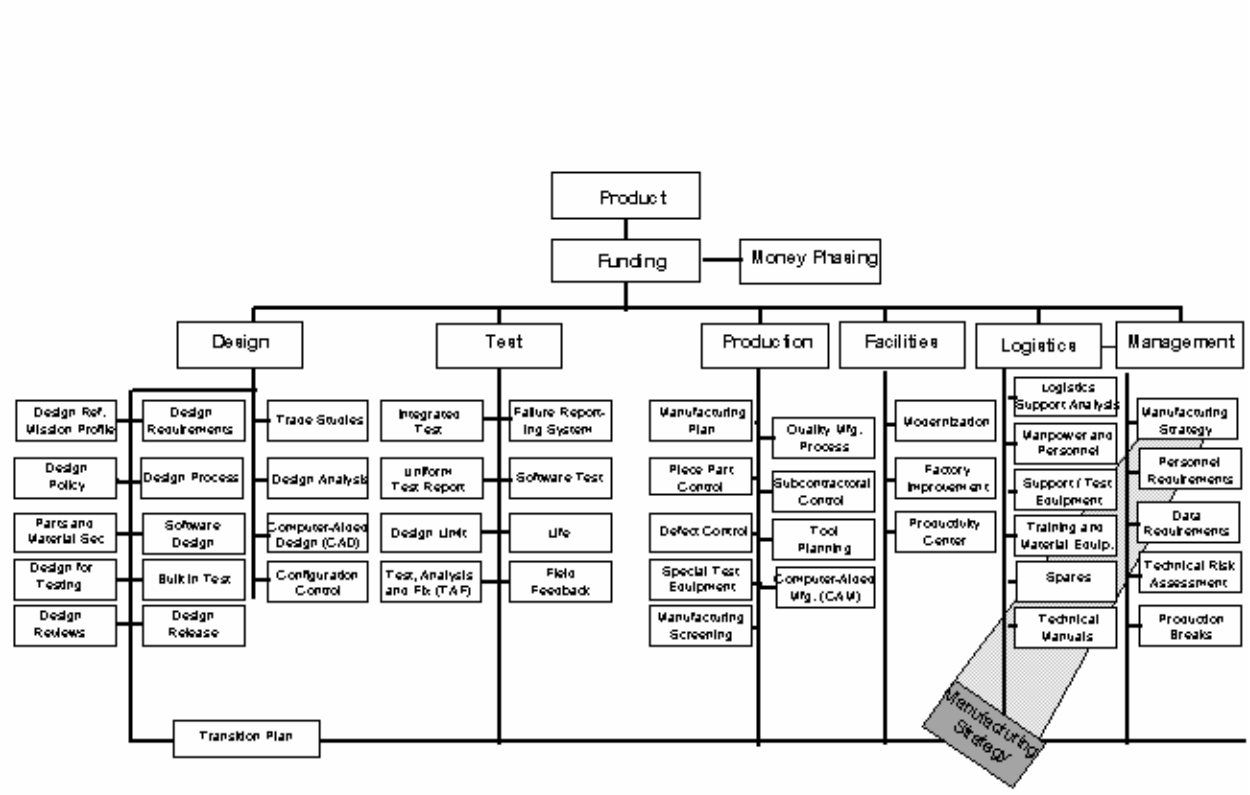
Chapter 9 -- Management

A. -- Introduction for Management Critical Path Templates

Our free enterprise system relies heavily on the law of supply and demand. When a supplier has the capability to make a product for which there is sufficient consumer demand, the resources of both the supplier and the customer are applied to ensure that the product is delivered for the price agreed upon, is received on or before the desired date, and performs the required functions. The risk drivers in this process include the quality and experience of the people assigned to the project. More specifically, the industry supplier must have the people resources to design, test, and produce an acceptable end item. To ensure that customer requirements, and any necessary changes thereto during the acquisition process, are communicated effectively to the supplier, the Government also must have competent people resources to provide clear direction and evaluate progress throughout the process.

Without adequate numbers of competent people in industry and Government, there is an extremely high risk of having an unacceptable product. Although material and time are very important resources requiring effective management, people are the key to a successful program.

B. -- Manufacturing Strategy



Area of Risk

One of the first tasks for the newly assigned program manager is the development of an overall acquisition strategy. Construction of the program acquisition strategy without due consideration to the manufacturing elements is a key area of risk to the capability of the industrial base meeting the schedule, performance, and quality desired of the end item. If the principal contractors do not know what is expected of them by the Government, they will be uncertain and reluctant to make the proper financial and personnel resource decisions necessary for facilitization, industrial modernization, labor commitments, subcontractor or vendor structure, and foreign and domestic technology and production sharing agreements. Inadequate and unnecessarily imprecise production planning information increases program risk to the contractors and adds delay and indifference to industrial market participation in the program. Resulting inefficiencies will increase substantially production and support costs.

Outline for Reducing Risk

- A manufacturing strategy as specified by DoD Directive 4245.6 (reference (h)) is outlined by the program manager as part of the initial acquisition strategy. The manufacturing strategy is refined progressively during the program's conceptual phase so that a sound, comprehensive manufacturing approach is available for dissemination with the solicitations for the development effort.

- Demands on the industrial base will be discernible readily from stated inventory objectives, operational capability dates, initial production requirements, delivery profiles, and production surge requirements.

- Maintenance, logistics, mobilization, and surge planning information enables assessing the demands on production capacity from spares and test and support equipment requirements.

- Use of Strategic and critical materials and vendor manufacturing capabilities is projected, including offshore requirements.

- Critical manufacturing technologies needed to efficiently produce the concept and the design are identified and pursued through appropriate RDT&E projects.

- Peculiar system and component manufacturing test equipments are scheduled for development and use.

- The contracting scheme is compatible with program risk and needed levels of Government visibility and control.

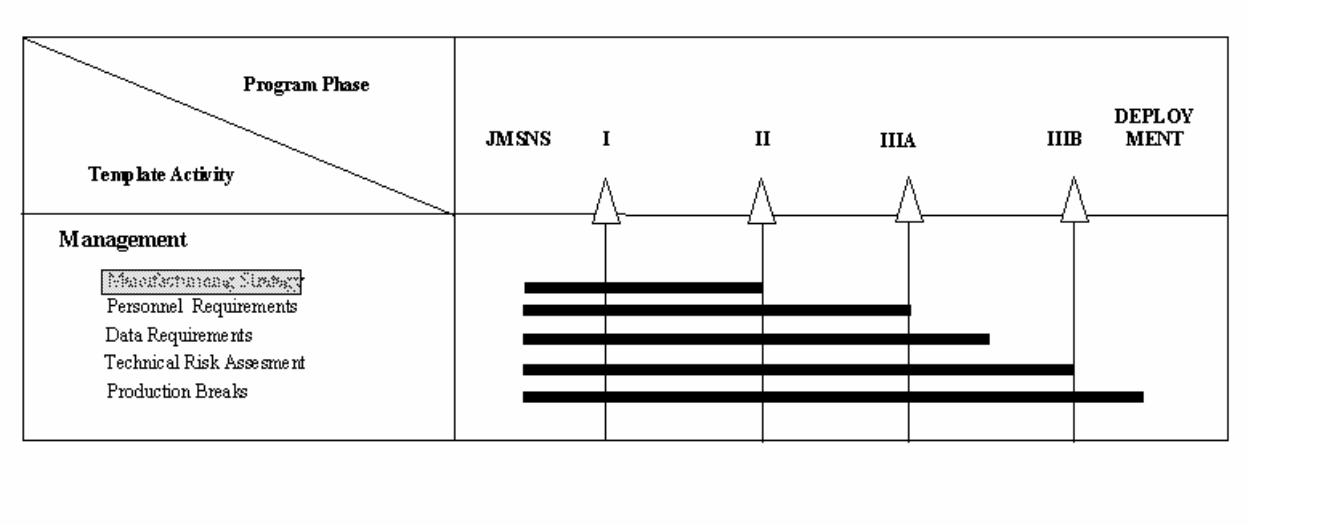
- The contractors are aware fully of Government plans for dual sourcing and "breakout" of Government-furnished equipment so that rights in data and technology transfer issues are resolved expeditiously, Procurement of necessary technical data is an integral part of the development effort.

- The Government manufacturing strategy is translated readily into contractor production and transition planning documents that convincingly show the contractors' appreciation of and

capability to respond to the magnitude and complexity of the manufacturing effort and their willingness to participate in mobilization, surge, and productivity enhancement projects.

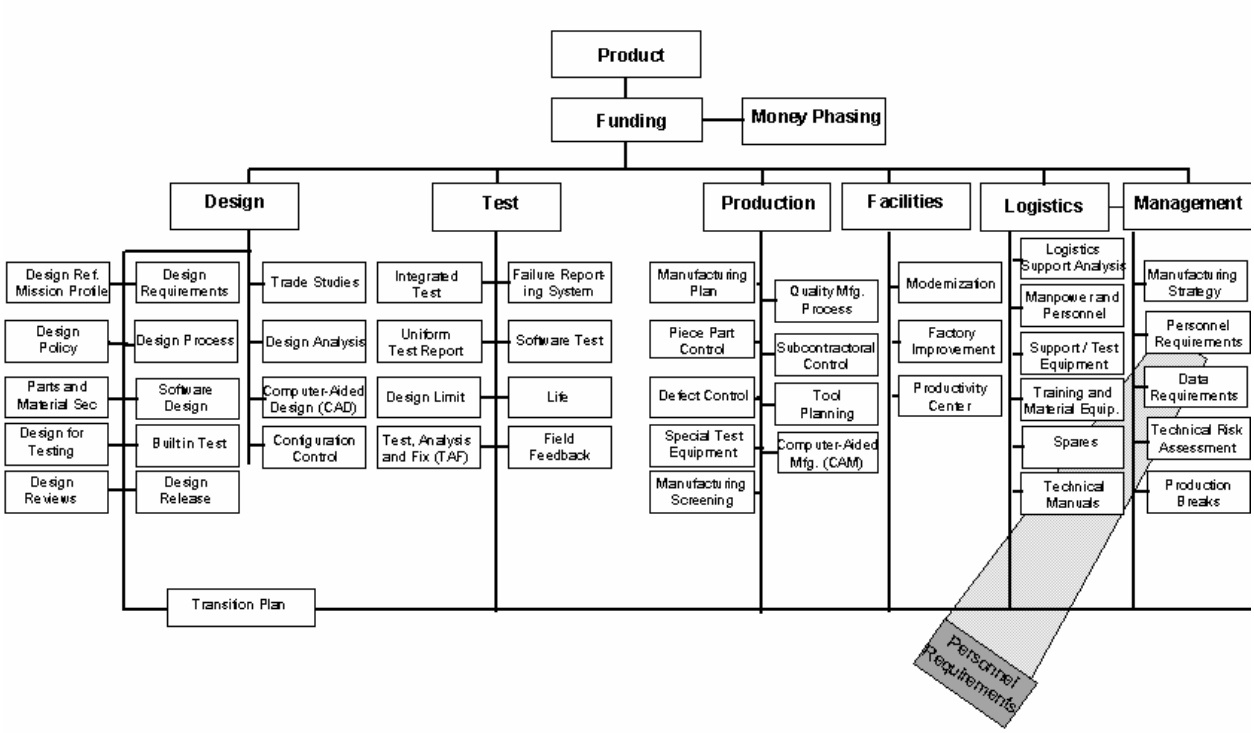
• Production matters are weighted heavily in engineering development source selection evaluations and the contractors are so informed.

Timeline



A manufacturing strategy should be developed at the initiation of program development to reduce risk while meeting cost, schedule, performance, and quality of the production items. As development progresses, the manufacturing strategy should be refined and updated so that a sound manufacturing approach is in place at the start of production.

C. -- Personnel Requirements



Area of Risk

It is a common practice in both industry and Government for program managers to be supported by a small number of key staff personnel collocated in the program office and by a large number of functional area experts who provide their support using a matrix management approach. Contractor program managers may lack the experience to orchestrate the entire effort from drawing board to finished product. Government program managers may likewise lack acquisition experience and proven leadership ability, and tour lengths are often too short to see the program through to completion. Engineering and manufacturing talent may lack critical continuity and corporate knowledge. For example, design engineering may be left to recent college graduates because the more experienced design engineers have been promoted to new fields of endeavor. Functional support personnel are also in the critical path, and the recruitment, training, and retention of competent, experienced personnel may not be a continuing corporate objective. History has proven that those programs for which Government or industry top managers only gave lip service to the precept that states "people are our most important resource" have suffered and often failed.

Outline for Reducing Risk

- Career progressions are defined for prospective program managers, and available formal training such as the Defense Systems Management College and informal training such as training with industry programs (for DoD personnel) are used.

- program manager tours are extended and stabilized, particularly in the Department of Defense, and civilian program managers are used in the Department of Defense on a selected

basis. Stability considerations argue strongly against changing program managers and key staff and functional support personnel at major program milestones.

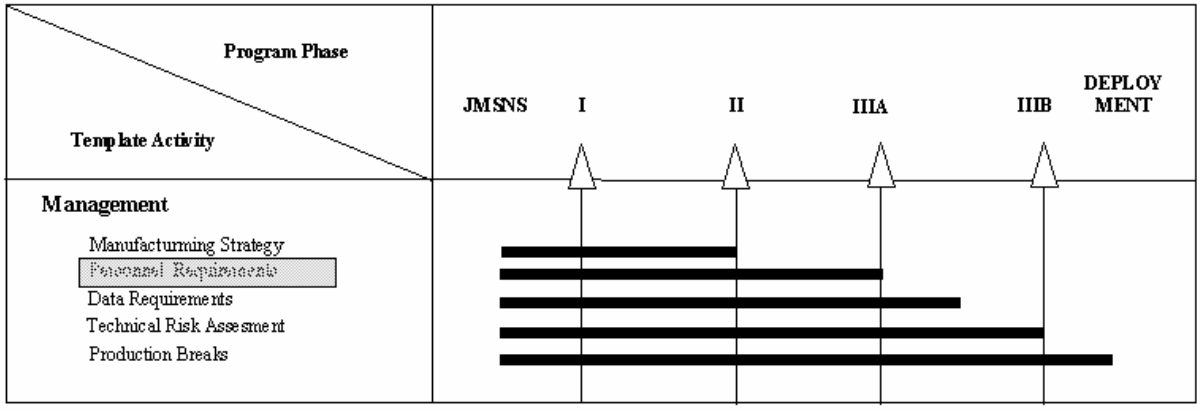
• A program manager never is assigned more than one major program.

• The use of matrix management, a proven concept, is coupled with as much collocation of key functional support personnel as practical.

• Line managers are involved in the recruitment, training, and retention of key technical personnel rather than delegating all such responsibility to the personnel support organization. To provide DoD line managers with greater control over personnel functions, innovative techniques, such as the Civil Service experiment being conducted at the Naval Weapons-Center (NWC), China Lake, and Naval Ocean Systems Center (NCISC), San Diego, are considered.

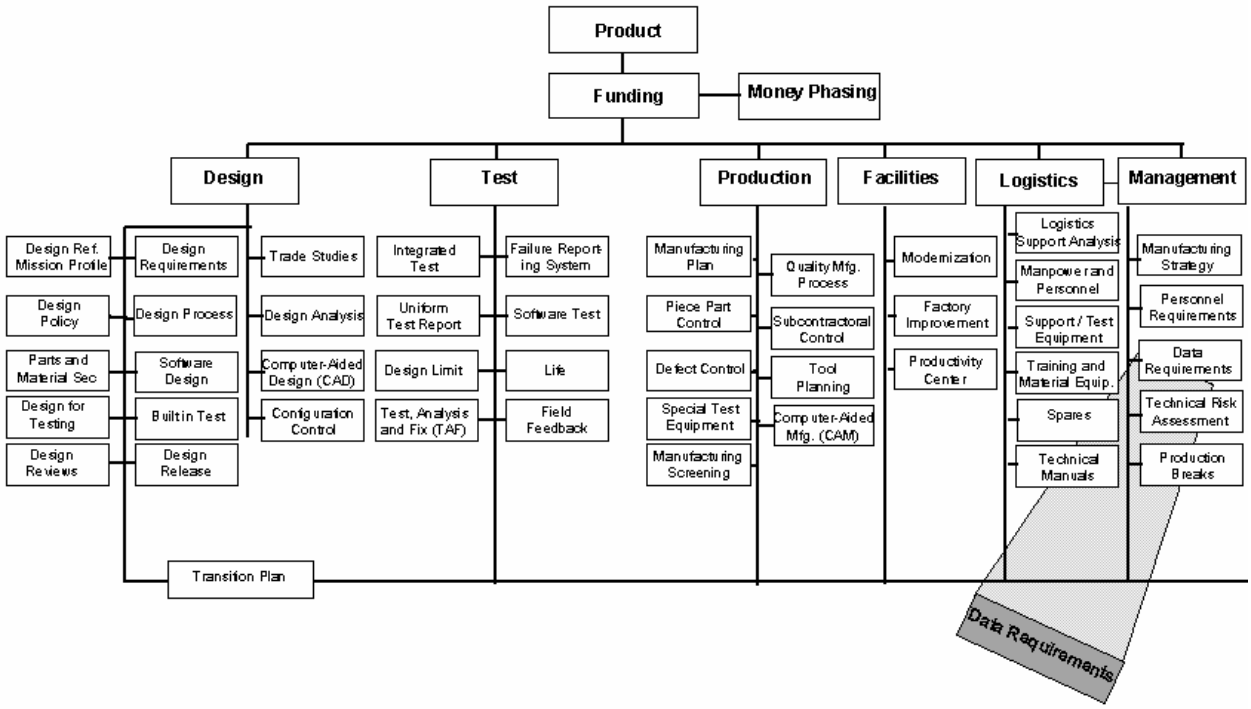
• Personnel with production experience are critical particularly in Government organizations because manufacturing operations usually are contracted with industry. Career development and training programs with a production orientation are supported zealously by the Military Services, and program managers ensure that their personnel attend or have commensurate experience.

Timeline



Personnel resources are the key determinant of successor failure throughout the life cycle of any program. To recruit, train, and retain the people necessary to ensure success, it is essential that Government and industry couple effective management and sound leadership during every program phase, including the transition from development to production.

D. -- Data Requirements



Area of Risk

The Government asks for too much technical data in their procurements, which increases the risk of cost overruns. Redundant data also may be procured by different Government functional organizations and the program office that did not coordinate their data requirements before contract definition. Often, this is a direct result of using a boilerplate list of data requirements when the request is submitted by the various Government offices responsible for the procurement. It is estimated that direct costs for data range from 6 to 20 percent of contracts, not including the overhead costs and the cost to the Government to process, review, and manage the data. A corollary problem is the degree to which any potentially useful data is evaluated and introduced into the decision making process. On the one hand, too much data is required and, on the other, not enough data is used for better program control. Control of data requirements has been sporadic at best and, even though the problem of poor data management has been identified in various studies over the past 20 years, it receives little emphasis because of little top level commitment.

Outline for-Reducing Risk

- All procurement data requirements are reviewed using an effective data review board before contract award, to ensure that the data received will satisfy the Government's needs, is in a format suitable for customer use, and is not redundant.

- An integrated data management system is established both in Government and industry for each major procurement. The objective is to tailor the technical data requirements to the needs of each program.

• Electronic data transfer is used. Pertinent data required by the Government can be requested by accessing the customer data base. The requested data can then be exercised in the Government's data base to extract the required information.

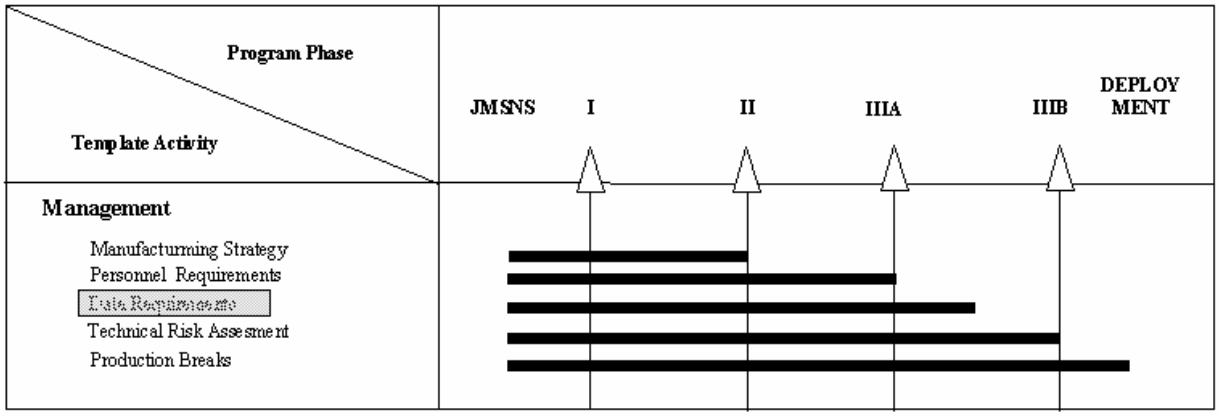
• The data requirements for a major program are reviewed at a level high enough to ensure that redundant data is not being requested by the different disciplines within the program office and its functional support organizations.

• Technical data libraries are established for ease of data retrieval, and the data is kept current.

• Data requirements are reviewed during each phase of the program to ensure that data being procured meets the needs of that particular program phase.

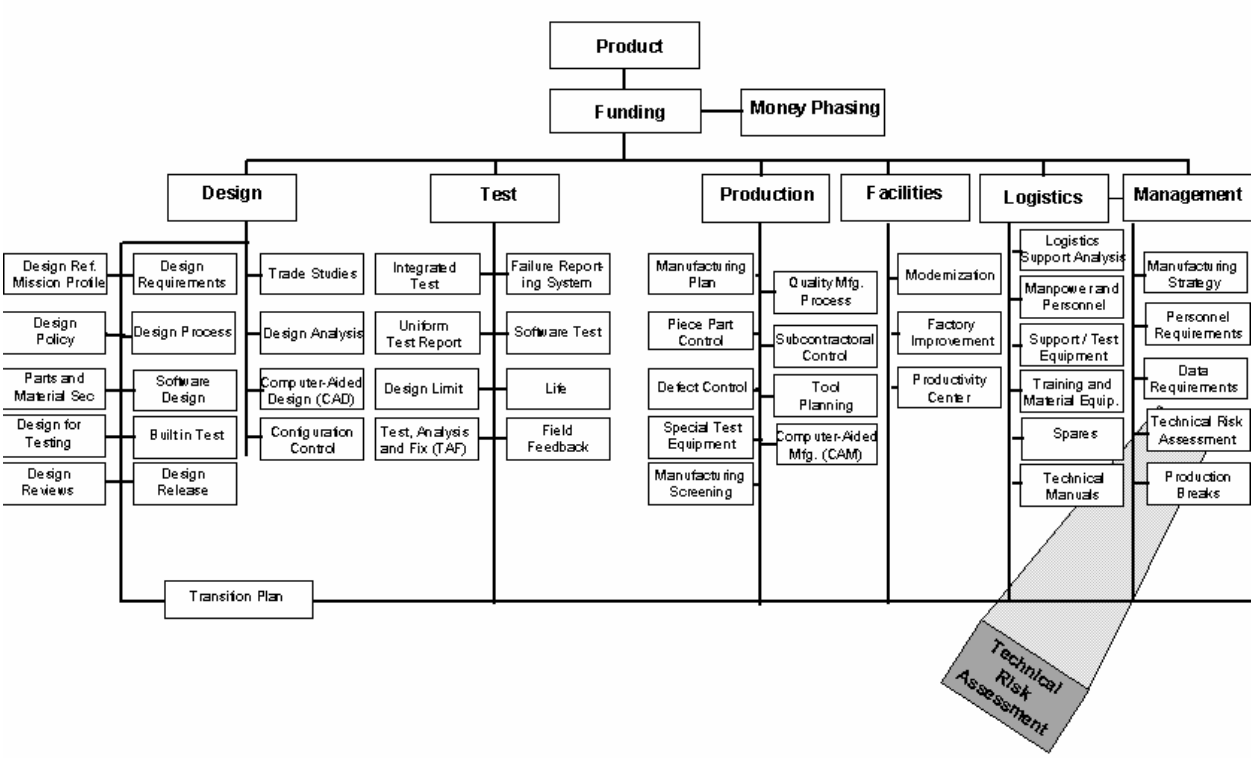
• Data is procured using well-defined data requirements lists, reasonable cost estimates, and realistic schedules.

Timeline



Useful data, properly applied during the decision making process, will ensure that the system being procured meets all the technical requirements and that the necessary reprocurement information is available when needed. An integrated data management plan. developed at the start of the program and approved at the appropriate management level, should lay out the technical data requirements for ail phases of the program to reduce-management risks.

E. -- Technical Risk Assessment



Area of Risk

The track record of major defense systems acquisitions has been poor over the past several years, as manifested by the length of the acquisition cycle, the unsatisfactory levels of effectiveness, and the pressure to reduce life cycle costs. In spite of numerous attempts to improve the management-oriented Defense System Acquisition Review process, the lack of consistent and predictable success has resulted in renewed interest in upgrading the process by an infusion of technical discipline. The 1981 DoD Acquisition Improvement Program not only identified the root cause of acquisition problems to be "uncertainty" but also called for increasing DoD efforts to quantify risk and for expanding the use of budgeted funds to deal with uncertainty. Since risk and the degree of uncertainty are synonymous and directly proportional to the seriousness of the acquisition problems faced by Government and industry program managers, why have many years of alleged emphasis on technical risk assessment achieved so few results? It must be concluded that management ignorance of technical risk assessment is itself a major source of risk in the transition from development to production.

Outline for Reducing Risk

- Technical risk management is specified as a contractual requirement, and early implementation in the development process is required.

- All areas of risk are identified as early as possible in the development cycle. A specific set of tracking indicators is determined for each major technical element (design, test, and production) as well as for cost and management.

• Plans are developed to track, measure, assess, and adjust for identified risks using a disciplined system Mat can be applied by managers from a variety of positions within the Government and the contractor organizations. This system provides a continuous assessment of program health against quantifiable parameters.

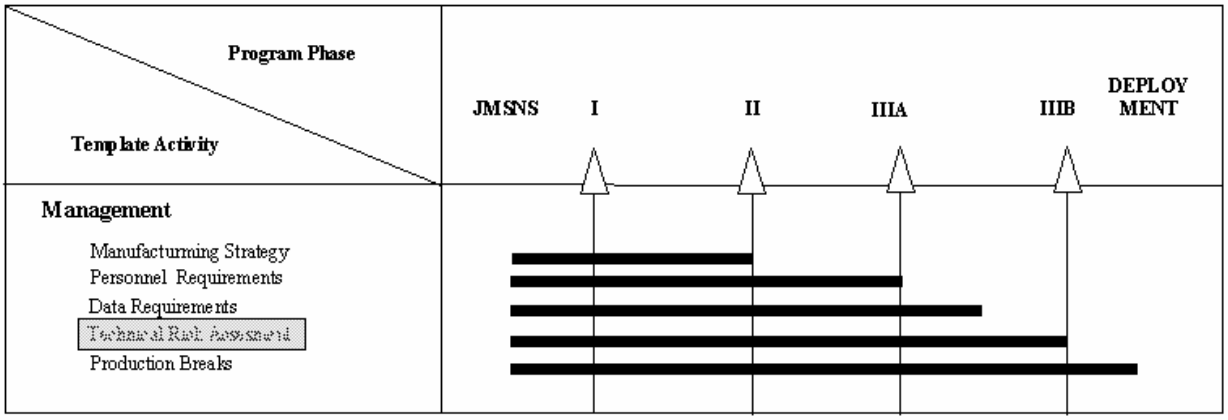
• Risk drivers are understood adequately by contractors, using qualified design and production engineers knowledgeable of the risk drivers, to identify and reduce program technical risks.

• Technical problems are highlighted before they become critical.

• Hasty shortcuts are avoided, mission profiles are reviewed, and existing analysis tools are used while implementing the technical risk assessment system.

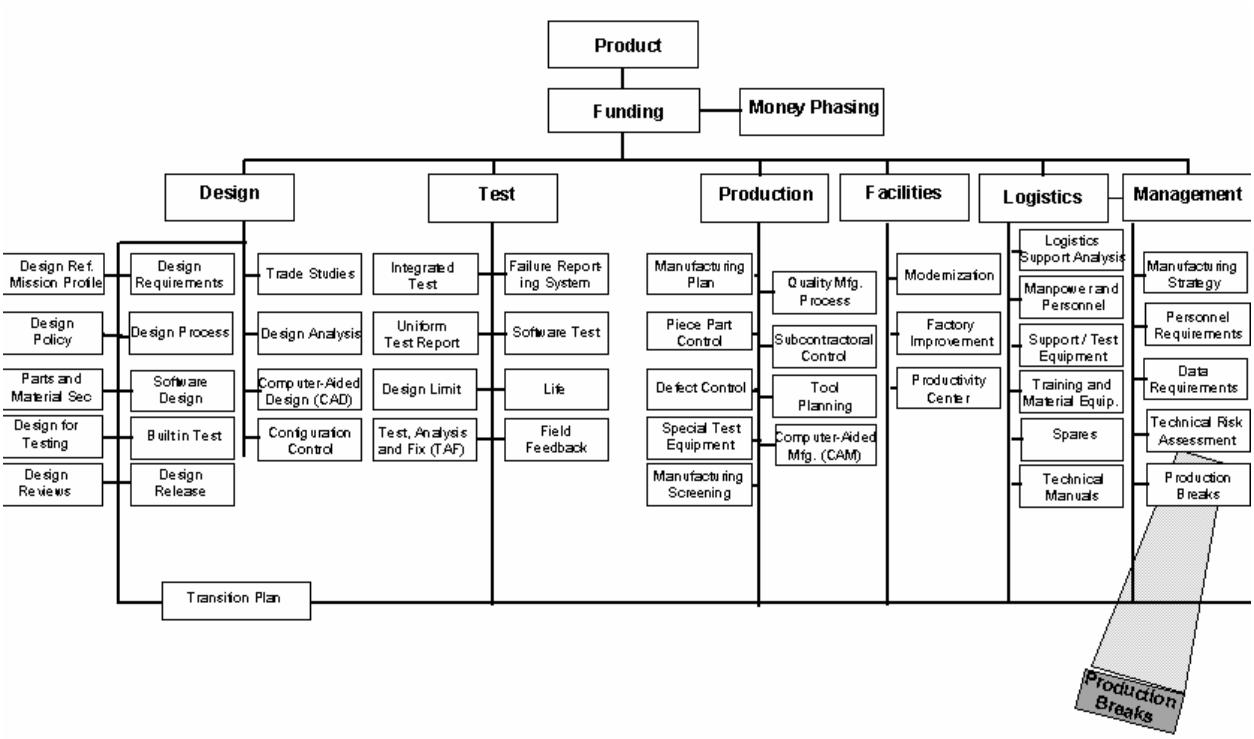
• Test programs are structured to verify that high risk design areas have been resolved.

Timeline



A technical risk assessment system should provide all levels of management with (1) a disciplined system for early identification of technical uncertainties, (2) a tool for instantaneous assessment of current program status, and (3) early key indicators of potential success or failure. To be effective, a technical risk assessment system should be initiated at the start of the program and function throughout the development and production phases.

F. -- Production Breaks



Area of Risk

Changes in production schedule range from reduced delivery rate (stretch-out) to a complete shutdown of the production line (production break). Stretch-outs and production breaks increase both technical risk and cost. Factory space, tooling, and equipment are idled, and in the worst case, may be eliminated. Publications and handbooks lose currency. Production flow is interrupted and benefits from assembly improvements and automation are lost. Experienced manufacturing and engineering personnel are either reassigned or dismissed. Morale suffers, teamwork is less apparent, problem identification and resolution become much more difficult to reestablish, and production efficiency degrades noticeably. Design improvements are less effective and less timely. Small suppliers and vendors whose orders represent much larger percentages of their total business are less able to adjust, and in the worst case, even sole source suppliers and vendors have been forced out of business.

Outline for Reducing Risk

- Experience has shown that the classic result of a production break is as illustrated in figure 9-1. The ideal solution, of course, is never to permit a break to occur. However, when the realities of the budget process increase the potential for a Government-mandated production break, understanding the impact might help the arguments for softening such a decision or preventing it from being made at all.

- The loss of learning that often includes a loss of process capability results in an overall program cost increase and a higher quantity of units produced before unit cost reaches the value it would have been without a break in production. A significant reduction in production rate, to a “misery rate” level, has similar effects. To prepare a case for modifying a

production break decision, use the following method to compute the cost of the loss of learning (see figure 9-1.):

– Determine value of learning for improvement before the break or stretchout.

– Determine percentage loss of learning for duration of break or stretchout and compute new cost of first unit produced after break or return to original production rate.

– Locate the new point for initial unit cost following break/return to original production rate. This point will correspond to the same quantity along the abscissa that existed just before the break/reduction in rate.

– Develop the new forecast learning curve for the continuation of production.

– Loss of learning cost is the difference between the cost of producing the quantity of units following the break or stretch-out versus the cost of the same quantity without the break or stretch-out.

- Use of multiyear contracting minimizes the risk of production breaks or stretch-out.

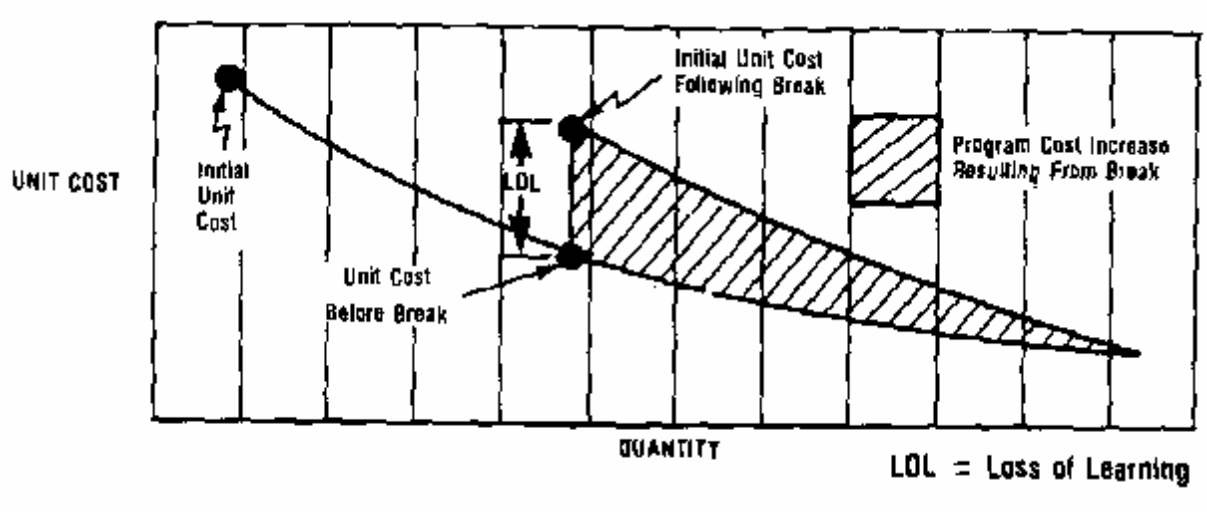
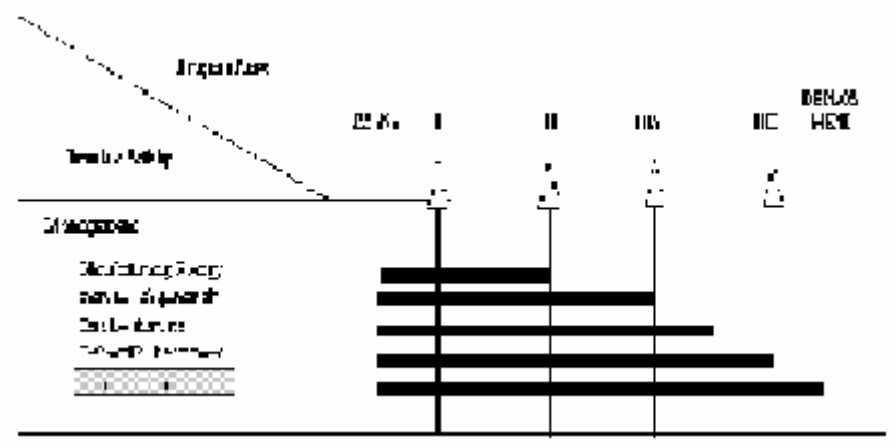


Figure 9-1. -- Production Break Impact on Learning Curve



The increase in production efficiency and attendant reduction in unit cost reflects the benefits of an uninterrupted learning curve, that is, no break in production, starting with initial production at Milestone IIIA.

Next Section

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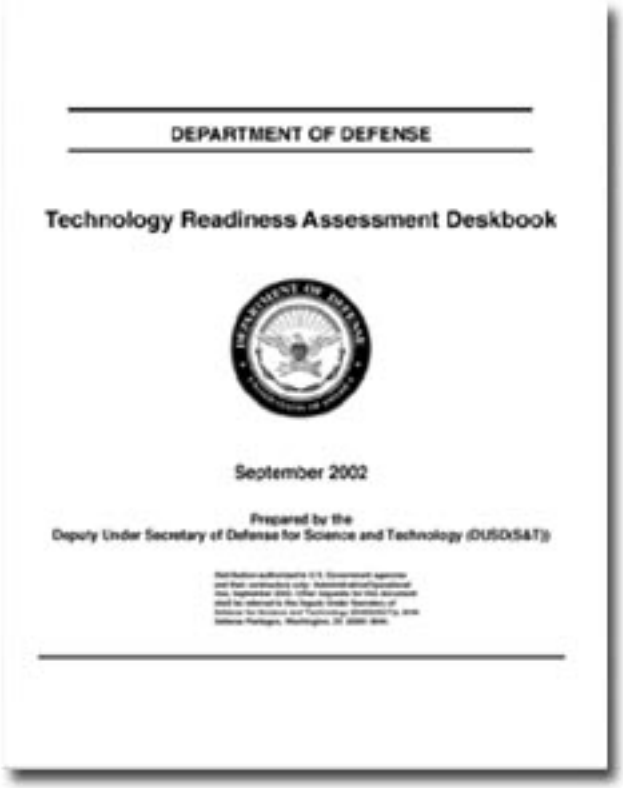
Appendix A -- Acronyms

APL	Approved Parts List
ATE	Automatic Test Equipment
BIT	Built-In Test
CAI	Computer-Aided Design
CAM	Computer-Aided Manufacturing
CDR	Critical Design Review
CMOS	Complimentary Metal Oxide Semiconductor
DOD	Department of Defense
DPA	Destructive Physical Analysis
DSARC	Defense Systems Acquisition Review Council
DSB	Defense Science Board
DT	Development Test
DT&E	Development Test and Evaluation
ECP	Engineering Change Proposal
ESS	Environmental Stress Screening
FOT&E	Follow-on Operational Test and Evaluation
FRACAS	Failure Reporting, Analysis, and Corrective Action System
FSD	Full-Scale Development
GAO	General Accounting Office
IES	Institute of Environmental Sciences
ILS	Integrated Logistics Support
IMIP	Industrial Modernization Incentive Program
IOT&E	initial Operational Test and Evaluation
IPF	Initial Production Funds
ISD	Instructional Systems Development
ITP	Integrated Test Plan
JMSNS	Justification for Major System New Start
LOL	Loss of Learning
LSA	Logistics Support Analysis
MFHBF	Mean Flight Hours Between Failure
MTBF	Mean Time Between Failure
MIL-HDBK	Military Handbook
MIL-SPEC	Military Specification
MIL-STD	Military Standard
NOSC	Naval Ocean Systems Center
NWC	Naval Weapons Center
OSD	Office of the Secretary of Defense
OT	Operational Test
PAT	Printed Circuit Board
PCB	Production Acceptance Test
PIN	Particle Induced Noise
PPBS	Planning, Programming, and Budgeting System

PRR	Production Readiness Review
RDT&E	Research, Development, Test, and Evaluation
RFP	Request for Proposal
SOW	Statement of Work
STE	Special Test Equipment
TAAF	Test, Analyze and Fix
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TPS	Test Program Set
T/TL	Transistor/Transistor Logic
USDR&E	Under Secretary of Defense for Research and Engineering

[19] DoD Technology Readiness Assessment Deskbook



DEPARTMENT OF DEFENSE

Technology Readiness Assessment Deskbook

September 2002

Prepared by the
Deputy Under Secretary of Defense for Science and Technology (DUSD(S&T))

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DEPARTMENT OF DEFENSE

Technology Readiness Assessment Deskbook

September 2002

Prepared by the
Deputy Under Secretary of Defense for Science and Technology (DUSD(S&T))

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I. INTRODUCTION

1.1 BACKGROUND

The recently revised Department of Defense (DoD) acquisition system is documented in Department of Defense Directive (DoDD) 5000.1,[1] Department of Defense Instruction (DoDI) 5000.2,[2] and DoD 5000.2-R,[3] all of which are available on Internet Web Site http://dod5000.dau.mil/index.htm.

A central theme of the acquisition system is that the technology employed in system development should be "mature" before system development begins.[4] Normally, for technology to be considered mature, it must have been applied in a prototype article (a system, subsystem, or component), tested in a relevant or operational environment, and found to have performed adequately for the intended application. This implies a need for a way to measure maturity and for a process to ensure that only sufficiently mature technology is employed. The DoD 5000 series of documents establish a requirement for Technology Readiness Assessments (TRAs) and provide an outline of the process and responsibilities for performing TRAs. These documents introduce Technology Readiness Levels (TRLs) as an accepted way to describe technology maturity. The National Aeronautics and Space Administration (NASA) has defined and used TRLs in its program reviews, and the NASA definitions are the basis for the definitions being used in DoD. A readiness level of TRL 6 or, preferably, TRL 7 is normally achieved before a technology is used in system development.

To carry out TRAs, DoD 5000.2-R assigns responsibilities to Program Managers (PMs), Component Science and Technology (S&T) Executives, Component Acquisition

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1 DoDD 5000.1, *The Defense Acquisition System,* October 23, 2000 (Administrative Reissuance Incorporating Change 1, January 4, 2001).

2 DoDI 5000.2, *Operation of the Defense Acquisition System,* April 5, 2002.

3 DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs,* April 5, 2002.

4 This reflects a major conclusion of a study performed by the Government Accounting Office (GAO). See Appendix B.

Executives (CAEs), and the Director of Defense Research and Engineering (DDR&E).[5] TRAs must be carried out before Milestone B and Milestone C of acquisition programs categorized as Acquisition Category One (ACAT I): ACAT ID[6] or ACAT IAM.[7]

1.2 PURPOSE OF THIS DOCUMENT

The current document is intended as a "TRA Deskbook" that will aid PMs, Component S&T Executives, CAEs, and their respective staffs and will serve as a guide to support everyone involved in the TRA process. Appendix A contains Points of Contact (POCs) for various TRA activities.

1.3 ORGANIZATION OF THIS DOCUMENT

The body of this document is a concise description of the responsibilities and procedures for meeting the TRA requirements of the Defense Acquisition System (DAS). The intent is to provide a working appreciation of the overall process and of where and how the TRAs fit into defense acquisition, including enough detail to allow a participant to get to work quickly. A set of appendixes provides the details of procedures, formats, templates, and so forth.

The expectation is that the basic architecture of the TRA process will remain relatively stable over time, whereas the details implementing the process will evolve, grow, or

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5 The current editions (as of 30 August 2002) of DoDI 5000.2 and DoD 5000.2-R assign this responsibility to the Deputy Under Secretary of Defense for Science and Technology (DUSD(S&T)). A pending memorandum from the Under Secretary of Defense for Acquisition, Logistics, and technology (USD(AT&L)) (see Appendix D of this document) assigns this responsibility to the Director of Defense Research and Engineering (DDR&E). The Office of the Director of Defense Research and Engineering (ODDR&E) staff proponent for TRAs is the DUSD(S&T).

6 An ACAT ID is a subcategory of the ACAT I program. ACAT I programs are Major Defense Acquisition Programs (MDAPs) or programs that the Milestone Decision Authority (MDA) designates ACAT I. An MDAP is an acquisition program that is not a highly sensitive classified program (as determined by the Secretary of Defense) and is designated by the USD(AT&L) as an MDAP or is estimated to cost more than certain specified amounts. The MDA for ACAT ID programs is the USD(AT&L). The "D" refers to the Defense Acquisition Board (DAB), which advises the USD(AT&L) at major decision points.

7 An ACAT IAM is a subcategory of the ACAT IA program. ACAT IA programs are Major Automated Information Systems (MAISs) or programs designated by the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)) to be ACAT IA. The MDA for the ACAT IAM programs is the DoD Chief Information Officer (CIO), who is ASD(C3I). The "M" in ACAT IAM refers to MAISs.

perhaps even become simpler over time. As changes occur, adapting the appendixes will provide an effective way for the deskbook to accommodate these changes.

1.4 ACQUISITION PROCESS OVERVIEW

Figure I-1 shows the architecture, or framework, of the defense acquisition process. An acquisition program is normally established in response to a recognized user need, but it could also be established to exploit a technological opportunity that might result in a new military capability, a reduced cost, or other benefit.

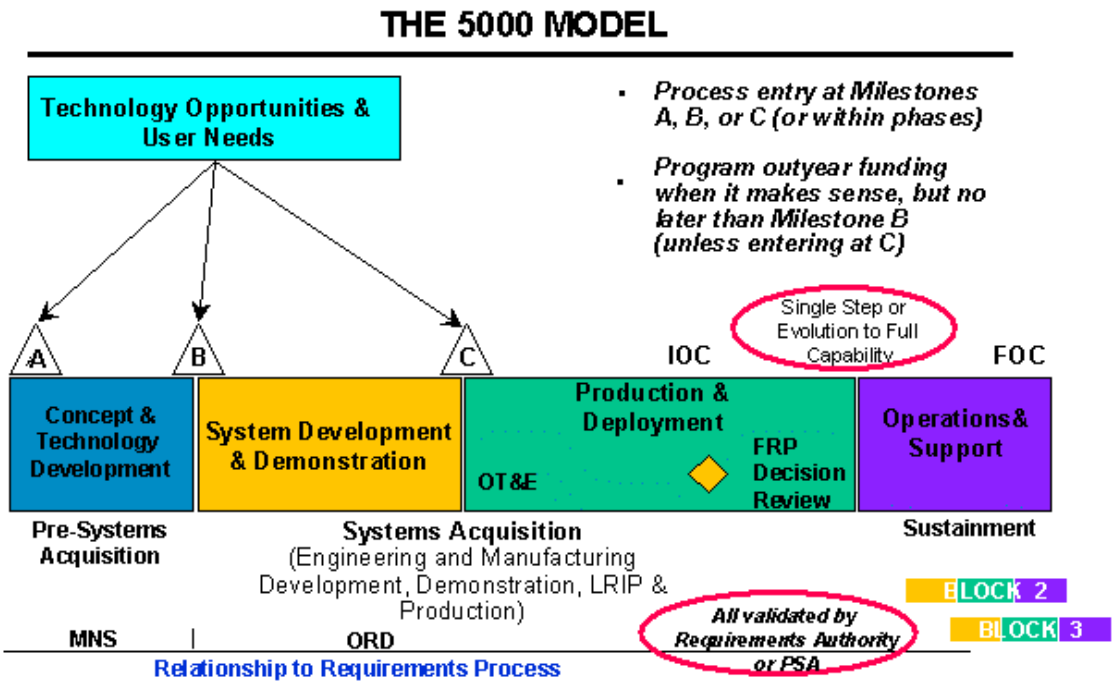

Figure I-1. Defense Acquisition Management Framework (Source: DoDI 5000.2)

During the first phase [Concept and Technology Development (CTD)], various system concepts, operational concepts, and technologies are examined to arrive at a system architecture. This is often a competitive phase that ends with the selection of a preferred system concept and a contractor. Most of the technologies needed to realize the system concept can be identified during this phase. A TRA is required before the Milestone B decision. The purpose of the Milestone B TRA is to ensure that the critical technologies on which the concept is based are sufficiently mature (or have acceptable risk-mitigation plans in place) so that the system development will not be delayed, overly costly, or unsuccessful.

Milestone B authorizes the program to proceed to the System Development and Demonstration (SDD) phase. During this phase, the system design and the manufacturing processes are developed, and developmental testing and operational testing are carried out to prove the functionality and operational effectiveness of the system. Prototypes demonstrated in an operational environment during the later part of SDD should be close to the production design and should be produced with final production processes wherever possible. A TRA is also required before the Milestone C decision, which authorizes the system for production and deployment.

The framework just described can be tailored to the specific acquisition program structure. For example, the program does not have to start at Milestone A. It can start at Milestone B or some other place between Milestone A and Milestone C. If it starts at or beyond Milestone B, a TRA will be conducted to ensure that the technology is ready for the upcoming phase of development.

The DoD 5000 series of documents encourage the use of an evolutionary acquisition strategy, and they require this strategy if the Operational Requirements Document (ORD) has time-phased requirements. An evolutionary acquisition strategy is one in which development, test, production, and deployment are conducted for two or more blocks of capability. The first block (Block 1) provides a useful, supportable capability. Each subsequent block provides greater capability until the objective capability of the ORD is realized. Normally, each successive block introduces later technology. To ensure that the technology is mature, a TRA is required for each block before the program has a Milestone B or Milestone C review.

Software is developed using a special process. This is an iterative, cyclical process of build-test-fix-test-deploy, often referred to as spiral development. Each release builds on the lessons of the previous release. There can be several releases during the acquisition and deployment of a system or system block. In the TRA process, software is considered an integral part of the system or subsystem in which it operates.

II. KEY RESPONSIBILITIES

Before an acquisition program can enter SDD (at Milestone B) or low rate initial production (LRIP) (at Milestone C), technology maturity must be assessed (paragraph C7.5.2, DoD 5000.2-R). DoDI 5000.2 establishes as acquisition policy that "… Unless some other factor is overriding in its impact, the maturity of the technology will determine the path to be followed" (paragraph 4.7.3.2.2.1). It further states that "… If technology is not mature, the DoD Component shall use alternative technology that is mature and that can meet the user's needs" (paragraph 4.7.3.2.2.2).

The PM is especially important in defense acquisition. He/she is responsible for planning and managing each program. The PM reports to a Program Executive Officer (PEO), who oversees several PMs. The PEO reports directly to the CAE, who reports through the Component Secretary to the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)).

The Component S&T Executive also reports to the CAE. The Component S&T Executive is responsible for developing the noncommercial technologies that will be needed to meet future operational requirements and for directing the Component TRAs. These TRAs are submitted to the CAE for approval, and an information copy is sent to the DDR&E. Subsequently, the CAE transmits the action version to the DDR&E. The DDR&E reports to the USD(AT&L) and is responsible for managing the overall Science and Technology (S&T) program within DoD and for evaluating each TRA received from a Component.

Determining a technology's maturity involves the participation of the PM, the Component S&T Executive, and the DDR&E.[8] The following paragraphs elaborate on these responsibilities. Figure II-1 is a nominal timeline for the required TRA activities. Figure II-2 displays the principal activities/responsibilities of the DDR&E Action Officer (AO). Section IV discusses the process.

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8 Appendix C includes extracts from the DoD 5000 series of documents that assign TRA responsibilities.

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Pages II-3 and II-4 are holder pages for an 11 × 17” figure that will be supplied.

2.1 Program Manager (PM)

2.1.1 Determining System Architecture and Identifying Technologies

Before Milestone B (during Concept Exploration and Component Advanced Development), the system architecture is determined, and the technologies required to develop the system are identified. Whenever the system concept requires technologies that are still being developed by Component S&T organizations, the PM will negotiate Technology Maturity Agreements (TMAs) with the Component S&T Executive. These agreements specify activities to be conducted to mature the technologies, the expected resulting TRL, the schedule, and the funding. See paragraph 2.2.1. Appendix F of this document contains a suggested TMA format.[9]

2.1.2 Requesting Milestone Review Meetings

The PM is responsible for requesting milestone review meetings. For ACAT ID programs, the Defense Acquisition Board (DAB)[10] conducts the review. For ACAT IAM programs, a group assembled by DoD's Chief Information Officer (CIO)[11] conducts the review. Concurrently with scheduling a milestone review meeting, the PM establishes a schedule for the submission of critical technologies. When establishing the schedule for submitting critical technologies, coordinating with the Component S&T Executive and, for ACAT ID and ACAT IAM programs, with the DDR&E is important so that each organization will have ample time to complete its respective TRA activities.

2.1.3 Determining Critical Technologies and Disseminating Information

The PM is charged with the fundamental task of determining which technologies are critical. A technology is "critical" if the system being acquired depends on this technology to meet the system operational requirements (including key performance parameters and cost) in development, production, and operation *and* if the technology or its application is either new or novel. Said another way, a new or novel technology is critical if it is

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9 The TMA format in Appendix F is an Army version. The reader will notice that the Army refers to a TMA as a "Technology Maturity Assessment."

10 The DAB is chaired by the USD(AT&L), who is the MDA for ACAT ID programs. The Vice Chairman of the Joint Chiefs of Staff (VCJCS) serves as the vice chairman.

11 The meeting is chaired by the ASD(C3I), who is the DoD CIO and MDA for ACAT IAM programs.

necessary to achieve the successful development of a system, its acquisition, and its operational utility.

Before identifying the critical technologies, the PM should send the DDR&E and the Component S&T Executive a memorandum that describes the process that will be used. About 16 weeks before a milestone review (see Figure II-1), on the schedule agreed to with the DDR&E and the Component S&T Executive, the PM should identify the critical technologies and compile the status, test results, and other information necessary to assess the maturity of these technologies.

After determining the critical technologies, the PM provides this information to the Component S&T Executive and sends an information copy to the DDR&E. Preferably, the identification of critical technologies will have been vetted and agreed upon between the PM and Component S&T Executive. In addition to the list of critical technologies, the PM should explain the function of each technology in the system and provide information on the status of each technology. This could include records of tests or applications of the technology. The PM should provide additional information as requested by the Component S&T Executive or the DDR&E. This identification of critical technologies is a critical step in the TRA process. For a readiness assessment to be useful, it must include all the critical technologies.

If an ACAT ID or ACAT IAM program integrates critical systems that are being developed in other programs, the PM of the higher order program (the "system-of-systems" program) is responsible for the technologies—including interface technologies—used on his/her side of the interfaces for the TRA. This PM should request (through the appropriate PEO or CAE, as necessary) and obtain the identification of any critical technologies on which the lower order programs depend.

If a program has competing designs at the time of the Milestone B or Milestone C review, the critical technologies of each design must be identified separately.

2.2 COMPONENT SCIENCE AND TECHNOLOGY (S&T) EXECUTIVE

2.2.1 Providing the Required Technology

The Component S&T Executive is responsible for developing the noncommercial technologies that will be needed to meet future operational requirements. In addition to advising PMs regarding the status and applicability of technologies, the Component S&T Executive will enter into TMAs with the PMs to establish how technologies will be matured

to support system development programs. These agreements are coordinated among all the stakeholders and reviewed by the DDR&E. They obligate the Component S&T Executive and the PM to a best-efforts commitment to meet a technology maturation schedule.

2.2.2 Directing the TRA

The Component S&T Executive directs the TRA and decides how it will be conducted. The TRA must include all critical technologies identified by the PM and can include additional technologies that the Component S&T Executive considers critical. Typically, much of the information used in a TRA comes from the PM, but the assessment *must be independent* of the PM.

The TRL definitions (see Section III, Table III-1) provide a convenient and unambiguous nomenclature for a technology's maturity status. The Component should use TRLs to relate TRA findings unless the DDR&E has approved alternative means beforehand. Willoughby charts are a possible alternative. An explanation of the assessed maturity status is required.

2.2.3 Processing the TRA Results

For ACAT ID and ACAT IAM programs, the Component S&T Executive signs the TRA (or accompanying memorandum) and accepts responsibility for its accuracy. He/she then submits the TRA to the CAE and, at the same time, sends an information copy to the DDR&E.

2.3 COMPONENT ACQUISITION EXECUTIVE (CAE)

For ACAT ID and ACAT IAM programs, the CAE submits a report to the DDR&E with an assessed TRL (or some equivalent measure) for each critical technology. This report can consist of a cover letter or memorandum endorsing the Component TRA and officially transmitting that TRA. This should be accomplished according to the agreed-upon schedule—normally, at least 6 weeks before a scheduled Milestone B or Milestone C. See Figure II-1.

2.4 DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING (DDR&E)

2.4.1 Preparation and Oversight

The DDR&E has both oversight and evaluation responsibilities for the TRA. An Action Officer (AO) assists as directed (see Figure II-2). Before the TRA is officially received from the Component, the AO reviews the critical technologies and the identification process, negotiates any perceived deficiencies, and provides oversight while the Component TRA is conducted. In addition, the AO participates in the TRA to the extent mutually agreed upon with the Component S&T Executive.

2.4.2 Evaluating the Component TRA

The DDR&E evaluates the Component TRA in cooperation with the Component S&T Executive and the PM. There is no rigid requirement that every critical technology has to be at a pre-specified TRL by Milestone B or Milestone C. However, for Milestone B, readiness levels of at least TRL 6 are typical (TRL 7 preferred), and, for Milestone C, readiness levels of at least TRL 8 are typical (TRL 9 preferred). At Milestone B, the DDR&E might conclude that a readiness level of TRL 5 is adequate for a critical technology if there is in place a planned and funded program to mature the technology quickly or if there is a mature backup technology that meets the program requirements and schedule. If the Component expects such a conclusion, the supporting information must be provided along with the TRA. At Milestone C, a similar situation could arise—most likely with respect to the manufacturing process technology required to achieve required production rates or cost goals.

After evaluating the Component TRA, the DDR&E either concurs with the findings or conducts an independent TRA. The DDR&E forwards either a concurrence with the findings of the Component TRA or the findings of the independent TRA to the Overarching Integrated Product Team (OIPT) and the DAB or CIO Review Group. This takes place at least 15 days before a Milestone B or Milestone C decision meeting (see Figure II-1). If this 15-day window is not possible, the date of the decision meeting should be reconsidered so the OIPT and DAB members or CIO Review Group members have ample time to review all the relevant information.

2.4.3 Preparing the National Defense Authorization Act (NDAA) Reports for the Secretary of Defense

Sec. 804 of the NDAA for Fiscal Year 2002, Conference Report, requires the Secretary of Defense to submit reports on the implementation of the DoD technology readiness policy. The DDR&E is responsible for preparing these reports. Paragraph 2.7 describes the responsibilities and procedures in more detail.

2.5 CHAIRMAN, OVERARCHING INTEGRATED PRODUCT TEAM (OIPT)

The OIPT [or, in the case of an ACAT IAM program, the Information Technology Overarching Integrated Product Team (IT OIPT)] is led by the appropriate Office of the Secretary of Defense (OSD). It is composed of

- The PM
- The PEO
- The representatives of the Component staff, the USD(AT&L) staff, the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)) staff, and the Joint Staff
- Other OSD principals involved in the oversight and review of a particular ACAT ID or ACAT IAM program.

The OIPT or IT OIPT provides strategic guidance for the early resolution of issues and conducts oversight and review as a program proceeds through its acquisition life cycle.

2.6 MILESTONE DECISION AUTHORITY (MDA)

The MDA is the individual designated in accordance with criteria established by the USD(AT&L)—or the ASD(C3I) for Automated Information System (AIS) acquisition programs—to approve the entry of an acquisition program into the next phase. The DAB or CIO Review Group provides a recommendation to assist the MDA in the decision.

2.7 SECRETARY OF DEFENSE

For each of the calendar years 2002 through 2005, the Secretary of Defense is required to report to Congress on the implementation of DoD policy regarding technology

maturity at the initiation of Major Defense Acquisition Programs (MDAPs)[12]. According to Sec. 804 of the NDAA for Fiscal Year 2002, Conference Report, the reports must

> identify each case in which a major defense acquisition program entered system development and demonstration [i.e., passed MS B] during the preceding calendar year and into which key technology has been incorporated that does not meet the technological maturity requirement [i.e., that technology must have been demonstrated in a relevant environment or, preferably, in an operational environment, to be considered mature enough to use for product development in systems integration] described in subsection (a) and provide a justification for why such technology was incorporated; and
>
> identify any determination of technological maturity with which the Deputy Under Secretary of Defense for Science and Technology[13] did not concur and explain how the issue has been or will be resolved.

The report for each calendar year must be submitted to the Committees on Armed Services of the Senate and the House of Representatives by March 1 of the following year (i.e., March 1 of years 2003 through 2006).

At the conclusion of each MDAP milestone review, an office designated by the DDR&E will compile the necessary information for these reports. At the beginning of each calendar year (2003 through 2006), the designated office will prepare the report for the Congressional committees. The DDR&E will submit the report to the USD(AT&L) for concurrence and forwarding to the immediate office of the Secretary of Defense. The Secretary of Defense will sign the report or cover letter and submit it to the Congressional committees as required.

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[12] This requirement is contained in Sec. 804 of the National Defense Authorization Act for Fiscal Year 2002, Conference Report. Appendix D of this document contains the complete text. The policy to which the Conference Report refers is in DoDI 5000.2, paragraph 4.7.3.2.2.2. Appendix D also provides various policy statements, directives, and so forth relevant to the TRA process.

[13] In light of the change to DoD 5000.2-R contained in the pending USD(AT&L) memorandum (see Appendix D), DDR&E should bear this responsibility.

III. TRL DEFINITIONS

DoD 5000.2-R establishes technology maturity expressed in TRLs as the centerpiece for the TRAs required for ACAT ID and ACAT IAM programs. Other means to accomplish a TRA are allowed but only when approved in advance by the DDR&E. Willoughby charts are a possible alternative; however, no alternatives to the TRL-based process have been approved thus far (as of September 2002).

It is important to have a strong grasp of the TRL concept. The tables in this section give the TRL fundamentals. Appendix E provides greater detail and examples.

Using TRLs to describe the maturity of technologies considered for use in a new system originated with NASA in the early 1980s. The levels ran from the earliest stages of scientific investigation (level 1) to successful use in a system (level 9), which equates to space flight for NASA. DoD has adopted the NASA definitions—with only minor modifications—for the nine TRLs.

Table III-1 defines and describes the DoD TRL levels. It also lists typical documentation that should be extracted or referenced to support a TRL assignment. Table III-2 includes a set of additional definitions that help provide a uniform interpretation of the levels.

Software is likely to be an important element in many TRAs. Since the TRL definitions in Table III-1 reflect a systems approach in which software is treated as a part of a component or system, software TRLs are not spelled out specifically in these definitions. However, because some guidelines would be useful in determining the TRLs of the software parts of components and systems, Table III-3 provides a set of software TRL definitions developed by the Army.

Table III-1. TRL Definitions, Descriptions, and Supporting Information (Source: DoD 5000.2-R, dated April 5, 2002)

TRL	Definition	Description	Supporting Information
1	Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.	Published research that identifies the principles that underlie this technology. References to who, where, when.
2	Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.	Publications or other references that outline the application being considered and that provide analysis to support the concept.
3	Analytical and experimental critical function and/or characteristic proof of concept	Active research and development (R&D) is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.	Results of laboratory tests performed to measure parameters of interest and comparison to analytical predictions for critical subsystems. References to who, where, and when these tests and comparisons were performed.
4	Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.	System concepts that have been considered and results from testing laboratory-scale breadboard(s). References to who did this work and when. Provide an estimate of how breadboard hardware and test results differ from the expected system goals.
5	Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include "high-fidelity" laboratory integration of components.	Results from testing a laboratory breadboard system are integrated with other supporting elements in a simulated operational environment. How does the "relevant environment" differ from the expected operational environment? How do the test results compare with expectations? What problems, if any, were encountered? Was the breadboard system refined to more nearly match expected system goals?

Table III-1. TRL Definitions, Descriptions, and Supporting Information (Continued) (Source: DoD 5000.2-R, dated April 5, 2002)

TRL	Definition	Description	Supporting Information
6	System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment.	Results from laboratory testing of a prototype system that is near the desired configuration in terms of performance, weight, and volume. How did the test environment differ from the operational environment? Who performed the tests? How did the test compare with expectations? What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems encountered before moving to the next level?
7	System prototype demonstration in an operational environment	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.	Results from testing a prototype system in an operational environment. Who performed the tests? How did the test compare with expectations? What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems encountered before moving to the next level?
8	Actual system completed and qualified through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.	Results of testing the system in its final configuration under the expected range of environmental conditions in which it will be expected to operate. Assessment of whether it will meet its operational requirements. What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems encountered before finalizing the design?
9	Actual system proven through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.	Operational Test and Evaluation (OT&E) reports.

Table III-2. Additional Definitions of TRL Descriptive Terms (Source: DoD 5000.2-R, dated April 5, 2002)

Term	Definition
Breadboard	Integrated components that provide a representation of a system/subsystem and that can be used to determine concept feasibility and to develop technical data. Typically configured for laboratory use to demonstrate the technical principles of immediate interest. May resemble final system/subsystem in function only.
High Fidelity	Addresses form, fit, and function. High-fidelity laboratory environment would involve testing with equipment that can simulate and validate all system specifications within a laboratory setting.
Low Fidelity	A representative of the component or system that has limited ability to provide anything but first-order information about the end product. Low-fidelity assessments are used to provide trend analysis.
Model	A functional form of a system, generally reduced in scale, near or at operational specification. Models will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.
Operational Environment	Environment that addresses all the operational requirements and specifications required of the final system to include platform/packaging.
Prototype	A physical or virtual model used to evaluate the technical or manufacturing feasibility or military utility of a particular technology or process, concept, end item, or system.
Relevant Environment	Testing environment that simulates the key aspects of the operational environment.
Simulated Operational Environment	Either (1) a real environment that can simulate all of the operational requirements and specifications required of the final system or (2) a simulated environment that allows for testing of a virtual prototype; used in either case to determine whether a developmental system meets the operational requirements and specifications of the final system.

Table III-3. Army Software TRL Definitions

TRL	Definition	Description
1	**SW**: Functionality conjectural	Lowest level of software readiness. Basic research begins to be translated into applied research and development. Examples might include a concept that can be implemented in software or analytic studies of an algorithm's basic properties.
2	**SW**: Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. Applications may be speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
3	**SW**: Analytical and experimental critical functions and/or characteristic proof of concept	Active R&D is initiated. This includes analytical studies to produce code that validates the analytical predictions of separate software elements. Examples include software components that are not yet integrated or representative but satisfy an operational need and algorithms run on a surrogate processor in a laboratory environment.
4	**SW:** Functionality demonstrated in a laboratory environment	Basic software components are integrated to establish that they will work together. They are relatively primitive with regard to efficiency and reliability compared with the eventual system. System software architecture development is initiated to include interoperability, reliability, maintainability, extensibility, scalability, and security issues. Software is integrated with simulated current/legacy elements as appropriate.
5	**SW:** Functionality and performance demonstrated in a relevant environment	Reliability of the software ensemble increases significantly. The basic software components are integrated with reasonably realistic supporting elements so that the software can be tested in a simulated environment. Examples include "high-fidelity" laboratory integration of software components. System software architecture is established. Algorithms are run on a processor(s) that has characteristics expected in the operational environment. Software releases are "Alpha" versions, and configuration control is initiated. Verification, Validation, and Accreditation (VV&A) is initiated.

Table III-3. Army Software TRL Definitions (Continued)

TRL	Definition	Description
6	**SW:** Functionality and performance demonstrated in a realistic simulated (live/virtual) operational environment	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in software-demonstrated readiness. Examples include testing a prototype in a live/virtual experiment or in simulated operational environment. Algorithm is run on a processor or in the simulated operational environment. Software releases are “Beta” versions and are configuration controlled. Software support structure in development. VV&A in process.
7	**SW:** Functionality and performance demonstrated in an operational test environment	Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as a command post or air/ground vehicle. Algorithms are run on processor of the operational environment integrated with actual external entities. Software support structure in place. Software releases are in distinct versions (e.g., Version 2.0). Frequency and severity of software deficiency reports do not significantly degrade functionality or performance. VV&A completed.
8	**SW:** Functionality, performance, and quality attributes validated in an operational environment	Software has been demonstrated to work in its final form and under expected conditions. In most cases, this TRL represents the end of system development. Examples include test and evaluation of the software in its intended system to determine whether it meets design specifications. Software releases are production versions and are configuration controlled in a secure environment. Software deficiencies are resolved rapidly through the support structure.
9	**SW:** Functionality, performance, and quality attributes proven in an operational environment through successive, successful accomplishment of mission operations	Actual application of the software in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of system development. Examples include using the system under operational mission conditions. Software releases are production versions and are configuration controlled. Frequency and severity of software deficiencies are at a minimum.

IV. THE TRA PROCESS

4.1 ACTION SEQUENCE FOR A TRA

Figure IV-1 graphically portrays the steps normally expected by the DDR&E in the assessment of technology readiness for an MDA. These steps[14] are as follows:

A. During CTD, the PM develops a system concept and a concept of operation. A functional analysis establishes the functions and performance levels necessary to meet the needs expressed in a Mission Needs Statement (MNS). For the system, the PM develops an Acquisition Program Baseline (APB) and a Work Breakdown Structure (WBS) and conducts a risk assessment, which includes technology risk. Technology choices will be made on the basis of risk, cost, and other factors. If some components or subsystems are not sufficiently mature to support a Milestone B decision, a component advanced development program and risk-reduction program will be planned, as necessary. The TMA is an appropriate means for reducing risk. The degree of detail is necessarily limited in CTD but becomes far greater in SDD.

B. From the WBS, the risk assessment, and the functional analysis, the PM identifies those technologies that are not already fully mature but that are critical to the accomplishment of goals for program cost and schedule and for system producibility, cost, and operational effectiveness. These will be listed as *critical technologies*.

   To support the TRA required before an upcoming Milestone B or Milestone C, the PM prepares a list of the critical technologies and an assessment of the maturity of each critical technology. Substantiating information normally consists of describing the status of components or subsystems, the testing that has been accomplished, and the results of this testing. Test environments and results are described in relation to the functional needs of the system concept. At least 16 weeks before a scheduled Milestone B or Milestone C (see Figure II-1), the list of critical technologies and the supporting information are sent to the Component S&T Executive, with a request for a TRA. At the same time, an information copy is sent to the DDR&E.

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[14] The steps that follow (A–J) are marked accordingly in Figure IV-1.

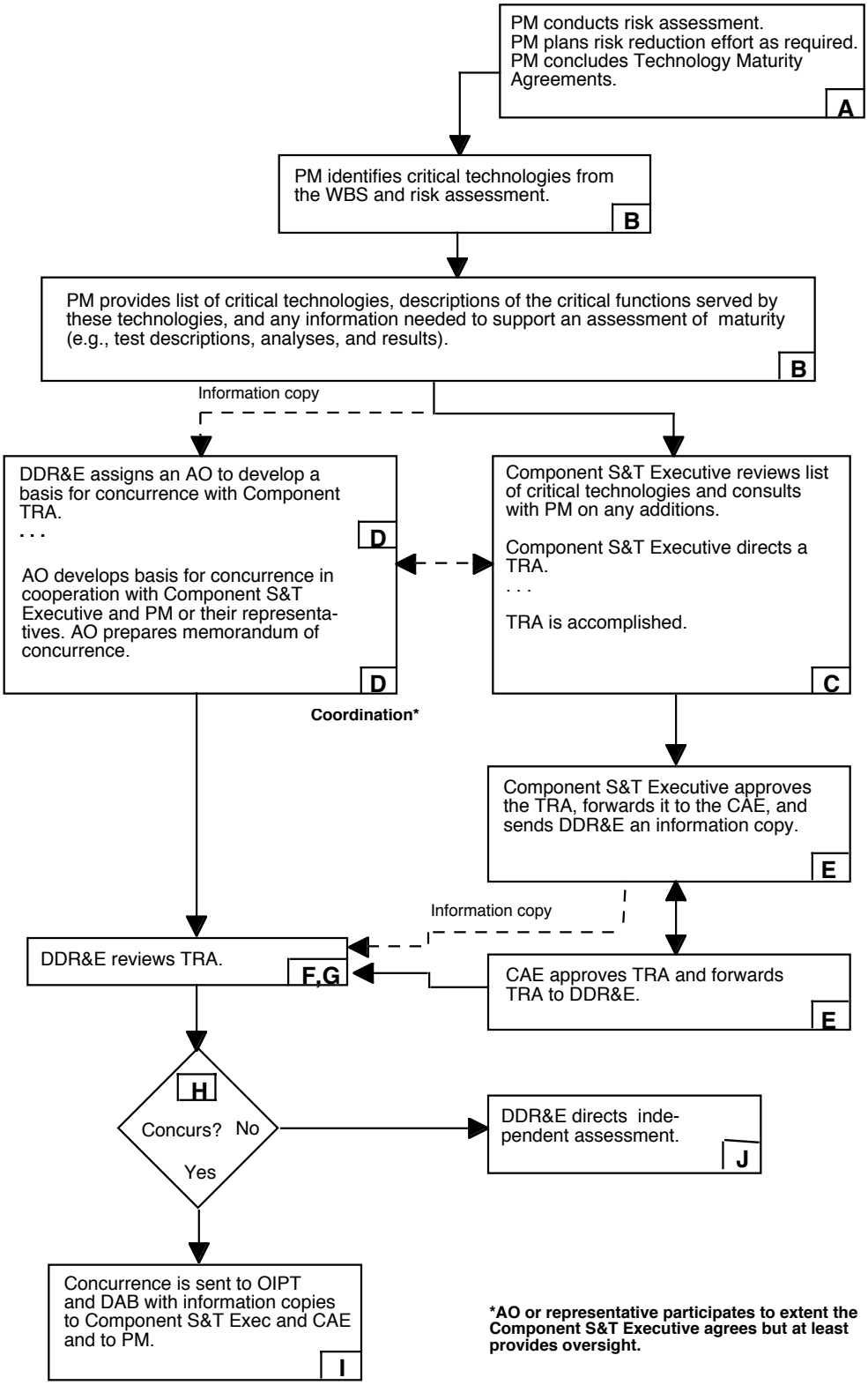

Figure IV-1. Flow Diagram for the TRA Process

C. The Component S&T Executive coordinates with the PM on any additions to the list of critical technologies and on any additional information needed for the TRA.

The Component S&T Executive directs and schedules the accomplishment of a TRA based on the PM's request and submission of the critical technologies information.

The TRA is conducted in accordance with Component guidelines and procedures. Appendix F provides sample procedures from the Components.

D. The DDR&E normally appoints a member of his/her staff to act as AO to develop a basis for the DDR&E to concur with the Component TRA. This basis must be sufficient to fulfill the DDR&E oversight responsibilities, but it should not be a duplication of the Component TRA.

The AO should review the critical technologies and the identification process, negotiate any perceived deficiencies, and provide oversight while the Component TRA is conducted. The AO should coordinate with the Component S&T Executive to determine to what extent the AO or technology specialists of the DDR&E staff could or should monitor or participate in the Component TRA. The Component S&T Executive is not required to agree to any such monitoring or participation beyond oversight.

E. When the Component TRA is completed, the Component S&T Executive approves it and forwards it to the CAE. At the same time, the Component S&T Executive sends an information copy to the DDR&E.

Subsequently, the CAE forwards the approved TRA to the DDR&E. Appendix G contains several actual TRAs that have been submitted for milestone decisions.

F. The AO develops a basis for DDR&E concurrence. The approach can be tailored to the specific situation (see paragraph 4.2, which describes one approach). The AO should minimize the impact on the PM and the Component S&T organization but still provide a sound basis for DDR&E concurrence. Monitoring or participating in the Component TRA will likely facilitate a quick concurrence. If the AO deems any critical technology to be insufficiently mature for the coming milestone, he/she tells the Component S&T Executive and the PM so that all involved have an opportunity to reach agreement on appropriate action.

G. Upon receiving the report and official TRA from the CAE, the AO confirms that it is consistent with the information copy.

H. The AO prepares a memorandum of concurrence or nonconcurrence for signature, presents the staff evaluation of the TRA to the DDR&E, provides whatever backup information is needed, and acts on the DDR&E's decision.

I. If the DDR&E concurs, the concurrence memorandum is transmitted to the OIPT and the DAB or to the IT OIPT and CIO Review Group. This must occur at least 2 weeks before the milestone meeting.

J. If the DDR&E does not concur, an independent assessment is required. The AO recommends a course of action and prepares a memorandum directing this action. The independent assessment should be a positive contribution to the acquisition program. For example, it could result in a revised, more realistic schedule, in the use of an alternative technology, or in a revised, evolutionary acquisition strategy. The independent assessment should be conducted as quickly as possible—whether this requires 1 day or several months. Typically, the Component funds the independent assessment.

Paragraph 4.2 offers an approach to developing the basis for DDR&E concurrence.

4.2 DDR&E CONCURRENCE

The DDR&E is required to evaluate the Component TRA before Milestone B and Milestone C of ACAT ID and ACAT IAM programs. An AO, designated by the DDR&E, will normally lead the evaluation effort.

It is recommended that the AO secure DDR&E concurrence as follows:

- When the DDR&E designates an AO, a memorandum is sent to his/her staff Directors. This memorandum alerts them to a possible need to provide assistance in their respective technology areas and requests them to designate a POC within their Directorates.
- The AO provides copies of the Component TRA to the designated POCs and invites comments by a certain date.
- The AO reviews the TRA and calls for assistance, as necessary, to obtain a competent assessment of the critical technologies or to determine whether all the critical technologies have been identified.
- If a disagreement with the Component TRA emerges, this is noted in a memorandum to the DDR&E. If the disagreement would jeopardize a favorable decision by the USD(AT&L) or the ASD(C3I), the AO obtains a full explanation and concurrence from the cognizant Director.

- The AO conveys the evaluation results to the DDR&E in a briefing or memorandum. Key Directors attend or coordinate.
- If the DDR&E does not concur with the Component TRA, the AO prepares the action memorandum to conduct an independent TRA.
- The AO prepares a memorandum for DDR&E signature. This memorandum gives the evaluation results of the Component TRA and the independent TRA, if conducted. It is sent to the Chairman of the OIPT or IT OIPT and to the Executive Secretary of the DAB or the appropriate staff officer to the ASD(C3I).

V. SUBMITTING A TRA

5.1 SKELETAL TEMPLATE FOR A TRA SUBMISSION

The following outline is a skeletal template for anticipated TRA submissions:

1.0 Purpose of This Document

2.0 Program Overview

2.1 Program Objective

2.2 Program Description

2.3 System Description

3.0 Technology Readiness Assessment

3.1 Process Description

3.2 Critical Technologies

3.3 Assessment of Maturity

3.3.1 First Critical Technology or Category of Technology

3.3.2 Next Critical Technology or Category of Technology

3.4 Summary of TRLs by Technology

4.0 Conclusion

5.2 ANNOTATED TEMPLATE FOR A TRA SUBMISSION

The following outline is an annotated version of the TRA template.

1.0 Purpose of This Document

Should be short and should give the program name, the system name if different from the program name, and the milestone or other decision point for which the TRA was performed. For example, "This document presents an independent Technology Readiness Assessment (TRA) for the UH-60M helicopter program in support of the Milestone B decision. The TRA was performed at the direction of the Army Science and Technology (S&T) Executive."

2.0 Program Overview

2.1 Program Objective

States what the program is trying to achieve (e.g., new capability, improved capability, lower procurement cost, reduced maintenance or manning, and so forth). Refer to the MNS or ORD that states the need for this capability.

2.2 Program Description

Describes the program, not the system. Does the program provide a new system or a modification to an existing operational system? Is it an evolutionary acquisition program? What capabilities will be realized in Block 1? When is initial operational capability (IOC)? Does it have multiple competing prime contractors? Into what architecture does it fit? Is it a system-of-systems? Does its success depend on the success of other acquisition programs?

2.3 System Description

Describes the overall system, the major subsystems, and components, as necessary, to give an understanding of what is being developed and to show what is new, unique, or special about it. Should include the systems, components, and technologies that will later be declared "critical technologies." Describes how the system works (if this is not obvious).

3.0 Technology Readiness Assessment

3.1 Process Description

Tells who led the TRA and what organizations or individuals performed the TRA. Identifies the special expertise of participating organizations or individuals. This should establish the competence and the independence of the TRA. In this context, "independence" means that the assessors are not unduly influenced by the opinions of the developers (government or industry). Usually, the PM or the System Program Office (SPO) will provide most of the data and other information that form the basis of a TRA. Nevertheless, the assessment *should be independent* of the PM or SPO.

States the analyses and investigations that were performed when making the assessment (e.g., examination of test setups, discussions with test personnel, analysis of test data, review of related technology, and so forth). This section is only a broad description of the process. Section 3.3 presents an opportunity to include more detail.

3.2 Critical Technologies

Lists the technologies included in the TRA. A table with the technology name and a few words that describe the technology and its function is appropriate. The technologies can be organized according to the WBS, as provided by the PM. The names of these critical technologies should be used consistently throughout the remainder of the document.

The PM is required to identify the critical technologies. The TRA is required to assess at least these technologies; however, other technologies that the TRA considers critical can also be included.

3.3 Assessment of Maturity

3.3.1 First Critical Technology or Category of Technology

Describes the technology (subsystem, component, or technology). Describes the function it performs and, if needed, how it relates to other parts of the system. Provides a synopsis of technology development history and status. This can include facts about related uses of the same or similar technology, numbers or

hours of testing of breadboards, numbers of prototypes built and tested, relevance of the test conditions, and results achieved. Finally, applies the criteria for TRLs and assigns a readiness level to the technology. States the readiness level (e.g., TRL 5) and the rationale for choosing this readiness level.

For a complex system, if the critical technologies presented are in categories (e.g., airframe or sensors), the information specified in the previous paragraph (e.g., describing the technology, describing the function it performs, and so forth) should be provided for each critical technology within a category.

3.3.2 Next Critical Technology or Category of Technology

Assessments of the maturity of other critical technologies should present the same information as that in paragraph 3.3.1.

3.4 Summary of TRLs by Technology

Presents a table that lists critical technologies and assesses the TRL of each technology.

4.0 Conclusion

States the Component S&T Executive's position concerning the maturity of the technologies and whether this maturity is adequate for the system to enter the next stage of development. If the position is supportive of entering the next stage (even though some critical technologies are less mature than would ordinarily be expected), explains what circumstances or planned work justifies the positive position.

The TRA should be signed "Approved By" the Component S&T Executive, or it should be transmitted with a cover memorandum that clearly states that the TRA presents the position of the Component S&T Executive. In effect, the Component S&T Executive must certify that he/she stands behind the statements in the Conclusion section.

ACRONYMS

ACAT	Acquisition Category
AIS	Automated Information System
AO	Action Officer
APB	Acquisition Program Baseline
ASD(C3I)	Assistant Secretary of Defense for Command, Control, Communications, and Intelligence
CAE	Component Acquisition Executive
CIO	Chief Information Officer
CTD	Concept and Technology Development
DAB	Defense Acquisition Board
DAS	Defense Acquisition System
DDR&E	Director of Defense Research and Engineering
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DUSD(S&T)	Deputy Under Secretary of Defense for Science and Technology
FOC	full operational capability
FRP	full-rate production
GAO	Government Accounting Office
IDA	Institute for Defense Analyses
IOC	initial operational capability
IT OIPT	Information Technology Overarching Integrated Product Team
LRIP	low rate initial production
MAIS	Major Automated Information System
MDA	Milestone Decision Authority
MDAP	Major Defense Acquisition Program
MNS	Mission Needs Statement
NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
NSIAD	National Security and International Affairs Division (GAO)
ODDR&E	Office of the Director of Defense Research and Engineering

OIPT	Overarching Integrated Product Team
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OT&E	operational test and evaluation
PEO	Program Executive Officer
PM	Program Manager
POC	Point of Contact
PSA	Principal Staff Assistant
R&D	research and development
S&T	Science and Technology
SDD	System Development and Demonstration
SPO	System Program Office
TMA	Technology Maturity Agreement
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics
VCJCS	Vice Chairman of the Joint Chiefs of Staff
VV&A	Verification, Validation, and Accreditation
WBS	Work Breakdown Structure

[20] DoD Technology Readiness Assessment Deskbook Appendixes

APPENDIXES FOR THE TRA DESKBOOK

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Appendix B – Summary of General Accounting Office (GAO) Reports and Expansion of Defense (DoD) Implementation B-1

Appendix C – Extracts from the Department of Defense (DoD) 5000 Series of Documents Refer and the Technology Readiness Assessments (TRAs) and Comments on the TRA Process C-1

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Appendix B—Summary of General Accounting Office (GAO) Reports and Department of Defense (DoD) Implementation B-1

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APPENDIX A
VARIOUS POINTS OF CONTACT (POCs)

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Table A-2. TRL IPT Members A-4

Table A-3. S&T Affordability Task Force (ATF) Members A-6

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APPENDIX B
SUMMARY OF GENERAL ACCOUNTING OFFICE (GAO) REPORTS AND DEPARTMENT OF DEFENSE (DoD) IMPLEMENTATION

B.1 GAO Reports B-3
B.2 GAO Recommendations B-7
B.3 DoD Comments and GAO Evaluation B-8
B.4 Cited References B-10
B.5 Uncited References B-10
Acronyms B-11

Several GAO reports addressed the DoD acquisition system and made recommendations that influenced the DoD 5000 series of publications. In particular, these reports influenced the involvement of the Component Science and Technology (S&T) communities on the acquisition review process and the use of Technology Readiness Assessments (TRAs).

The following presents a brief summary of GAO-related work, along with references for the source documents.

B.1 GAO REPORTS

The subcommittee on Readiness and Management Support of the Committee on Armed Services, U.S. Senate, which has oversight on acquisitions policy, enlisted the GAO in a study of best commercial practices as related to defense acquisition. A series of GAO reports and related testimony assessed how best commercial practices could improve the way DoD incorporates new technology into weapon system programs and reduces risk. These reports, issued from 1996–2000 (the principal of which are listed as Refs. 1, 2, 3), offered DoD some guidance and resulted in many of the changes in the current issues of the DoD 5000 series of documents [Department of Defense Directive (DoDD) 5000.1, Department of Defense Instruction (DoDI) 5000.2, and DoD 5000.2-R] (Refs. 4, 5, 6).

The weapon system acquisition cycle for DoD major weapon systems before the issuance of References 4, 5, and 6 could be illustrated as shown in Figure B-1. Technology, design, and manufacturing knowledge was obtained concurrently.

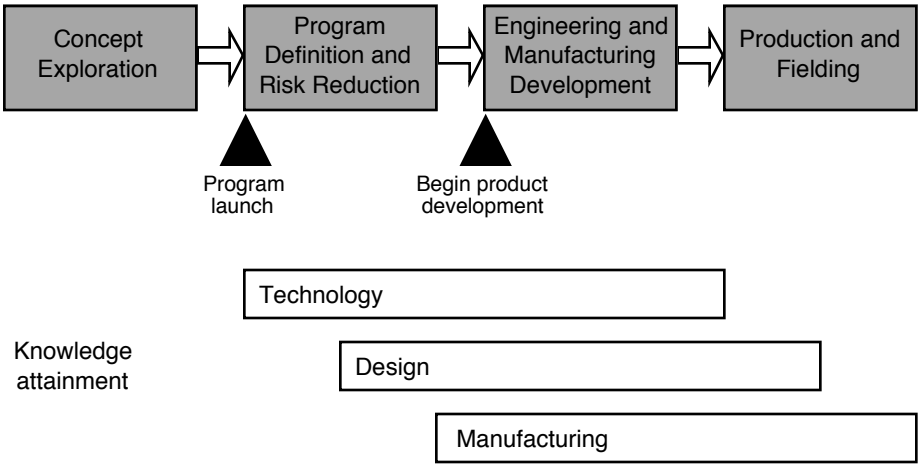

Figure B-1. DoD's Current Weapon System Acquisition Cycle

The major GAO recommendation that followed best commercial practice was to minimize technology development during product development and match requirements with technological capability before product development is launched. Proof that the technology will work and can be demonstrated to a high level of maturity is critical to lowering risk and avoiding large cost overruns. Associated with this principle are the needs to develop high standards for finding the maturity and readiness of technology, to establish disciplined paths that technology must take to be included in products, and to provide strong gatekeepers to decide when to allow the technology into a product development program. GAO recommended that DoD not launch a program until the technologies needed to meet a new weapons requirement are mature. To separate this technology development from the program, GAO best practices recommendations suggest that a technology and concept maturation phase follow concept exploration and precede program launch, as illustrated in Figure B-2.

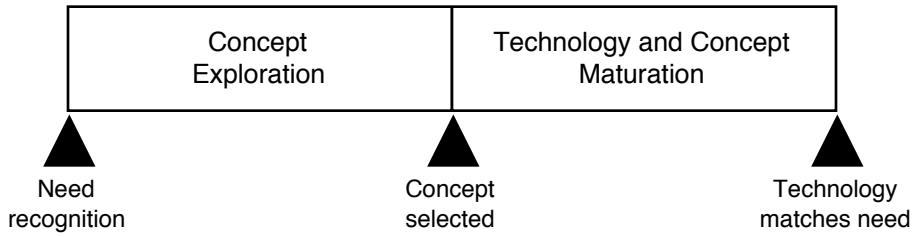

Figure B-2. Weapon Acquisition Phases That Should Precede the Launch of a New Program

The GAO review of best practices for including new technology in products (see Ref. 2) applied a scale of Technology Readiness Levels (TRLs) pioneered by the National Aeronautics and Space Administration (NASA) and adapted by the Air Force Research Laboratory (AFRL). "TRLs proved to be reliable indicators of the relative maturity of the 23 technologies reviewed, both commercial and military, and their eventual success after they were included in product development programs" (Ref. 2, p. 22)

To show that design is mature, the GAO studies suggest that a product development phase should include a distinct system integration effort *before* the system demonstration effort to demonstrate the effectiveness of the product and processes. See Figure B-3.

Figure B-4 shows GAO's final proposal for a potential DoD technology and product development process based on commercial best practices. It should be noted that leading commercial firms launch a new product later than DoD—after technology is

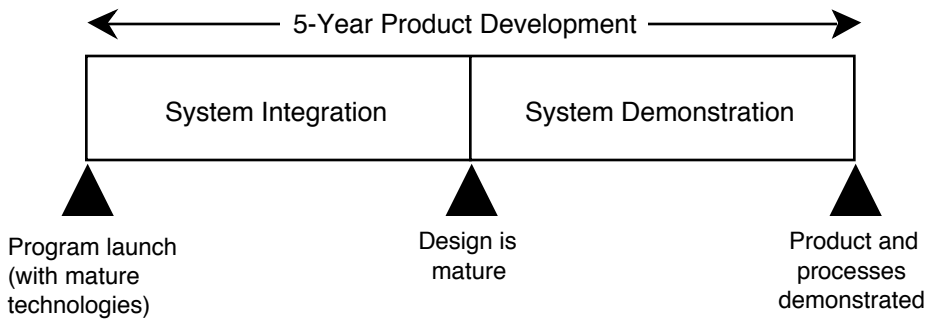

Figure B-3. Product Development Phase To Deliver a Mature Design and Key Processes

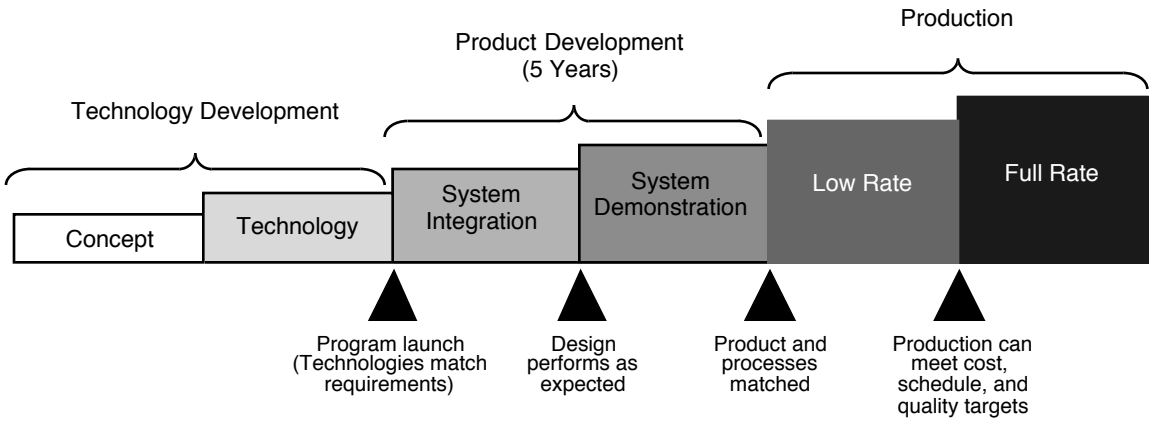

Figure B-4. Potential DoD Technology and Product Development Process Incorporating Best Practices

complete. Paragraphs B.2 and B.3 of this appendix provide the GAO recommendations for DoD management of Technology Development and the DoD response as reported in Reference 2. DoD did not agree entirely with GAO's recommendations and is willing to accept more risk. DoD considered TRL 6 as an acceptable readiness-level risk for a weapon system entering the program definition stage (see Figure B-1) and TRL 7 as an acceptable readiness-level risk for the Engineering and Manufacturing Development (EMD) stage. GAO accepted this.

Figure B-5 shows the process initially proposed by the TRA Working Group (see Appendix A) for accomplishing a TRA.[1] This would occur before Milestone B (MS B) and

[1] This is in the context of the acquisition process established by DoDI 5000.2

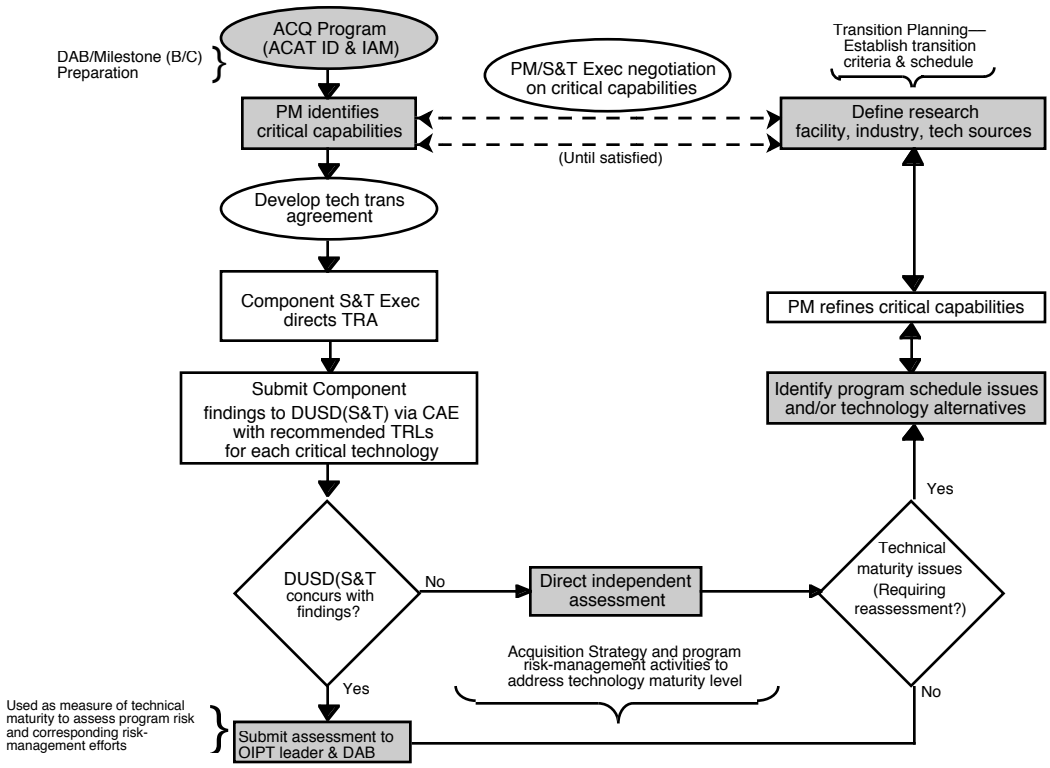

Figure B-5. Proposed TRA Process

Milestone C (MS C). Figure B-6 outlines the associated Defense Acquisition Management Framework presented in DoD 5000.2-R.

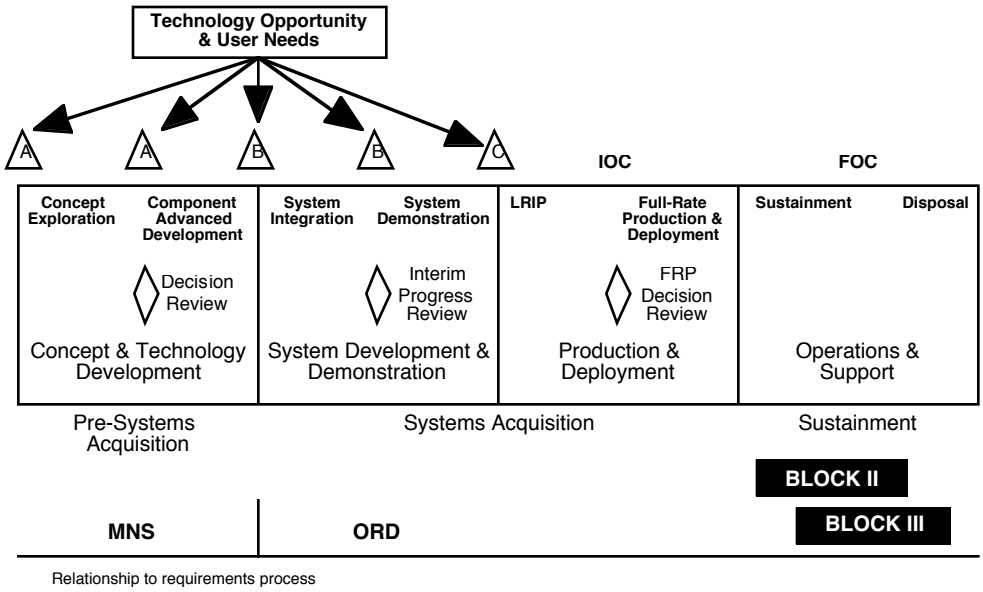

Figure B-6. Defense Acquisition Management Framework

B.2 GAO RECOMMENDATIONS

The following paragraphs are direct quotations from Reference 2: GAO/NSIAD-99-162, *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes*.

> We have previously recommended that DOD separate technology development from weapon system programs. That recommendation was made without prejudice toward the necessity of technology development but rather with the intent that programs could be better managed if such development was conducted outside of a program manager's purview. Similarly, the recommendations that follow are made without prejudice toward-or the intention of compromising-the basic research and other activities that S&T organizations perform. We recognize that implementation of these recommendations will have organizational, funding, and process implications and will require the cooperation of the Congress (p. 62).
>
> To help ensure that new technologies are vigorously pursued and successfully moved into weapon system programs, we recommend that the Secretary of Defense adopt a disciplined and knowledge-based method for assessing technology maturity, such as TRLs, DOD-wide. This practice should employ standards for assessing risks of handoff to program managers that are based on a technology's level of demonstration and its criticality to meeting the weapon system's requirements (p.63).
>
> With these tools in hand, we recommend that the Secretary (1) establish the place at which a match is achieved between key technologies and weapon system requirements as the proper time for committing to the cost, schedule, and performance baseline for developing and producing that weapon system and (2) require that key technologies reach a high maturity level—analogous to TRL 7-before making that commitment. This would approximate the launch point for product development as practiced by leading commercial firms (p. 63).
>
> We recommend that the Secretary find ways to ensure that the managers responsible for maturing the technologies and designing weapon systems before product development are provided the more flexible environment that is suitable for the discovery of knowledge, as distinct from the delivery of a product. Providing more flexibility will require the cooperation of requirements managers and resource managers so that rigid requirements or the threat of jeopardizing the funding planned to start product development will not put pressure on program managers to accept immature technologies. Such an environment may not be feasible if the program definition and risk reduction phase remains the effective launch point for an entire weapon system program (p. 63).
>
> An implication of these recommendations is that S&T organizations will have to play a greater role in maturing technologies to higher levels and should be funded accordingly. Therefore, we recommend that the Secretary of Defense evaluate the different ways S&T organizations can play a greater role in helping technologies reach high levels of maturity before product

development begins. For example, given that a technology has sufficient potential for application to a weapon system, at a minimum, an S&T organization should be responsible for taking a technology to TRL 6 before it is handed off to a program office at the program definition and risk reduction phase. During this phase, the program manager would be responsible for maturing the technology to TRL 7 before it is included in an engineering and manufacturing development program. In a situation where a single, design-pacing technology is to be developed for a known application—like the nonpenetrating periscope—an S&T organization should be required to mature that technology to TRL 7 before it is turned over to a product development manager. S&T organizations could play a similar role when a significant new technology is being prepared for insertion into an existing weapon system. Finally, when multiple new technologies are to be merged to create a weapon system, S&T organizations should be required to bring key technologies to TRL 6 and then become part of a hybrid organization with product developers to integrate the technologies and bring them to TRL 7 before handing full responsibility to a product development manager (pp. 63–64).

To help guard against the possibility that the more basic research and technology development activities would be compromised by having S&T organizations routinely take key technologies to TRL 6 or higher, we recommend that the Secretary extract lessons from the nonpenetrating periscope, the AAAV, and the Army's Future Scout programs, and other ATD and ACTD programs. Specifically, the Secretary should assess whether the resources needed to enable S&T organizations to play a leading role in the development of technologies and, in some cases, preliminary system design, detracted from or displaced more basic research and technology development programs (p. 64).

Finally, we recommend that the Secretary empower managers of product development programs to refuse to accept key technologies with low levels of demonstrated maturity. The Secretary can encourage this behavior through supportive decisions on individual programs, such as by denying proposals to defer the development of key technologies and by favoring proposals to lengthen schedules or lessen requirements to reduce technological risk early (p. 64).

B.3 DoD COMMENTS AND GAO EVALUATION

The following paragraphs are direct quotations from Reference 2: GAO/NSIAD-99-162, *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes*.

DOD generally concurred with a draft of this report and its recommendations, noting that the traditional path to new weapon system development is no longer affordable or necessary (see app. I). DOD stated that it has embarked upon a "Revolution in Business Affairs" that will enable new technologies to be developed more efficiently and effectively. It believes that the first steps in this direction have already been taken but agrees that more progress needs to be made. DOD agreed that TRLs are necessary in

assisting decision-makers in deciding on when and where to insert new technologies into weapon system programs and that weapon system managers should ensure that technology is matured to a TRL 7 before insertion occurs. DOD concurred that S&T organizations should be involved in maturing technologies to high levels, such as TRL 6, before transitioning to the engineering and manufacturing development phase and agreed to assess the impact of this involvement on other S&T resources. We note that the best practice is to mature technology to at least a TRL 7 before starting the engineering and manufacturing development phase, whether the technology is managed by an S&T organization, a weapon system program manager, or a hybrid of the two organizations (pp. 64–65).

DOD noted that while TRLs are important and necessary, the increasing projected life for new weapon systems, total ownership costs, and urgency based upon threat assessments are also important considerations for system development decisions. We agree and note that our recommendations are not intended to cover all aspects of weapon system development decisions or to suggest that technology maturity is the only factor in such decisions. Rather, the recommendations are in keeping with the purpose of the report, "to determine whether best practices offer methods to improve the way DOD matures new technology so that it can be assimilated into weapon system programs with less disruption." We believe that a knowledge-based approach to maturing technology, such as TRLs, can benefit other considerations as well. For example, decisions on what technologies to include in a weapon system and when to include them can have a significant bearing on its total ownership costs.

DOD stated that there should be an established point for the transition of technologies and that it plans to supplement its milestone review process with additional guidance in the next revisions to DOD 5000.2-R. It also stated that its policy on the evolutionary approach to weapon acquisitions should be developed in consonance with the technology transition strategy. We cannot comment on the revisions to the directive or the evolutionary acquisition policy because they have yet to be published. However, under the current milestone review process, the pressures placed on a program during the program definition and risk reduction phase—when much technology development occurs—can operate against the flexibility and judgments that are needed to mature technologies. If the revisions to the directive supplement the current milestones without relieving the pressures brought to bear on programs as they are launched in the program definition and risk reduction phase, it will remain difficult to discourage the acceptance of immature technologies in the design of new weapon systems. To relieve these pressures, we encourage DOD, as it develops the directive and the evolutionary acquisition policy, to separate technology development from product development and to redefine the launch point for a program as the point at which enough knowledge has been gained to ensure that a match is reached between the maturity of key technologies and weapon system requirements (pp. 65–66).

DOD also stated that program managers already have the ability to reject inappropriately mature technologies, and to the extent technology immaturity affects acquisition baselines, to advise acquisition executives of

feasible alternatives. We did not find this to be the case in our review. Rather, we found that the program managers' ability to reject immature technologies is hampered by (1) untradable requirements that force acceptance of technologies despite their immaturity and (2) reliance on tools for judging technology maturity that fail to alert the managers of the high risks that would prompt such a rejection. As noted in the report, once a weapon system program begins, the environment becomes inflexible and deviations to program baselines can attract unwanted attention. This reality limits the program managers' ability to reject immature technologies (p. 66).

B.4 CITED REFERENCES

1. GAO/T-NSIAD 99-116, *Defense Acquisition: Best Commercial Practices Can Improve Program Outcomes*. Statement for the Record by Louis J. Rodrigues, Director, Defense Acquisition Issues, National Security and International Affairs Division. Testimony Before the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate, March 1999.
   (See Internet Web Site http://www.fas.org/man/gao/nsiad-99-116.htm).
2. GAO/NSIAD-99-162, *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes*. United States General Accounting Office (GAO) Report to the Chairman and Ranking Minority Member, Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate, July 1999.
   (See Internet Web Site http://www.fas.org/man/gao/nsiad-99-162.htm).
3. GAO/T-NSIAD-00-137, *Defense Acquisition: Employing Best Practices Can Shape Better Weapon System Decisions*. Statement of David M. Walker, Comptroller General of the United States. Testimony Before the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate, April 26, 2000.
   See Internet Web Site http://www.gao.gov/archive/2000/ns00137t.pdf).
4. DoDD 5000.1, *The Defense Acquisition System,* 23 October 2000 (Incorporating Change 1, January 4, 2001).
   (See Internet Web Site http://dod5000.dau.mil/index.htm).
5. DoDI 5000.2, *Operation of the Defense Acquisition System*, (Including Change 1), 4 January 2001.
   (See Internet Web Site http://dod5000.dau.mil/index.htm).
6. DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAP) and Major Automated Information System (MAIS) Acquisition Programs,* April 5, 2002.
   (See Internet Web Site http://dod5000.dau.mil/index.htm).

B.5 UNCITED REFERENCES

USD(AT&L), ASD(C31), and DOT&E Memorandum, "Mandatory Procedures for Major Defense Acquisition Programs (MDAP), and Major Automated Information System (MAIS) Acquisition Programs," dated January 2001.

ODDR&E Memo for ODUSD(S&T) Directors, "Interim Guidance for Implementing TRL," dated July 12, 2001.

ACRONYMS

AAAV	Advanced Amphibious Assault Vehicle
ACAT	Acquisition Category
ACTD	Advanced Concept Technology Demonstration
AFRL	Air Force Research Laboratory
ASD(C3I)	Assistant Secretary of Defense for Command, Control, Communications, and Intelligence
ATD	Advanced Technology Demonstration
CAE	Component Acquisition Executive
DAB	Defense Acquisition Board
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DUSD(S&T)	Deputy Under Secretary of Defense for Science and Technology
EMD	Engineering and Manufacturing Development
FOC	full operational capability
GAO	General Accounting Office
IOC	initial operational capability
LRIP	low rate initial production
MAIS	Major Automated Information System
MDAP	Major Defense Acquisition Program
MNS	Mission Needs Statement
NASA	National Aeronautics and Space Administration
NSIAD	National Security and International Affairs Division (GAO)
ODDR&E	Office of the Director of Defense Research and Engineering
ODUSD(S&T)	Office of the Deputy Under Secretary of Defense for Science and Technology
ORD	Operational Requirements Document
PM	Program Manager
S&T	Science and Technology
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics

APPENDIX C
EXTRACTS FROM THE DEPARTMENT OF DEFENSE (DoD) 5000 SERIES OF DOCUMENTS RELEVANT TO TECHNOLOGY READINESS ASSESSMENTS (TRAs) AND COMMENTS ON THE TRA PROCESS

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C.3.3 DoD 5000.2-R (April 5, 2002) C-16

Acronyms C-17

The DoD 5000 series documents relevant to TRAs are

- Department of Defense Directive (DoDD) 5000.1, *The Defense Acquisition System,* (Incorporating Change 1, January 4, 2001), 23 October 2000
- Department of Defense Instruction (DoDI) 5000.2, *Operation of the Defense Acquisition System,* (Including Change 1); 4 January 2001
- DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs*, April 5, 2002.

For background and reference, the portions of these documents relevant to TRA responsibilities are extracted here. A brief summary of the requirements for the assessments is also provided. These DoD 5000 series documents appear on Internet Web Site http://dod5000.dau.mil/index.htm.

C.1 EXTRACTS FROM DoD 5000 SERIES DOCUMENTS THAT SET TRA PROCEDURES AND POLICY

C.1.1 DoDD 5000.1

- **Paragraph 4.3.1**

  To ensure that the Defense Acquisition System provides useful military capability to the operational user as rapidly as possible, evolutionary acquisition strategies shall be the preferred approach to satisfying operational needs. Evolutionary acquisition strategies define, develop, and produce/deploy an initial, militarily useful capability ("Block I") based on proven technology, time-phased requirements, projected threat assessments, and demonstrated manufacturing capabilities, and plan for subsequent development and production/deployment of increments beyond the initial capability over time (Blocks II, III, and beyond). The scope, performance capabilities, and timing of subsequent increments shall be based on continuous communications among the requirements, acquisition, intelligence, and budget communities. In planning evolutionary acquisition strategies, program managers shall strike an appropriate balance among key factors, including the urgency of the operational requirement; the maturity of critical technologies; and the interoperability, supportability, and affordability of alternative acquisition solutions. To facilitate evolutionary acquisition, program managers shall use appropriate enabling tools, including a modular open systems approach to ensure access to the latest technologies and products, and facilitate affordable and supportable modernization of fielded assets. Sustainment strategies must

evolve and be refined throughout the life cycle, particularly during development of subsequent blocks in an evolutionary strategy.

- **Paragraph 4.3.4**

  Milestone decision authorities shall not commit the Department to the initiation of low-rate initial production (or any production in the case of systems where low-rate initial production is not required) of an acquisition program unless and until certain fundamental criteria have been considered and evaluated. These criteria include, but are not necessarily limited to, demonstrated technology maturity; well-defined and understood user requirements that respond to identified threats; acceptable interoperability, affordability, and supportability; and a strong plan for rapid acquisition using evolutionary approaches as the preferred strategy, open systems designs, and effective competition.

- **Paragraph 4.5.1**

  There is no one best way to structure an acquisition program so that it accomplishes the objectives of the Defense Acquisition System. Decision-makers and program managers shall tailor acquisition strategies to fit the particular conditions of an individual program, consistent with common sense, sound business management practice, applicable laws and regulations, and the time-sensitive nature of the user's requirement. Proposed programs may enter the acquisition process at various decision points, depending on concept and technology maturity. Tailoring shall be applied to various aspects of the acquisition system, including program documentation, acquisition phases, the timing and scope of decision reviews, and decision levels. Milestone decision authorities shall promote flexible, tailored approaches to oversight and review based on mutual trust and a program's dollar value, risk, and complexity.

C.1.2 DoDI 5000.2

- **Paragraph 4.7.2.3.2.6**

  [Component S&T Executive shall] conduct independent technology assessments and assist in determining the maturity of critical system technologies for transition to the System Acquisition process, during System Development and Demonstration and at Milestone C.

- **Paragraph 4.7.2.3.3.1**

  ATDs shall be used to demonstrate the maturity and potential of advanced technologies for enhanced military operational capability or cost effectiveness.

- **Paragraph 4.7.2.4.5**

  The practical result of a preference for more mature technology is initiation of individual programs at later stages of development, after determination of technology maturity. As a consequence, most MDAPs will be initiated at Milestone B. On the rare occasions when an earlier program initiation is appropriate, it will take place at entry to or during Component Advanced Development. At program initiation in advance of Milestone B, the MDA shall approve the acquisition strategy, the acquisition program baseline, IT certification for MAISs (reference (u)), and exit criteria for the Component Advanced Development work effort if not already established.

- **Paragraph 4.7.3.2.1.2**

  This phase [System Development and Demonstration] can be entered either directly out of technology opportunity and user need activities or from Concept Exploration. The actual entry point depends on the maturity of the technologies, validated requirements (including urgency of need), and affordability. The MDA shall determine the appropriate entrance point, which shall be Milestone B. There shall be only one Milestone B per program, or evolutionary block.

- **Paragraph 4.7.3.2.2.1**

  Entrance into System Development and Demonstration is dependent on three things: technology (including software) maturity, validated requirements, and funding. Unless some other factor is overriding in its impact, the maturity of the technology will determine the path to be followed. Programs that enter the process at Milestone B shall have a system architecture and an operational architecture for their relevant mission area.

- **Paragraph 4.7.3.2.2.2**

  Technology is developed in S&T or procured from industry. Technology must have been demonstrated in a relevant environment (reference (c) for a discussion of technology maturity) or, preferably, in an operational environment (using the transition mechanisms) to be considered mature enough to use for product development in systems integration. If technology is not mature, the DoD Component shall use alternative technology that is mature and that can meet the user's needs. The determination of technology maturity is made by the DoD Component S&T Executive, with review of the determination for MDAPs by the DUSD(S&T). If the DUSD(S&T) does not concur with the determination, the DUSD(S&T) will direct an independent assessment. To promote increased consideration of technological issues early in the development process, the MDA shall, at each acquisition program decision, consider any position paper prepared by a Defense research facility

on a technological issue relating to the major system being reviewed; and any technological assessment made by a Defense research facility (reference(w)). A defense research facility is a DoD facility that performs or contracts for the performance of basic research or applied research known as exploratory development.

- **Paragraph 4.7.3.2.3.1.1**

  Prior to approving entry into System Development and Demonstration at Milestone B, the MDA shall consider the validated ORD, System Threat Assessment, independent technology assessment and any technology issues identified by DoD research facilities, any early operational assessments or test and evaluation results, analysis of alternatives including compliance with the Department of Defense's strategic plan (based on the Government Performance and Results Act (GPRA), reference (x)), the independent cost estimate or, for MAISs, component cost analysis and the economic analysis, manpower estimate (if applicable), whether an application for frequency allocation has been made (if the system will require utilization of the electromagnetic spectrum), system affordability and funding, the program protection for Critical Program Information, anti-tamper provisions, the Delegation of Disclosure Authority Letter (DDL) concerning foreign disclosure of program information vis-à-vis foreign participation in the program and/or sales of the system, the proposed acquisition strategy, cooperative opportunities, and infrastructure and operational support.

- **Paragraph 4.7.3.2.3.1.2**

  At Milestone B, the MDA shall confirm the acquisition strategy approved prior to release of the final Request for Proposal and approve the development acquisition program baseline, low-rate initial production quantities (where applicable), and System Development and Demonstration exit criteria (and exit criteria for interim progress review, if necessary). For shipbuilding programs, the lead ship engineering development model shall be authorized at Milestone B. Critical systems for the lead and follow ships shall be demonstrated given the level of technology maturity and the associated risk prior to ship installation. Follow ships may be initially authorized at Milestone B, to preserve the production base, with final authorization dependent on completion of critical systems demonstration, as directed by the MDA.

- **Paragraph 4.7.3.2.3.1.3**

  The DOT&E and the cognizant Overarching Integrated Product Team Leader shall approve the Test and Evaluation Master Plan (TEMP) (including the LFT&E strategy, if applicable) for all OSD test and evaluation oversight

programs. If full-up, system-level LFT&E is unreasonably expensive and impractical, a waiver shall be approved by the USD(AT&L), for programs where he or she is the MDA, or by the CAE, for programs where he or she is the MDA, and an alternative LFT&E plan shall be approved by the DOT&E before entry into System Development and Demonstration (reference (y)).

- **Paragraph 4.7.3.2.3.1.4**

  For MDAPs, a Milestone B decision shall be the occasion for submission of a revised Selected Acquisition Report (DoD 5000.2-R, reference (h)). IT intended for use by non-military users shall be accessible to people with disabilities (reference (v)).

- **Paragraph 4.7.3.3.2**

  Regardless of the entry point, approval at Milestone C is dependent on the following criteria being met (or a decision by the MDA to proceed):

- **Paragraph 4.7.3.3.2.1**

  Technology maturity (with an independent technology readiness assessment), system and relevant mission area (operational) architectures, mature software capability, demonstrated system integration or demonstrated commercial products in a relevant environment, and no significant manufacturing risks …

C.1.3 DoD 5000.2-R

- **Paragraph C7.5.1**

  Technology maturity shall measure the degree to which proposed critical technologies meet program objectives. Technology maturity is a principal element of program risk. A technology readiness assessment shall examine program concepts, technology requirements, and demonstrated technology capabilities to determine technological maturity.

- **Paragraph C7.5.2**

  The PM shall identify critical technologies via the WBS (see paragraph C5.3.1.). Technology readiness assessments for critical technologies shall occur sufficiently prior to milestone decision points B and C to provide useful technology maturity information to the acquisition review process.

- **Paragraph C7.5.3**

  The DoD Component Science and Technology (S&T) Executive shall direct the technology readiness assessment and, for ACAT ID and ACAT IAM programs, submit the findings to the CAE, who shall submit his or her report to the DUSD(S&T) with a recommended technology readiness level (TRL) (or some equivalent assessment) for each critical technology. When the

Component S&T Executive submits his or her findings to the CAE, he or she shall provide the DUSD(S&T) an information copy of those findings. In cooperation with the Component S&T Executive and the program office, the DUSD(S&T) shall evaluate the technology readiness assessment and, if he/she concurs, forward findings to the OIPT leader and DAB. If the DUSD(S&T) does not concur with the technology readiness assessment findings, an independent technology readiness assessment, under the direction of the DUSD(S&T), shall be required.

- **Paragraph C7.5.4**

  TRL descriptions appear at Appendix 6. TRLs enable consistent, uniform, discussions of technical maturity, across different types of technologies. Decision authorities shall consider the recommended TRLs (or some equivalent assessment methodology (e.g., Willoughby templates) when assessing program risk. TRLs are a measure of technical maturity. They do not discuss the probability of occurrence (i.e., the likelihood of attaining required maturity) or the impact of not achieving technology maturity.

- **Paragraph C7.6.4.4**

  For ACAT ID decision points, the OIPT leader shall provide the DAB chair, principals, and advisors an integrated assessment using information gathered through the IPT process. The leader's assessment shall focus on core acquisition management issues and shall consider independent assessments, including technology readiness assessments, which the OIPT members normally prepare. These assessments typically occur in context of the OIPT review and shall be reflected in the OIPT leader's report. There shall be no surprises at this point—all team members shall work issues in real time and shall be knowledgeable of their OIPT leader's assessment. OIPT and other staff members shall not require the PM to provide pre-briefs independent of the OIPT process.

- **Paragraph C7.6.7**

  Assessments, independent of the developer and the user, ensure an impartial evaluation of program status. Consistent with statutory requirements and good management practice, the Department of Defense shall require independent assessments of program status (e.g., the independent cost estimate or technology readiness assessment). Senior acquisition officials shall consider these assessments when making acquisition decisions. Staff offices that provide independent assessments shall support the orderly and timely progression of programs through the acquisition process. IPTs shall have access to independent assessments to enable full and open discussion of issues.

C.2 EXTRACTS FROM DoD 5000 SERIES DOCUMENTS THAT ASSIGN TRA RESPONSIBILITIES

C.2.1 Program Manager (PM)

- **DoD 5000.2-R (C7.5.2)**

  The PM shall identify critical technologies via the WBS (see paragraph C5.3.1.). Technology readiness assessments for critical technologies shall occur sufficiently prior to milestone decision points B and C to provide useful technology maturity information to the acquisition review process.

- **DoD 5000.2-R (C7.3.1.4)**

  The PM shall brief the acquisition program to the DAB and specifically emphasize technology maturity, risk management, affordability, critical program information, technology protection, and rapid delivery to the user. The PM shall address any interoperability and supportability requirements linked to other systems, and indicate whether those requirements will be satisfied by the acquisition strategy under review. If the program is part of a system-of-systems architecture, the PM shall brief the DAB in that context. If the architecture includes less than ACAT I programs that are key to achieving the expected operational capability, the PM shall also discuss the status of and dependence on those programs.

- **DoD 5000.2-R (C7.3.2.3)**

  Principal participants at DoD CIO reviews shall include (as appropriate to the issue being examined) the following department officials: the Deputy DoD CIO; IT OIPT Leader; ACAT ID OIPT Leaders; Cognizant PEO(s) and PM(s); Cognizant OSD PSA, CAEs and CIOs of the Army, Navy, and Air Force. Participants shall also include (as appropriate to the issue being examined) executive-level representatives from the following organizations: Office of USD(AT&L); Office of the Under Secretary of Defense (Comptroller); Office of the Joint Chiefs of Staff; Office of DOT&E; Office of the Director, PA&E; and Defense Information Systems Agency.

- **DoD 5000.2-R (C7.6.4.1)**

  All ACAT ID and IAM programs shall have an OIPT to provide assistance, oversight, and review as the program proceeds through its acquisition life cycle. An appropriate official within OSD, typically the Director of Strategic and Tactical Systems or the Principal Director, Command, Control, Communications, Intelligence, Surveillance, and Reconnaissance & Space, shall lead the OIPT for ACAT ID programs. The Deputy DoD CIO or designee shall lead the OIPT for ACAT IAM programs. The OIPT for ACAT IAM programs is called

the IT OIPT. OIPTs shall comprise the PM, PEO, Component Staff, Joint Staff, and OSD staff involved in oversight and review of the particular ACAT ID or IAM program.

- **DoD 5000.2-R (C7.6.5.1)**

  The PM, or designee, shall form and lead an IIPT to support the development of strategies for acquisition and contracts, cost estimates, evaluation of alternatives, logistics management, training, cost-performance trade-offs, etc. The PM, assisted by the IIPT, shall develop and propose to the OIPT, a WIPT structure. The IIPT shall coordinate the activities of the WIPTs and review issues they do not address. WIPTs shall meet as required to help the PM plan program structure and documentation and resolve issues.

- **DoD 5000.2-R (C7.7.1)**

  It shall be Department policy to keep reporting requirements to a minimum. Nevertheless, complete and current program information is essential to the acquisition process. Consistent with the tables of required regulatory and statutory information appearing in DoD Instruction 5000.2 (reference (a)), decision authorities shall require PMs and other participants in the defense acquisition process to present only the minimum information necessary to understand program status and make informed decisions. The MDA shall "tailor-in" program information case-by-case, as necessary. IPTs shall facilitate the management and exchange of program information.

- **DoD 5000.2-R (C7.14.1)**

  PMs shall implement internal management controls in accordance with DoD Directive 5000.1 (reference (jjjjj)), DoD Instruction 5000.2 (reference (a)), this Regulation, and DoD Directive 5010.38 (reference (kkkkk)). APB parameters shall serve as control objectives. PMs shall identify deviations from approved APB parameters and exit criteria as materiel weaknesses. PMs shall focus on results, not process.

- **DoD 5000.2-R (C7.15.1.1)**

  Program plans describe the detailed activities of the acquisition program. In coordination with the PEO, the PM shall determine the type and number of program plans needed to manage program execution.

- **DoDD 5000.1 (4.3.1)**

  To ensure that the Defense Acquisition System provides useful military capability to the operational user as rapidly as possible, evolutionary acquisition strategies shall be the preferred approach to satisfying operational needs. Evolutionary acquisition strategies define, develop, and produce/deploy an initial, militarily useful capability ("Block I") based on proven technology,

time-phased requirements, projected threat assessments, and demonstrated manufacturing capabilities, and plan for subsequent development and production/deployment of increments beyond the initial capability over time (Blocks II, III, and beyond). The scope, performance capabilities, and timing of subsequent increments shall be based on continuous communications among the requirements, acquisition, intelligence, and budget communities. In planning evolutionary acquisition strategies, program managers shall strike an appropriate balance among key factors, including the urgency of the operational requirement; the maturity of critical technologies; and the interoperability, supportability, and affordability of alternative acquisition solutions. To facilitate evolutionary acquisition, program managers shall use appropriate enabling tools, including a modular open systems approach to ensure access to the latest technologies and products, and facilitate affordable and supportable modernization of fielded assets. Sustainment strategies must evolve and be refined throughout the life cycle, particularly during development of subsequent blocks in an evolutionary strategy.

C.2.2 Deputy Under Secretary of Defense for Science and Technology DUSD(S&T)

- **DoD 5000.2-R (C7.5.3)**

  The DoD Component Science and Technology (S&T) Executive shall direct the technology readiness assessment and, for ACAT ID and ACAT IAM programs, submit the findings to the CAE who shall submit his or her report to the DUSD(S&T) with a recommended technology readiness level (TRL) (or some equivalent assessment) for each critical technology. When the Component S&T Executive submits his or her findings to the CAE, he or she shall provide the DUSD(S&T) an information copy of those findings. In cooperation with the Component S&T Executive and the program office, the DUSD(S&T) shall evaluate the technology readiness assessment and, if he/she concurs, forward findings to the OIPT leader and DAB. If the DUSD(S&T) does not concur with the technology readiness assessment findings, an independent technology readiness assessment, under the direction of the DUSD(S&T), shall be required.

- **DoD 5000.2-R (C7.6.7)**

  Assessments, independent of the developer and the user, ensure an impartial evaluation of program status. Consistent with statutory requirements and good management practice, the Department of Defense shall require independent assessments of program status (e.g., the independent cost estimate or technology readiness assessment). Senior acquisition officials shall consider these assessments when making acquisition decisions. Staff offices that

provide independent assessments shall support the orderly and timely progression of programs through the acquisition process. IPTs shall have access to independent assessments to enable full and open discussion of issues.

C.2.3 Component Acquisition Executive (CAE)

- **DoD 5000.2-R (C7.5.3)**

  The DoD Component Science and Technology (S&T) Executive shall direct the technology readiness assessment and, for ACAT ID and ACAT IAM programs, submit the findings to the CAE who shall submit his or her report to the DUSD(S&T) with a recommended technology readiness level (TRL) (or some equivalent assessment) for each critical technology. When the Component S&T Executive submits his or her findings to the CAE, he or she shall provide the DUSD(S&T) an information copy of those findings. In cooperation with the Component S&T Executive and the program office, the DUSD(S&T) shall evaluate the technology readiness assessment and, if he/she concurs, forward findings to the OIPT leader and DAB. If the DUSD(S&T) does not concur with the technology readiness assessment findings, an independent technology readiness assessment, under the direction of the DUSD(S&T), shall be required.

C.2.4 Component Science and Technology (S&T) Executive

- **DoD 5000.2-R (C7.5.3)**

  The DoD Component Science and Technology (S&T) Executive shall direct the technology readiness assessment and, for ACAT ID and ACAT IAM programs, submit the findings to the CAE who shall submit his or her report to the DUSD(S&T) with a recommended technology readiness level (TRL) (or some equivalent assessment) for each critical technology. When the Component S&T Executive submits his or her findings to the CAE, he or she shall provide the DUSD(S&T) an information copy of those findings. In cooperation with the Component S&T Executive and the program office, the DUSD(S&T) shall evaluate the technology readiness assessment and, if he/she concurs, forward findings to the OIPT leader and DAB. If the DUSD(S&T) does not concur with the technology readiness assessment findings, an independent technology readiness assessment, under the direction of the DUSD(S&T), shall be required.

C.2.5 Defense Acquisition Board [Chaired by the Under Secretary of Defense for Acquisition Technology and Logistics (USD(AT&L))]

- **DoD 5000.2-R (C7.3.1.1)**

  The DAB shall advise the Under Secretary of Defense (Acquisition, Technology, and Logistics) on critical acquisition decisions. The Under Secretary of Defense (Acquisition, Technology, and Logistics) shall chair the DAB, and the Vice Chairman of the Joint Chiefs of Staff shall serve as vice-chair. DAB membership shall comprise the following executives: Under Secretary of Defense (Comptroller); Under Secretary of Defense (Policy); Under Secretary of Defense (Personnel & Readiness); Assistant Secretary of Defense (Command, Control, Communications, and Intelligence)/Department of Defense Chief Information Officer; Director, Operational Test and Evaluation; and the Secretaries of the Army, Navy, and the Air Force. United States Joint Forces Command shall be available to comment on interoperability and integration issues that the JROC forwards to the DAB. The DAE may ask other department officials to participate in reviews, as required.

C.2.6 Defense Acquisition Executive (DAE)

- **DoD 5000.2-R (C7.3.1.3)**

  The Defense Acquisition Executive shall conduct DAB reviews at major program milestones and at the Full-Rate Production Decision Review (if not delegated to the CAE), and at other times, as necessary. An ADM shall document the decision(s) resulting from the review.

C.2.7 DoD Chief Information Officer (CIO) Reviews

- **DoD 5000.2-R (C7.3.2.1)**

  DoD CIO Reviews shall provide the forum for ACAT IAM milestones, for deciding critical ACAT IAM issues when they cannot be resolved at the OIPT level, and for enabling the execution of the DoD CIO's acquisition-related responsibilities for IT, including NSS, under the Clinger-Cohen Act and Title 10 USC (references (ppp) and (eeeee)). Wherever possible, these reviews shall take place in the context of the existing IPT and acquisition milestone review process. Where appropriate, an ADM shall typically document the decision(s) resulting from the review.

C.2.8 Overarching Integrated Product Team (OIPT)

- **DoD 5000.2-R (C7.6.4.1)**

  All ACAT ID and IAM programs shall have an OIPT to provide assistance, oversight, and review as the program proceeds through its acquisition life cycle. An appropriate official within OSD, typically the Director of Strategic and Tactical Systems or the Principal Director, Command, Control, Communications, Intelligence, Surveillance, and Reconnaissance & Space, shall lead the OIPT for ACAT ID programs. The Deputy DoD CIO or designee shall lead the OIPT for ACAT IAM programs. The OIPT for ACAT IAM programs is called the IT OIPT. OIPTs shall comprise the PM, PEO, Component Staff, Joint Staff, and OSD staff involved in oversight and review of the particular ACAT ID or IAM program.

- **DoD 5000.2-R (C7.6.4.2)**

  The OIPT shall form upon departmental intention to start an acquisition program. The OIPT shall charter the IIPT and WIPTs. The OIPT shall consider the recommendations of the IIPT regarding the appropriate milestone for program initiation and the minimum information needed for the program initiation milestone review. OIPTs shall meet, thereafter, as necessary over the life of the program. The OIPT leader shall act to resolve issues when requested by any member of the OIPT, or when so directed by the MDA. The goal is to resolve as many issues and concerns at the lowest level possible, and to expeditiously escalate issues that need resolution at a higher level. The OIPT shall bring only the highest-level issues to the MDA for decision.

- **DoD 5000.2-R (C7.6.4.3)**

  The OIPT shall normally convene two weeks before a planned decision point. It shall assess the information and recommendations that the MDA will receive, in the same context, and to the same ACAT level. It shall also assess family-of-system or system-of-system capabilities within mission areas in support of mission area operational architectures developed by the Joint Staff. If the program includes a pilot project, such as TOC Reduction, the PM shall report the status of the project to the OIPT. The OIPT shall then assess progress against stated goals. The PM's briefing to the OIPT shall specifically address interoperability and supportability (including spectrum supportability) with other systems, anti-tamper provisions, and indicate whether those requirements will be satisfied by the acquisition strategy under review. If the program is part of a family-of-systems architecture, the PM shall brief the OIPT in that context. If the architecture includes less than ACAT I programs that are key to achieving the expected operational capability, the PM shall also discuss the status of and dependence on those programs. The OIPT leader shall recom-

mend to the MDA whether the anticipated review should go forward as planned.

- **DoD 5000.2-R (C7.6.4.4)**

  For ACAT ID decision points, the OIPT leader shall provide the DAB chair, principals, and advisors an integrated assessment using information gathered through the IPT process. The leader's assessment shall focus on core acquisition management issues and shall consider independent assessments, including technology readiness assessments, which the OIPT members normally prepare. These assessments typically occur in context of the OIPT review, and shall be reflected in the OIPT leader's report. There shall be no surprises at this point—all team members shall work issues in real time and shall be knowledgeable of their OIPT leader's assessment. OIPT and other staff members shall not require the PM to provide pre-briefs independent of the OIPT process.

C.2.9 Integrated Product Teams (IPTs)

- **DoD 5000.2-R (C7.6.2)**

  IPTs are an integral part of the defense acquisition oversight and review process. For ACAT ID and IAM programs, there are generally two levels of IPT: the OIPT and WIPT(s). Each program shall have an OIPT and at least one WIPT. WIPTs shall focus on a particular topic such as cost/performance, test, or contracting. An Integrating IPT (IIPT) (which is a WIPT) shall coordinate WIPT efforts and cover all topics not otherwise assigned to another IPT. IPT participation is the primary way for any organization to participate in the acquisition program.

C.2.10 Authority of Key Acquisition System Officials

- **DoDD 5000.1 (Paragraph 5)**

  The Under Secretary of Defense (Acquisition, Technology, and Logistics) (USD(AT&L)), the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) (ASD(C3I)), and the Director of Operational Test and Evaluation (DOT&E) are key officials of the Defense Acquisition System. They may jointly issue DoD Instructions, DoD publications, and one-time directive-type memoranda, consistent with DoD 5025.1-M (reference (h)), that implement the policies contained in this Directive. Any such issuance shall be jointly signed by the USD(AT&L), the ASD(C3I), and the DOT&E.

C.3 COMMENTS ON THE TRA PROCESS

C.3.1 DoDD 5000.1, Change 1 (January 2001)

DoDD 5000.1, Change 1 (January 2001), in discussing "Rapid and Effective Transition From Acquisition to Deployment and Fielding" (Section 4.3 under the topics of "Evolutionary Acquisition and Departmental Commitment to Production" and "Effective Management" and Section 4.5 under the topic of "Tailoring") sets forth the following:

- Evolutionary acquisition strategies are the preferred approach to satisfying operational needs. Maturity of critical technologies is one of the key factors to be considered in planning evolutionary acquisition strategies. Milestone Decision Authorities (MDAs) shall not commit the Department to the initiation of low rate initial production (LRIP) (or any production in the case of systems where LRIP is not required) until technology maturity has been demonstrated (among other fundamental criteria).
- In discussing effective management, DoDD 5000.1 emphasizes that no best way exists to structure an acquisition program and that proposed programs may enter the acquisition process at various decision points depending on concept and technology maturity.

C.3.2 DoDI 5000.2, Change 1

DoDI 5000.2, Change 1, in listing criteria for approval at Milestone B (MS B) and Milestone C (MS C), requires that "technology maturity" (with an independent TRA) be ascertained. Technology maturity is only one of the many considerations in MS B and MS C approval and what constitutes desired maturity is not indicated.

C.3.3 DoD 5000.2-R (April 5, 2002)

Chapter C7 of DoD 5000.2-R (April 5, 2002) establishes the mandatory policies and procedures for making major program decisions for Acquisition Category (ACAT) ID and ACAT IAM programs. Sections C7.5 and C7.6 deal specifically with technology maturity and the responsibilities of various action and decision-making entities, including the Program Manager (PM), the DoD Component Science and Technology (S&T) Executive, the Component Acquisition Executive (CAE), the Deputy Under Secretary of Defense for Science and Technology (DUSD(S&T)), the Overarching Integrated Product Team (OIPT), the Defense Acquisition Board (DAB), and the Working Integrated Product Team (WIPT). Section C7.6 allows for independent assessments and invites industry participation.

Appendix 6 of DoD 5000.2-R lists 9 TRLs and their definitions.[2] The specific level for passing MS B and MS C is not directed. Nonetheless, the wording "… in an appropriate simulated environment, or preferably in an operational environment" strongly suggests TRL 6 or TRL 7 at MS B.

ACRONYMS

ACAT	Acquisition Category
ADM	Acquisition Decision Memorandum
APB	Acquisition Program Baseline
ASD(C3I)	Assistant Secretary of Defense for Command, Control, Communications, and Intelligence
ATD	Advanced Technology Demonstration
CAE	Component Acquisition Executive
CIO	Chief Information Officer
DAB	Defense Acquisition Board
DAE	Defense Acquisition Executive
DDL	Delegation of Disclosure Authority Letter
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DOT&E	Director of Operational Test and Evaluation
DUSD(S&T)	Deputy Under Secretary of Defense for Science and Technology
GPRA	Government Performance and Results Act
IIPT	Integrating IPT
IPT	Integrated Product Team
IT	Information Technology
JROC	Joint Requirements Oversight Committee
LFT&E	Live Fire Test and Evaluation
LRIP	low rate initial production
MAIS	Major Automated Information System
MDA	Milestone Decision Authority
MDAP	Major Defense Acquisition Program
MS	Milestone

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2 These definitions also appear in Section III of this TRA Deskbook.

OIPT	Overarching Integrated Product Team
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
PA&E	Program Analysis and Evaluation
PEO	Program Executive Officer
PM	Program Manager
PSA	Principal Staff Assistant
S&T	Science and Technology
TEMP	Test and Evaluation Master Plan
TOC	total ownership cost
TRA	Technology Readiness Assessment
USC	United States Code
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics
WBS	Work Breakdown Structure
WIPT	Working Integrated Product Team

APPENDIX D
POLICY STATEMENTS

Various policy statements, directives, and so forth relevant to the Technology Readiness Assessment (TRA) process are provided for reference.

National Defense Authorization Act (NDAA) for Fiscal Year 2002, SEC. 804. Reports on Maturity of Technology at Initiation of Major Defense Acquisition Programs..... D-3

Memorandum for Secretaries of the Military Departments … Subject: Evolutionary Acquisition and Spiral Development, Apr 12, 2002, from the Under Secretary of Defense D-5

Memorandum for the Office of the Deputy Under Secretary of Defense for Science and Technology (ODUSD(S&T)) Directors, Subject: Interim Guidance for Implementing Technology Readiness Levels, Jul 12, 2001 ..... D-9

Memorandum for Director, Strategic and Tactical Systems … Subject: Deputy Under Secretary of Defense (Science and Technology) (DUSD(S&T)) Staff Participation in OIPTs, Sep 6, 2001 ..... D-21

Terms of Reference for Technology Readiness Level (TRL) Integrated Product Team (IPT) D-25

Pending Memorandum from the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) Assigning TRA Responsibilities to the Director of Defense Research and Engineering (DDDR&E) D-27

Acronyms/Glossary D-29

107TH CONGRESS
1st Session

HOUSE OF REPRESENTATIVES

REPORT
107–333

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2002

CONFERENCE REPORT

TO ACCOMPANY

S. 1438

DECEMBER 12, 2001.—Ordered to be printed

SEC. 804. REPORTS ON MATURITY OF TECHNOLOGY AT INITIATION OF MAJOR DEFENSE ACQUISITION PROGRAMS.

(a) REPORTS REQUIRED.—Not later than March 1 of each of years 2003 through 2006, the Secretary of Defense shall submit to the Committees on Armed Services of the Senate and the House of Representatives a report on the implementation of the requirement in paragraph 4.7.3.2.2.2 of Department of Defense Instruction 5000.2, as in effect on the date of enactment of this Act, that technology must have been demonstrated in a relevant environment (or, preferably, in an operational environment) to be considered mature enough to use for product development in systems integration.

(b) CONTENTS OF REPORTS.—Each report required by subsection (a) shall—

(1) identify each case in which a major defense acquisition program entered system development and demonstration during the preceding calendar year and into which key technology has been incorporated that does not meet the technological maturity requirement described in subsection (a), and provide a justification for why such key technology was incorporated; and

(2) identify any determination of technological maturity with which the Deputy Under Secretary of Defense for Science and Technology did not concur and explain how the issue has been or will be resolved.

(c) MAJOR DEFENSE ACQUISITION PROGRAM DEFINED.—In this section, the term "major defense acquisition program" has the meaning given that term in section 139(a)(2) of title 10, United States Code.

THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

APR 12 2002

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
ASSISTANT SECRETARIES OF DEFENSE
INSPECTOR GENERAL, DEPARTMENT OF DEFENSE
GENERAL COUNSEL, DEPARTMENT OF DEFENSE
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Evolutionary Acquisition and Spiral Development

Since the publication of DoD Directive 5000.1 and DoD Instruction 5000.2, in which the Department established a preference for the use of evolutionary acquisition strategies relying on a spiral development process, there has been some confusion about what these terms mean and how spiral development impacts various processes such as contracting and requirements generation that interface with an evolutionary acquisition strategy. The purpose of this memorandum is to address those questions.

Evolutionary acquisition and spiral development are methods that will allow us to reduce our cycle time and speed the delivery of advanced capability to our warfighters. These approaches are designed to develop and field demonstrated technologies for both hardware and software in manageable pieces. Evolutionary acquisition and spiral development also allow insertion of new technologies and capabilities over time. Therefore, these approaches provide the best means of getting advanced technologies to the warfighter quickly while providing for follow-on improvements in capability. Evolutionary acquisition and spiral development are similar to pre-planned product improvement but are focused on providing the warfighter with an initial capability which may be less than the full requirement as a trade-off for earlier delivery, agility, affordability, and risk reduction.

Attached is a set of definitions. My points of contact for further information are Skip Hawthorne in the Acquisition Initiatives office, 703-697-6399, skip.hawthorne@osd.mil, or Ramona Lush in the Acquisition Resources and Analysis office, 703-695-5166, ramona.lush@osd.mil.

E.C. Aldridge, Jr.

Attachment
As stated

DEFINITIONS

Evolutionary Acquisition. An acquisition strategy that defines, develops, produces or acquires, and fields an initial hardware or software increment (or block) of operational capability. It is based on technologies demonstrated in relevant environments, time-phased requirements, and demonstrated manufacturing or software deployment capabilities. These capabilities can be provided in a shorter period of time, followed by subsequent increments of capability over time that accommodate improved technology and allowing for full and adaptable systems over time. Each increment will meet a militarily useful capability specified by the user (i.e., at least the thresholds set by the user for that increment); however, the first increment may represent only 60% to 80% of the desired final capability.

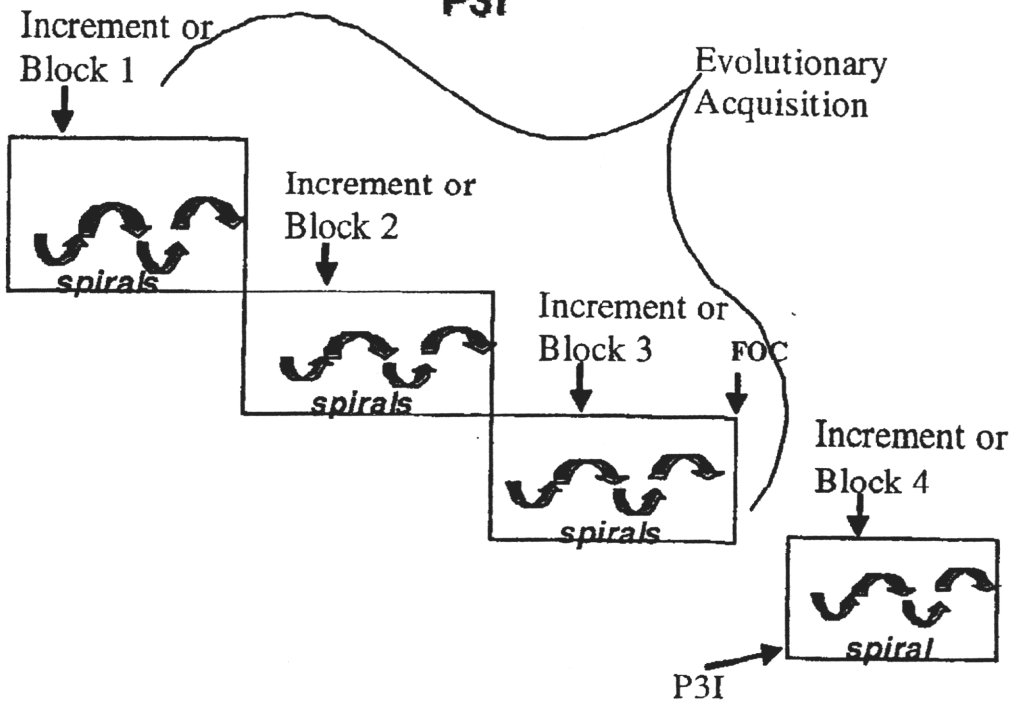
There are two basic approaches to evolutionary acquisition. In one approach the ultimate functionality can be defined at the beginning of the program, with the content of each deployable increment determined by the maturation of key technologies. In the second approach the ultimate functionality cannot be defined at the beginning of the program, and each increment of capability is defined by the maturation of the technologies matched with the evolving needs of the user.

Spiral Development. An iterative process for developing a defined set of capabilities within one increment. This process provides the opportunity for interaction between the user, tester, and developer. In this process, the requirements are refined through experimentation and risk management, there is continuous feedback, and the user is provided the best possible capability within the increment. Each increment may include a number of spirals. Spiral development implements evolutionary acquisition.

Increment or Block. A militarily useful and supportable operational capability that can be effectively developed, produced or acquired, deployed, and sustained. Each increment of capability will have its own set of thresholds and objectives set by the user.

Pre-Planned Product Improvement (P3I). A traditional acquisition strategy that provides for adding improved capability to a mature system.

Evolutionary Acquisition, Spiral Development, & P3I



OFFICE OF THE DIRECTOR OF
DEFENSE RESEARCH AND ENGINEER
3040 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-3040

JUL 12 2001

MEMORANDUM FOR ODUSD(S&T) DIRECTORS

SUBJECT: Interim Guidance for Implementing Technology Readiness Levels

The new June 10, 2001 updated Department of Defense Regulation 5000.2R, Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs reflects the Science and Technology (S&T) role in the acquisition process. The S&T community must be actively engaged in enabling the rapid transition of mature technologies to product developers and actively participate in acquisition system integrated product teams. The regulation requires that the Component Science and Technology Executives conduct a technology readiness level (TRL) assessment (or some equivalent assessment) for critical technologies identified in ACAT ID and ACAT IAM programs prior to Milestone B and C. In cooperation with the Component S&T Executive and program office, the DUSD (S&T) must evaluate this assessment (including the Technology Readiness Level for each critical technology) and forward a concurrence with these findings to the Overarching Integrated Product Team Leader and the Defense Acquisition Board. It should be noted that TRL assessments are the preferred approach for all new programs unless DUSD (S&T) approves an equivalent assessment method.

The DSTAG recommended that a TRL IPT be established to define the guidelines and framework for implementing and applying TRLs in a consistent manner throughout the Department. The IPT developed guidelines for the S&T community to use in implementing TRL during the process. The attached interim guidelines include:

- Technology Readiness Assessment Process (Attachment 1)
- Definitions of Technology Readiness Levels (Attacment 2)
- Elements for a Technology Readiness Agreements including a sample (not mandatory) (Attachment 3)

Your active leadership and participation in your technical area plays a significant role in the implementation of TRLs across the Department. As shown in the TRL Process chart, we will be required to validate TRL assessments conducted by the Component S&T Executives. Attachment 4 is an example of a format that can be used in reviewing the TRL assessment of an acquisition

program. Note that our review needs to be signed by both the technical action offices and his/her director. As a recognized partner in the acquisition process, we must insert ourselves much earlier in the process. I personally encourage each of you and your staffs to be actively involved during the identification of critical technologies process and in the Working Integrated Product Teams (WIPTs) for ACAT ID and ACAT IAM programs.

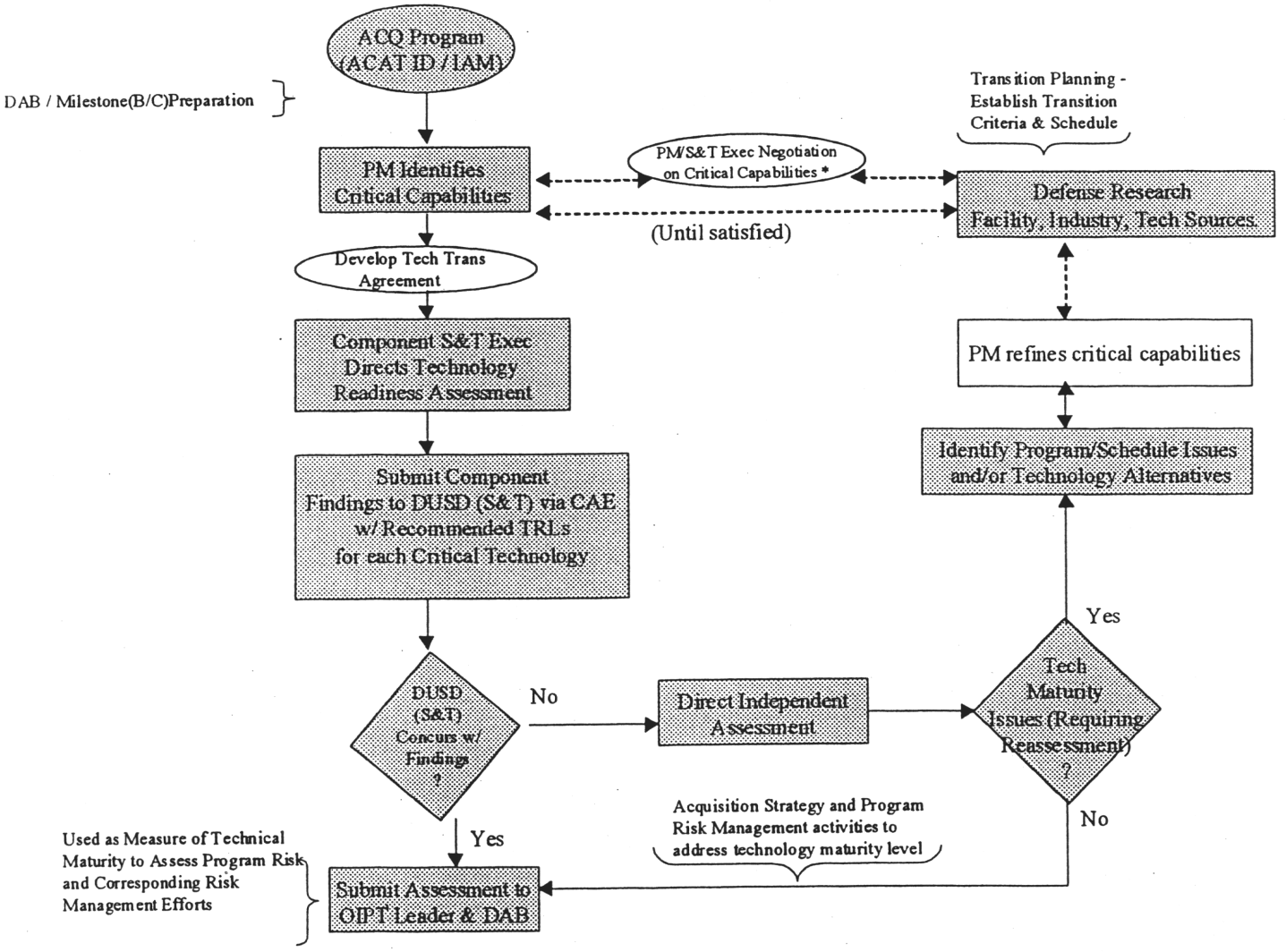
The S&T Plans and Programs office is responsible for maintaining a list of all ACAT ID AND acat iam programs requiring technology assessments and maintaining a copy of DUSD(S&T)'S review of TRL assessments. If you have any questions or comments, please contact Mr. Al Shaffer, Director, S&T Plans and Programs at (703) 695-9604.

Delores M. Etter

Delores M. Etter
Deputy Under Secretary of Defense
(Science and Technology)

Attachments:
As stated.

TECHNOLOGY READINESS ASSESSMENT PROCESS



* NO NEGOTIATION ON TRL ASSESSMENT

Attachment 1

DEFINITIONS OF TECHNOLOGY READINESS LEVEL

The following table lists the various technology readiness levels and descriptions from a systems approach for both HARDWARE and SOFTWARE.(Components may provide additional clarifications for Software)

Technology Readiness Level	Description
1. Basic principles observed and reported.	Lowest Level of Technology Readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.
2. Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there is no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
3. Analytical and experimental critical functions and/or characteristic proof of concept.	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Component and/or breadboard validation in laboratory environment.	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.
5. Component and/or breadboard validation in relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that it can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.
6. System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment, or in a simulated operational environment.
7. System prototype demonstration in an operational environment.	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment, such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
8. Actual system completed and "flight qualified" through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9. Actual system "flight proven" though successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of system development. Examples include using the system under operational mission conditions.

DEFINITIONS:

BREADBOARD: Integrated components that provide a representation of a system/subsystem and which can be used to determine concept feasibility and to develop technical data. Typically configured for laboratory use to demonstrate the technical principles of immediate interest. May resemble final system/subsystem in function only.

"HIGH FIDELITY": Addresses form, fit and function. High fidelity laboratory environment would involve testing with equipment that can simulate and validate all system specifications within a laboratory setting.

"LOW FIDELITY": A representative of the component or system that has limited ability to provide anything but first order information about the end product. Low fidelity assessments are used to provide trend analysis.

MODEL: A reduced scale, functional form of a system, near or at operational specification. Models will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.

OPERATIONAL ENVIRONMENT: Environment that addresses all of the operational requirements and specifications required of the final system to include platform/packaging.

PROTOTYPE: The first early representation of the system which offers the expected functionality and performance expected of the final implementation. Prototypes will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.

RELEVANT ENVIRONMENT: Testing environment that simulates the key aspects of the operational environment.

SIMULATED OPERATIONAL ENVIRONMENTAL: Environment that can simulate all of the operational requirements and specifications required of the final system or a simulated environment that allows for testing of a virtual prototype to determine whether it meets the operational requirements and specifications of the final system.

ELEMENTS OF TECHNOLOGY TRANSITION AGREEMENT

The following elements should be considered for inclusion in a technology agreement between an acquisition program, the intended receiver of a technology or capability development, and a science and technology activity, the developer and provider of the technology. Not every one of these elements is appropriate for every agreement, but each agreement should have considered these for inclusion.

Agreements, to be effective, must be reviewed periodically with both S&T management and program office management representatives participating. These reviews should address technical progress and future directions.

Elements to be provided by the Program Office:

a. **Target Acquisition Program.** A brief description of the acquisition program intended to receive the technology that is to be transitioned. Include major program objectives, current phase of acquisition life cycle, and projected initial operational capability date.

b. **Program Manager/Project Officer.** Program manager and individual in program office responsible for day-to-day management with contact information.

c. **Acquisition Program Technology Need.** Brief description of the benefit that this technology will bring to the acquisition program, or need satisfied. Where possible, relate benefit to ORD, KPP, etc. Include need dates for specific capabilities.

d. **Integration Strategy.** Describe the process for integrating the technology into the acquisition program. Include elements of acquisition strategy – evolutionary acquisition, block upgrade, etc., as well as required contractor to contractor agreements

Elements to be provided by S&T Activity

a. **Description of Technology or Capability to be Delivered.** Brief description of what the S&T activity intends to develop for transition to the acquisition program. Include capability delivery dates.

b. **Technology Manager.** Individual designated by the S&T activity to be the coordinator and day-to-day manager of the development of the needed technology.

c. **Current Status of Technology.**

   1. **Status Summary.** Summarize current state of development. Identify primary areas where additional development is required. Provide estimate of current TRL.

2. **Risk Analysis.** Major areas of risk, prioritized, with planned mitigation activities. Include technical (e.g., producibility, affordability, sustainability) cost, and schedule risks.

d. **Technology Development Strategy**. Outline approach planned. Efforts required beyond those currently underway; integration plans if multiple projects are planned. Planned ATD or ACTD developments, if applicable

e. **Key Technical Measures of Readiness to Transition**. Identify the key parameters or attributes that will be used to measure whether or not the technology development effort is proceeding appropriately. Include parameter to be tracked, current state, interim progress estimates, and final objective. Technology Readiness Levels are a measure of technical maturity and can be used to assess readiness to transition.

f. **Program Plan.** Show major activities/efforts comprised by the technology development activity with milestones.

Signatures. Technology transition agreements should be signed as required to commit the participating organizations to the plan outlined in the agreement. The program manager(s) of the acquisition program(s) involved and the S&T project manager, should sign.

- SAMPLE -

TECHNOLOGY TRANSITION AGREEMENT

Basic Transition Agreement

1. **Description of Technology or Capability to be Delivered.**

2. **Target Acquisition Program.**

3. **Acquisition Program Technology Need**

4. **Integration Strategy**

5. **Program Manager/Project Officer**

6. **Technology Manager**

Technical Details and Programmatics

1. **Technology – Current Status**

   a. **Summary – Status**

   b. **Risk Analysis**

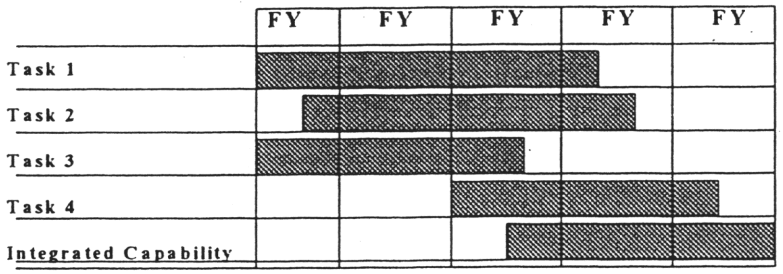
Top Risks	Brief Description	Mitigation Strategy

2. **Technology Development Strategy.**

3. **Key Measures of Transition Readiness**

Attribute/Parameter	Current	Interim (w/Est Date)	Final Objective

4. **Program Plan**



SIGNATURES:

Acquisition PM **S&T Project Manager**

ODUSD (S&T)/WS UH-60M Program
Technology Readiness Level Assessment

The UH-60M Program TRL assessment is grouped into three categories. They are Cockpit Digitization, Propulsion, and Airframe. These categories are subdivided into 16 individual TRL assessments. Source information for this appraisal includes direct knowledge of specific supporting science and technology (S&T) activities, documentation provided by the SAALT staff, and information derived from the DOT&E website on Black Hawk modernization at http://www.dote.osd.mil/reports/FY00/army/00blackhawkuh60.html.

Category 1 - Cockpit Digitization

Element 1 - Stormscope

- Army Assessment: 8 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Commercial-off-the-Shelf (COTS) item, already fielded on the UH-60Q and HH-60L

Element 2 - Dual Embedded GPS Inertial (EGI) Navigation System

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: EGI has flown on CH-47 and MH-60K. Apache Program is currently demonstrating/qualifying an updated version.

Element 3 - Cockpit Voice Recorder (CVR)/Flight Data Recorder (FDR)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: COTS component. Technology demonstrated on the MH-60K Program and civil aviation aircraft. Qualification efforts ongoing for MH-60K and MH-47E fleets.

Element 4 - Advanced Flight Control Computer (AFCC)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Based upon SH-60 and S-92 architecture. Qualification testing is ongoing.

Element 5 - Improved Data Modem (IDM)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: IDM currently in use on OH-58D and AH-64 platforms.

Category 2 - Propulsion

Element 1 - Crashworthy External Fuel System (CEFS)

- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Product of a Cooperative Research and Development Agreement intended to improve the crashworthiness and reduce the ballistic vulnerability of the existing Extended Range Fuel System (ERFS). Airworthiness Qualification Testing ongoing.

ODUSD (S&T)/WS UH-60M Program
Technology Readiness Level Assessment (cont'd)

Category 2 – Propulsion (cont'd)

Element 2 - Wide Chord Blade (WCB)
- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: DoD Dual Use Application Program COSSI effort to qualify a commercially developed main rotor blade for use in the military environment. Airworthiness Qualification Testing ongoing.

Element 3 - T700-GE-701C Engine
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Currently fielded on the UH-60L with over 400 A/C, 2 engines per A/C

Element 4 - Improved Durability Gearbox (IDGB), Rotorhead & Control
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Currently fielded on the UH-60L with over 400 A/C

Element 5 - Improved Infrared (IR) Suppressor
- Army Assessment: 7 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Discrete Design Modifications to HIRSS currently installed on the UH-60 fleet. System flight demonstrations completed with no significant issues noted.

Category 3 - Airframe

Element 1 - Refurbishment
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: No new technologies or materials being used in refurbishment efforts.

Element 2 - Standardization
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Using existing Maintenance Work Orders for the current version of the UH-60L aircraft.

Element 3 - Tailcone & Stabilator
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Being accomplished already on the UH-60A/L aircraft.

Element 4 - Transition Access Door
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: Same modification being accomplished on the UH-60Q.

ODUSD (S&T)/WS UH-60M Program
Technology Readiness Level Assessment (cont'd)

Category 3 – Airframe (cont'd)

Element 5 - Electro Magnetic Interference (EMI) Wiring
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: No new technologies or materials required. Material solution for the UH-60M is currently fielded wiring or that used on MH-60K.

Element 6 - External Stores Support System (ESSS)
- Army Assessment: 9 DUSD (S&T) Assessment: Concur
- Supporting Rationale: No new technologies required. Currently fielded on the UH-60L.

Action Officer: >>Signed<< Date:_____
Paul F. Piscopo, Staff Specialist for Aircraft Systems

Director: >>Signed<< Date:_____
George Ullrich, Director, Weapons Systems Directorate

Prepared by: Mr. Paul F. Piscopo, ODUSD (S&T)/WS, 06/06/01 Attachment 4

OFFICE OF THE DIRECTOR OF
DEFENSE RESEARCH AND ENGINEERING
3040 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-3040

SEP 6 2001

MEMORANDUM FOR DIRECTOR, STRATEGIC AND TACTICAL SYSTEMS
PRINCIPAL DIRECTOR, DASD (C3IISR/SPACE)

SUBJECT: Deputy Under Secretary of Defense (Science and Technology) (DUSD(S&T)) Staff Participation in OIPTs

In light of the recent change to the DoD 5000 series, the expanded role of S&T in the acquisition process requires Science and Technology (S&T) staff officers become active members of Overarching Integrated Product Teams (OIPT) for ACAT ID and ACAT IAM programs. The regulation requires that the Component Science and Technology Executives conduct a technology readiness level (TRL) assessment (or some equivalent assessment) for critical technologies identified in ACAT ID and ACAT IAM programs prior to Milestone B and C. In cooperation with the Component S&T Executive and program office, the DUSD(S&T) must evaluate this assessment and forward a concurrence with these findings to the Overarching Integrated Product Team Leader and the Defense Acquisition Board. Through active participation in OIPTs, the S&T staff officer can make informed recommendations to the DUSD(S&T).

I have attached a list of known major programs that identifies an S&T staff member for each program. The S&T Plans and Programs office is responsible for maintaining the master list. My point of contact for this effort is Beth Foster who can be reached at (703)614-9442, beth.foster@osd.mil.

Alan R. Shaffer
Director, S&T Plans and Programs

Attachment

ACAT ID AND ACAT IAM LIST
As of September 4, 2001

Service/Program	S&T Directorate	S&T Staff Officer
ARMY		
ATACMS-BAT – Army Tactical Missile System-Brilliant Anti-Armor Submunition	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
COMANCHE – Reconnaissance Attack Helicopter	Weapon Systems	Dr. Lew Sloter (703)588-7405 lewis.sloter@osd.mil
CRUSADER – Advanced Field Artillery System/Future Armored Resupply Vehicle	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil
FBCB2 – Force XXI Battle Command Brigade and Below Program	Information Systems	Maj Jim Sweeney (703)588-7412 james.sweeney@osd.mil
IAV – Interim Armor Vehicle	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil
MCS (ATCCS) – Maneuver Control System	Information Systems	Dr. Eric Landree (703)588-7415 eric.landree@osd.mil
NAVY		
AAAV – Advanced Amphibious Assault Vehicle	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil
ALAM – Advanced Land Attack Missile	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
CEC – Cooperation Engagement Capability	Information Systems	CAPT Frank Garcia (703)588-7411 frank.garcia@osd.mil
CVN(X) – Next Generation Nuclear Aircraft Carrier	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil
DD 21 – 21st Century Destroyer Program	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil
JSOW/UNITARY – Joint Stand-Off Weapon with Unitary Warhead variant	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
LPD 17 – Amphibious Assault Ship	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil
MIDS-LVT – MultiFunctional Information Distribution System-Low Volume Terminal	Information Systems	Maj Jim Sweeney (703)588-7412 james.sweeney@osd.mil
SSN 774 – VIRGINIA CLASS Submarine	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil

T-AKE – Auxiliary Dry Cargo Ships	Weapon Systems	Mr. Jack Taylor (703)588-7405 jack.taylor@osd.mil
USMC H-1 Upgrades – Marine Corps Mid-life Upgrade to AH-1W Attack Helicopter and UH-1N Utility Helicopter	Weapon Systems	Dr. Lew Sloter (703)588-7405 lewis.sloter@osd.mil
AIR FORCE		
ABL – Airborne Laser	Weapon Systems	Mr. Keith Truesdell (703)588-7408 keith.truesdell@osd.mil
AEHF – Advanced Extremely High Frequency Program	Information Systems	Dr. Steve King (703)588-7414 steven.king@osd.mil
C-130 AMP – C-130 Aircraft Avionics Modernization Program	Sensor Systems	Mr. Jeff Paul (703)588-7442 jeffrey.paul@osd.mil
C-5 RERP – C5 Aircraft Reliability and Reengining Program	Weapon Systems	Mr. Mike Richman (703)588-7430 michael.richman@osd.mil
EELV – Evolved Expendable Launch Vehicle	Sensor Systems	Mr. Andy Culbertson (703)588-7407 andy.culbertson@osd.mil
F-22 – Advanced Tactical Fighter	Weapon Systems	Dr. Lew Sloter (703)588-7405 lewis.sloter@osd.mil
GBS – Global Broadcast Service	Information Systems	Maj Jim Sweeney (703)588-7412 james.sweeney@osd.mil
JASSM – Joint Air-to-Surface Standoff Missile	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
JDAM – Joint Direct Attack Munition	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
MP RTIP – Multi-Platform Radar Technology Insertion Program	Sensor Systems	Mr. Jeff Paul (703)588-7442 jeffrey.paul@osd.mil
MILSTAR – Satellite Low Data Rate/Medium Data Rate Communication System	Information Systems	Mr. John Grosh (703)588-7413 john.grosh@osd.mil
NAVSTAR GPS – Global Positioning System	Sensor Systems	Mr. Jeff Paul (703)588-7442 jeffrey.paul@osd.mil
RTIP – Radar Technology Insertion Program for JSTARS Aircraft	Sensor Systems	Mr. Jeff Paul (703)588-7442 jeffrey.paul@osd.mil
SBIRS – Space-Based Infrared System Program	Information Systems Sensor Systems	CAPT Frank Garcia (703)588-7411 frank.garcia@osd.mil Mr. Andy Culbertson (703)558-7407 andrew.culbertson@osd.mil

WIDEBAND GAPFILLER – Wideband communications satellite system to fill the gap between DCS/GBS and Advanced Wideband System	Sensor Systems	Mr. Jeff Paul (703)588-7442 jeffrey.paul@osd.mil
DoD		
PATRIOT PAC-3 – Patriot Advanced Capability	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
Navy Area TBMD – Navy Area Theater Ballistic Missile Defense	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
NMD – National Missile Defense Program	Sensor Systems	Mr. Andy Culbertson (703)588-7407 andrew.culbertson@osd.mil
THAAD – Theater High Altitude Area Defense	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
NTW – Navy Theater Wide Ballistic Missile Defense	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
MEADS – Medium Extended Air Defense System	Weapon Systems	Mr. Art McGregor (703)588-7406 arthur.mcgreor@osd.mil
JSF – Joint Strike Fighter	Weapon Systems	Dr. Lew Sloter (703)588-7405 lewis.sloter@osd.mil
JSIMS – Joint Simulation System	DMSO	CAPT Mike Lilienthal (703)988-0660 mlilienthal@dmso.mil
NPOESS – National Polar-Oribiting Operational Environmental Satellite System	Information Systems	CAPT Frank Garcia (703)588-7411 frank.garcia@osd.mil

TERMS OF REFERENCE
FOR
TECHNOLOGY READINESS LEVEL (TRL)
INTEGRATED PRODUCT TEAM (IPT)

PURPOSE:

DoD 5000.2-R requires technology readiness assessments for critical technologies occur prior to milestone decision point B and C to provide useful technology maturity information to the acquisition review process. It states further that technology readiness assessments shall examine program concepts, technology requirements, and demonstrated technology capabilities to determine technology maturity. To ensure this is accomplished in a consistent manner throughout DoD, the Defense Science and Technology Advisory Group established this TRL IPT to define guidelines and a framework for implementing and applying TRLs.

SCOPE:

The IPT will conduct the following actions:

- Develop guidelines for implementing and applying TRLs consistently throughout DoD for both hardware and software.
- Establish a repeatable process to the extent possible for assessing technology readiness consistently across the Services and Agencies.
- Identify impediments and issues for applying TRLs and conducting technology readiness assessments.
- Identify funding issues associated with the transition between TRL 6 and TRL 7.
- Define the application of TRLs to the insertion of commercial technology in new and/or legacy systems.
- Identify training requirements in support of TRL implementation strategy.

ROLES AND RESPONSIBILITIES:

The IPT is sponsored by the Deputy Under Secretary of Defense (Science and Technology) in conjunction with the Defense Science and Technology Advisory Group. Mr. Alan Shaffer will serve as IPT Chair. The IPT membership will be composed of Service and Agency Representatives identified by the S&T Executives as well as Service Acquisition Representatives. The current membership is contained in attachment 1.

The IPT Chair will provide status briefings to the Defense S&T Advisory Group biweekly.

DELIVERABLES:

The IPT deliverable will include a set of guidelines for applying TRLs and a notional process flowchart for implementing TRLs consistently throughout DoD.

THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-3010

ACQUISITION AND TECHNOLOGY

MEMORANDUM FOR SERVICE ACQUISITION EXECUTIVES
DIRECTOR, ACQUISITION INITIATIVES
DEPUTY ASSISTANT SECRETARY OF THE ARMY (RESEARCH AND TECHNOLOGY)
CHIEF OF NAVAL RESEARCH
DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE (SCIENCE, TECHNOLOGY AND ENGINEERING)
CHIEF SCIENTIST, MISSILE DEFENSE AGENCY
DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
DIRECTOR, DEFENSE THREAT REDUCTION AGENCY

SUBJECT: Technology Readiness Assessment (TRA) Policy

The 5000 series acquisition policy documents require technology readiness assessments prior to Milestone B and C decisions. The purpose of these assessments is to provide information to the Defense Acquisition Board on the maturity of critical technologies. Following a recommendation by the Business Initiative Council to revise the TRA procedures, the Office of the Director of Defense Research and Engineering led an Integrated Product Team (IPT) review of the process. Based on this review, we remain committed to conducting TRAs for all ACAT ID and ACAT IAM programs.

The effectiveness of the TRA process relies upon early and continuous communication between the acquisition and science and technology communities—especially in the determination of a program's critical technologies. To facilitate collaboration, the IPT recommended that technology maturity agreements (TMAs) be prepared for all ACAT 1D and ACAT IAM programs. I support the recommendation and request the acquisition community develop TMAs for all programs. This process is intended to eliminate unnecessary reviews by having an up front agreement on which, if an, critical technologies require more extensive assessment. The attached policy guidance is effective immediately and will be incorporated in the next update to the 5000 series.

E.C. Aldridge

Attachments:
As stated

Changes to DoD 5000.2-R

Insert new paragraph after C7.5.4 requiring formal technology maturity agreements as follows:

C7.5.5. The PM responsible for the acquisition of a system shall work with the Component S&T community and provide the technical information required for assessing the maturity of critical technologies. To facilitate the technology readiness assessment process, the PM and Component S&T Executive shall jointly prepare a Technology Maturity Agreement (TMA). TMAs shall include all relevant parties, i.e., activities that are essential in the identification, assessment and maturation of critical technologies, as signatories, and may suffice for the TRA if all critical technologies are mature. The primary purposes of the agreement are to provide early determination of critical technologies and to initiate the necessary collaboration between the acquisition and S&T communities. The agreements will serve as a baseline for the decisional assessment required for Milestones B and C. The TMA should be prepared as early as possible, but at least 120 days prior to the DAB. The DDR&E shall review all TMAs for ACAT ID and ACAT IAM programs. The PM shall keep the agreement current and in a validated status. There is no mandatory format for the TMAs, however, a recommended format is at Appendix __.

Change paragraph C7.5.3 as follows to eliminate unnecessary TRAs:

C7.5.3. The DoD Component Science and Technology (S&T) Executive shall direct the technology readiness assessment and, for ACAT ID and ACAT IAM programs, submit the findings to the CAE who shall submit his or her report to the DDR&E with a recommended technology readiness level (TRL) (or some equivalent assessment) for each critical technology. When the Component S&T Executive submits his or her findings to the CAE, he or she shall provide the DDR&E an information copy of those findings. In cooperation with the Component S&T Executive and the program office, the DDR&E shall evaluate the technology readiness assessment and, if he/she concurs, forward findings to the OIPT leader and DAB. The Component S&T Executive's assessment can be based on the TRA conducted by the PM or any other assessment, developed separately by the Component S&T or be a combination of both. If the DDR&E does not concur with the technology readiness assessment findings, an independent technology readiness assessment, under the direction of the DDR&E, shall be required.

ACRONYMS/GLOSSARY

AAAV	Advanced Amphibious Assault Vehicle
ABL	Airborne Laser
ACAT	Acquisition Category
ACQ	Acquisition
ACTD	Advanced Concept Technology Demonstration
AEHF	Advanced Extremely High Frequency
AFCC	Advanced Flight Control Computer
ALAM	Advanced Land Attack Missile
ATACMS-BAT	Army Tactical Missile System-Brilliant Anti-Armor Submunition
ATCCS	Army Tactical Command and Control System
ATD	Advanced Technology Demonstration
C-130 AMP	C-130 Avionics Modernization Program
C3	command, control, and communications
C-5 RERP	C-5 Aircraft Reliability and Reengining
CAE	Component Acquisition Executive
CEC	Cooperation Engagement Capability
CEFS	Crashworthy External Fuel System
COMANCHE	Reconnaissance Attack Helicopter
COSSI	Cost and Operation and Support Savings Initiative
COTS	commercial off-the-shelf
CRUSADER	Advanced Field Artillery System/Future Armored Resupply Vehicle
CVN(X)	Next Generation Nuclear Aircraft Carrier
CVR	Cockpit Voice Recorder
DAB	Defense Acquisition Board
DASD	Deputy Assistant Secretary of Defense
DCS	Defense Communications System
DD 21	21st Century Destroyer Program
DDR&E	Director of Defense Research and Engineering
DoD	Department of Defense
DOT&E	Director of Operational Test and Evaluation
DSTAG	Defense Science and Technology Advisory Group
DUSD(S&T)	Deputy Under Secretary of Defense for Science and Technology

EELV	Evolved Expendable Launch Vehicle
EFRS	Extended Range Fuel System
EGI	Embedded GPS Inertial
EMI	electromagnetic interference
ESSS	External Stores Support System
F-22	Advanced Tactical Fighter
FBCB2	Force XXI Battle Command Brigade and Below Program
FDR	Flight Data Recorder
FY	Fiscal Year
GBS	Global Broadcast Service
GPS	Global Positioning System
HIRSS	Hover Infrared Suppression System
IAV	Interim Armor Vehicle
IDGB	Improved Durability Gearbox
IDM	Improved Data Modem
IPT	Integrated Product Team
IR	Infrared
JASSM	Joint Air-to-Surface Standoff Missile
JDAM	Joint Direct Attack Munition
JSF	Joint Strike Fighter
JSIMS	Joint Simulation Program
JSOW/UNITARY	Joint Stand-Off Weapon With Unitary Warhead Variant
JSTARS	Joint Surveillance Target Attack Radar System
KPP	Key Performance Parameter
LPD	Amphibious Assault Ship
MAIS	Major Automated Information System
MCS	Maneuver Control System
MDAP	Major Defense Acquisition Program
MEADS	Medium Extended Air Defense System
MIDS-LVT	MultiFunction Information Distribution System-Low Volume Terminal
MILSTAR	Military Strategic, Tactical & Relay (Satellite Low Data Rate/Medium Data Rate Communication System)
MP RTIP	Multi-Platform Radar Technology Insertion Program
NAVSTAR GPS	Navigation Satellite Timing & Ranging Global Positioning System

NMD	National Missile Defense
NPOESS	National Polar-Orbiting Operational Environmental Satellite System
NTW	Navy Theater Wide
ODUSD(S&T)	Office of the Deputy Under Secretary of Defense for Science and Technology
OIPT	Overarching Integrated Product Team
ORD	Operational Requirements Document
P3I	Pre-Planned product Improvement
PAC	PATRIOT Advanced Capability
PM	Program Manager
RTIP	Radar Technology insertion Program (for JSTARS Aircraft)
S&T	Science and Technology
SAALT	Secretary of the Army for Acquisition, Logistics, and Training
SBIRS	Space-Based infrared System
SSN	VIRGINIA Class Submarine
T-AKE	Auxiliary Dry Cargo Ship
TBMD	Theater Ballistic Missile Defense
THAAD	Theater High Altitude Defense
TMA	Technology Maturity Agreement
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
USMC H-1	Marine Corps Mid-life Upgrade to AH-1 Attack Helicopter and UH-1N Utility Helicopter
WCB	Wide Chord Blade
WIDEBAND GAPFILLER	Wideband communications satellite system to fill the gap between DCS/GBS and Advanced Wideband System
WIPT	Working Level Integrated Product Team

APPENDIX E
TECHNOLOGY READINESS LEVEL (TRL) EXAMPLES

Table III-1 of the TRA Deskbook contains the definitions of the various TRLs and notes some of the information that supports assignment of a technology to specific levels of readiness. To aid in making the definitions more concrete, this appendix contains several examples of readiness levels for technologies as the evolved to full maturity.

Ring Laser Gyro[3] E-3
Technology Steel Readiness Levels Example: HSLA-100 Steel for Aircraft Carrier Structure[4] E-13

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[3] Compliments of the Army, in which the evolution of a technology is depicted graphically.

[4] Compliments of the Navy, in which the evolution of a materials technology is presented, with a full description at each TRL.

RING LASER GYRO

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
1	Basic Principles observed and reported	**Basic research** – Invention of Gas Laser
2	Technology concept and/or application formulated.	**Basic research** – Invention of Ring Laser. Theoretical description of Ring Laser Gyro
3	Analytical and experimental critical function and/or characteristic proof of concept.	**Applied research** – Demonstration of Ring Laser as a rate sensor
4	Component and/or breadboard validation in laboratory environment.	**Applied research** – Demonstration of Ring Laser Gyro (RLG)-based Inertial Measurement Unit (IMU) operation under temperature, shock, vibration, and g-loading
5	Component and/or breadboard validation in relevant environment.	**Advanced Technology Demonstration** – Demonstration of HG1700-based guidance set components (IMU, GPS receiver, control system, flight computer) in a high-fidelity hardware-in-the-loop facility
6	System/subsystem model or prototype demonstrated in a relevant environment.	**Advanced Technology Demonstration** – Demonstration of actual flight-ready HG1700-based guidance set in a high-fidelity hardware-in-the-loop facility and under expected levels of shock, vibration, altitude and temperature
7	System prototype demonstrated in an operational environment.	**System Design and Development** – Demonstration of actual Guided MLRS missile in a flight test sequence from an operational launcher. Successful operation in multiple flight demonstrations
8	Actual system completed and "flight qualified" through test and demonstration.	**Low Rate Initial Production** – Developmental Test and Evaluation of GMLRS in its final form under mission conditions.
9	Actual system "flight proven" through successful mission operations.	**Production** – Operational Test and Evaluation of GMLRS by the soldier, airman, or seaman.

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
1	Basic Principles observed and reported	**Basic research** – Invention of Gas Laser
2	Technology concept and/or application formulated.	**Basic research** – Invention of Ring Laser. Theoretical description of Ring Laser Gyro

Laser

Research

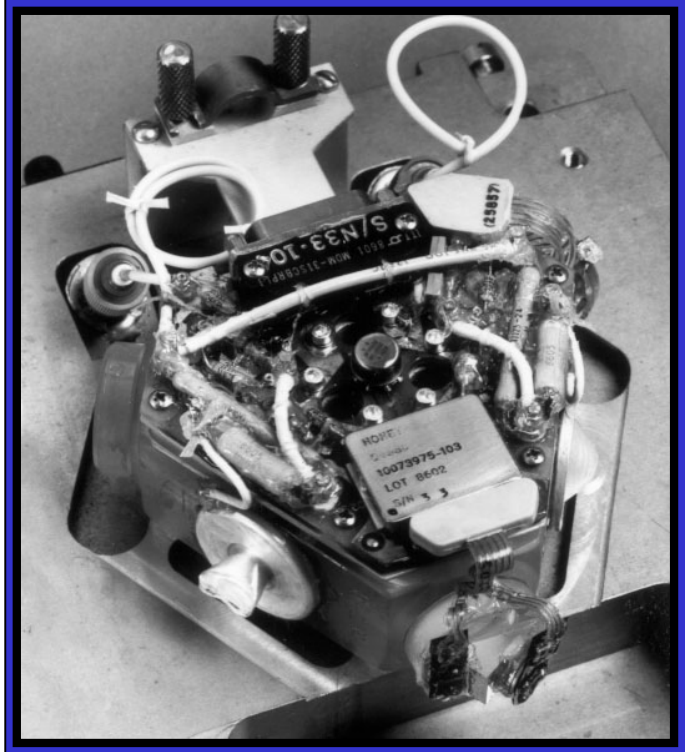
Facility

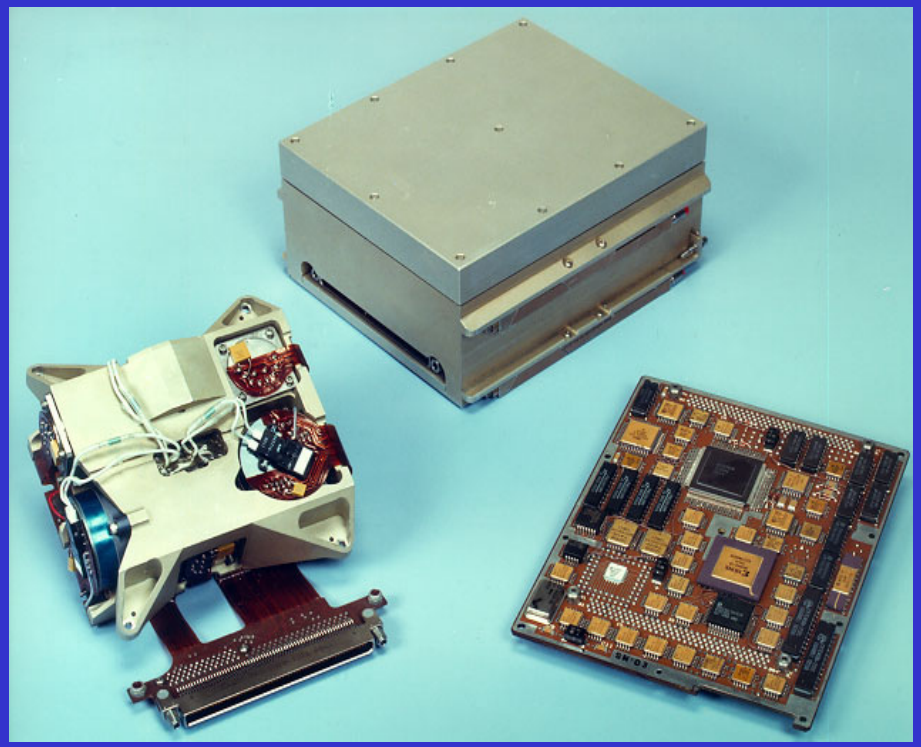
circa 1960

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
3	Analytical and experimental critical function and/or characteristic proof of concept.	**Applied research** – Demonstration of Ring Laser as a rate sensor

Ring Laser Gyro circa 1975

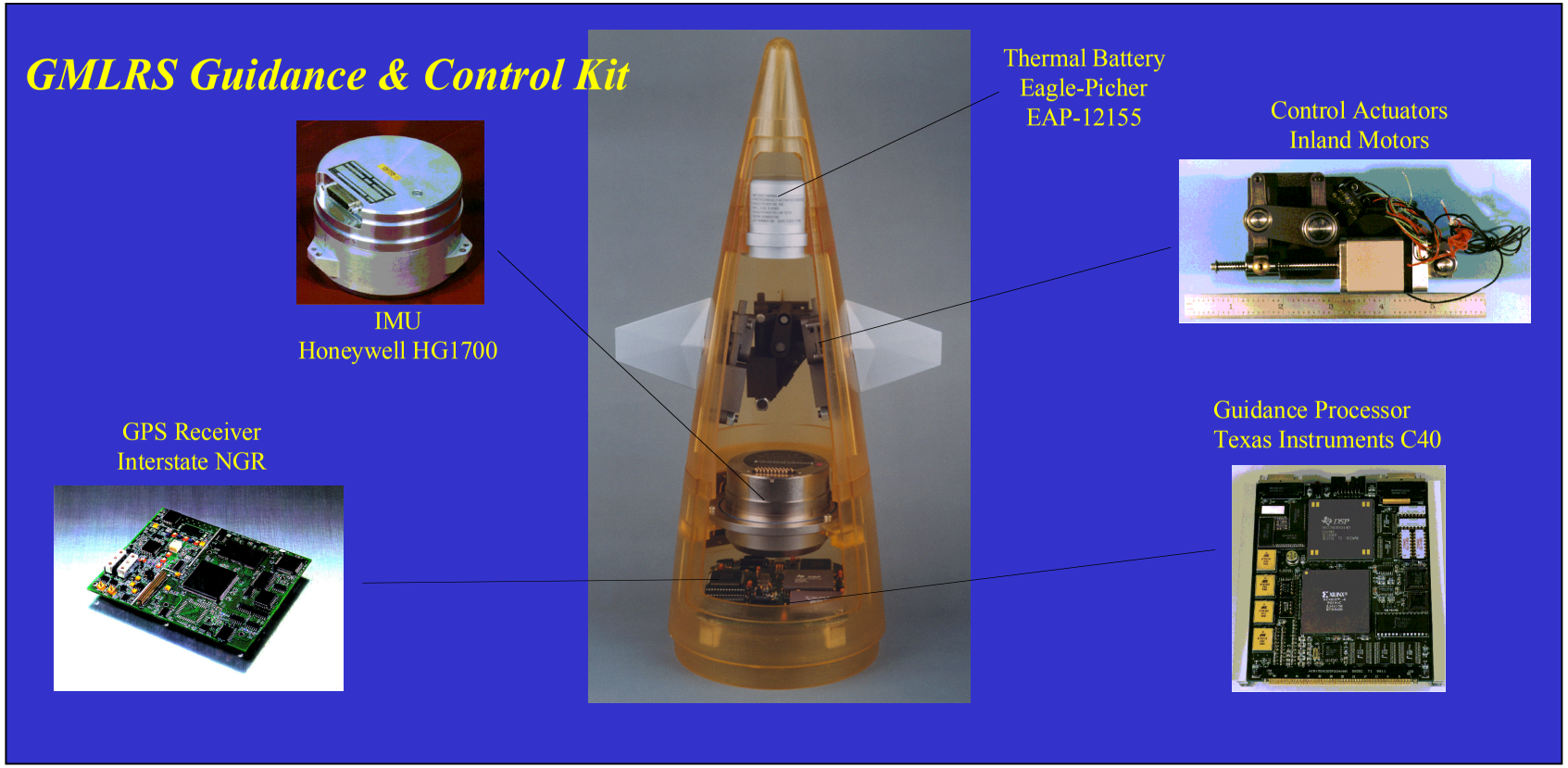




HG1108 Inertial Measurement Unit circa 1990

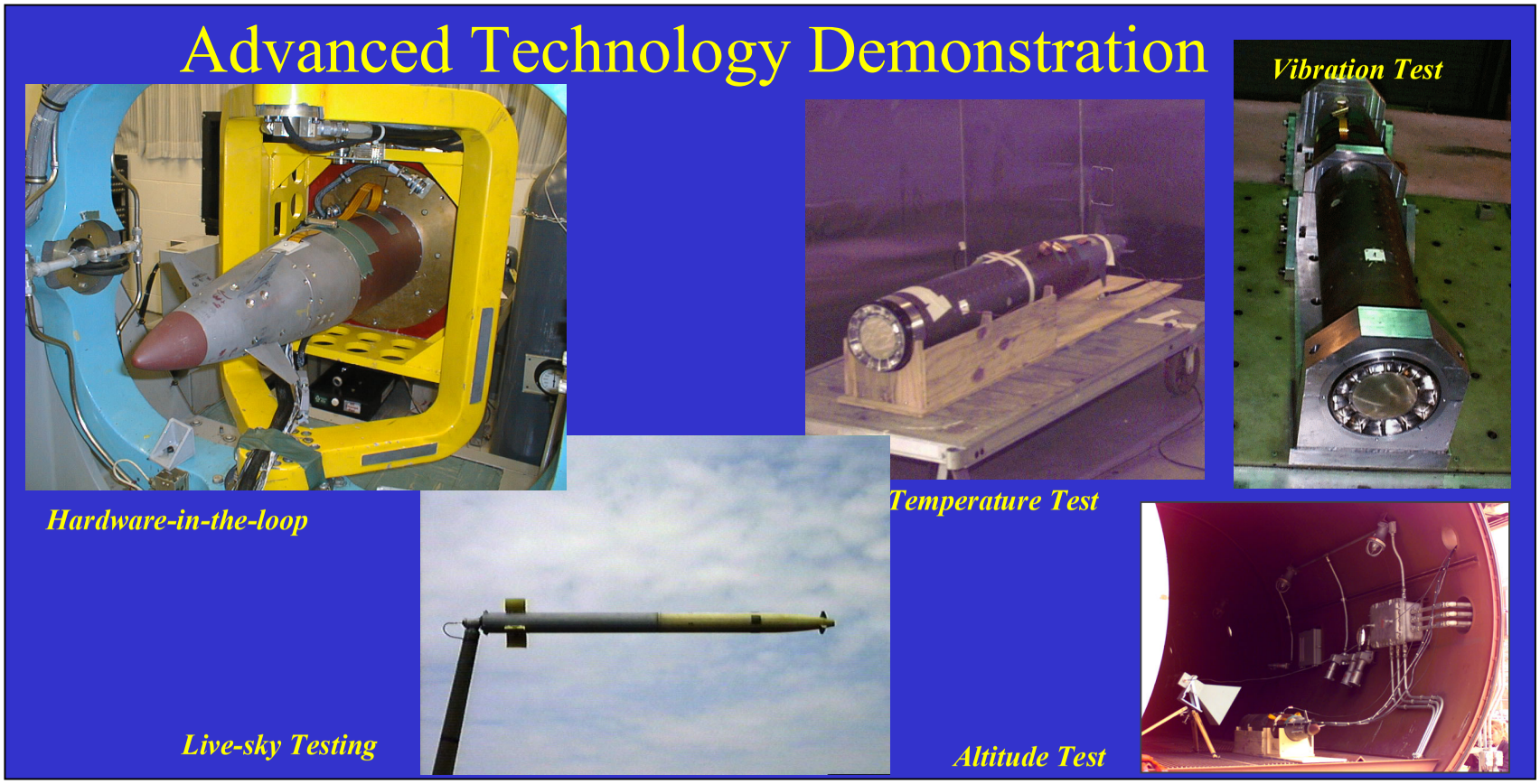
Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
5	Component and/or breadboard validation in relevant environment.	**Advanced Technology Demonstration** – Demonstration of HG1700-based guidance set components (IMU, GPS receiver, control system, flight computer) in a high-fidelity hardware-in-the-loop facility



Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
6	System/subsystem model or prototype demonstrated in a relevant environment.	**Advanced Technology Demonstration** – Demonstration of actual flight-ready HG1700-based guidance set in a high-fidelity hardware-in-the-loop facility and under expected levels of shock, vibration, altitude and temperature



Technology Readiness Example

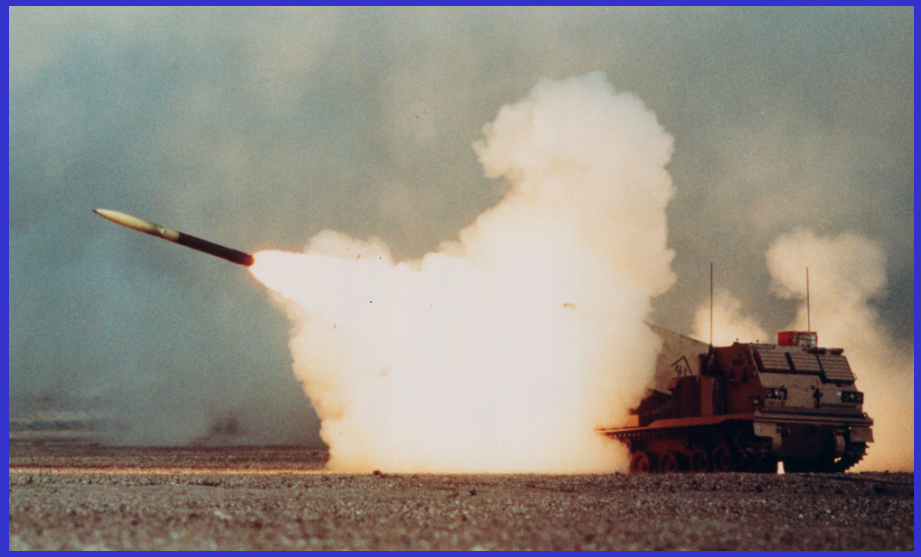
Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
7	System prototype demonstrated in an operational environment.	**System Design and Demonstration** – Demonstration of actual Guided MLRS missile in a flight test sequence from an operational launcher. Successful operation in multiple flight demonstrations

Advanced Technology Demonstration

GPS-aided IMU Flight
(2m miss at 49 km range)

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
8	Actual system completed and "flight qualified" through test and demonstration.	**Low Rate Initial Production** – Developmental Test and Evaluation of GMLRS in its final form under mission conditions.
9	Actual system "flight proven" through successful mission operations.	**Production** – Operational Test and Evaluation of GMLRS by the soldier, airman, or seaman.



TECHNOLOGY STEEL READINESS LEVELS

EXAMPLE: HSLA-100 STEEL FOR AIRCRAFT CARRIER STRUCTURE

MARCH 2002

Technology Readiness Level 1:
Basic Principles Observed and Reported

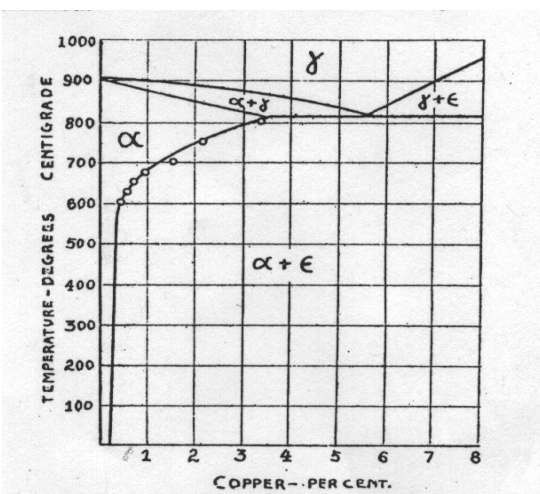
The lowest Technology Readiness Level (TRL), where scientific research begins to be translated into technology's basic properties.

With the mass industrialization of structural steel welding for shipbuilding in World War II, the quest for high-strength steels with good weldability was a motivation for metallurgical research that continued through the post-war era. Carbon strengthening and alloying that resulted in high strength was counter to weldability. The fundamental metallurgical tools for steel alloy design (e.g., phase transformation, phase diagrams, relationship of microstructure to properties, precipitation strengthening, and so forth) were developing at a dramatic rate along with the U.S. steel industry.

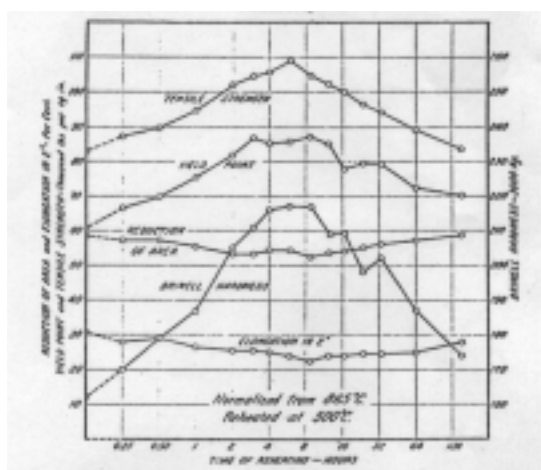
In the 1930s, the unique property of precipitation hardening induced by alloying of copper in steel was established. The phase diagrams for the Fe-Cu system were formulated, the solubility limits of Cu in low carbon steel were explored, and laboratory studies of copper steels were conducted. However, the benefit of Cu-strengthening as a means toward optimum strength, toughness, and weldability was not recognized.

Key References:

Smith, C.S. and E.W. Palmer, "The Precipitation-hardening of Copper Steels," *Trans. AIME*, Vol. 105 (1933).



Fe-Cu Phase Diagram



Precipitation Hardening in Heat Treatment of an 0.27% C, 1% Cu Steel

Technology Readiness Level 2: Invention Begins

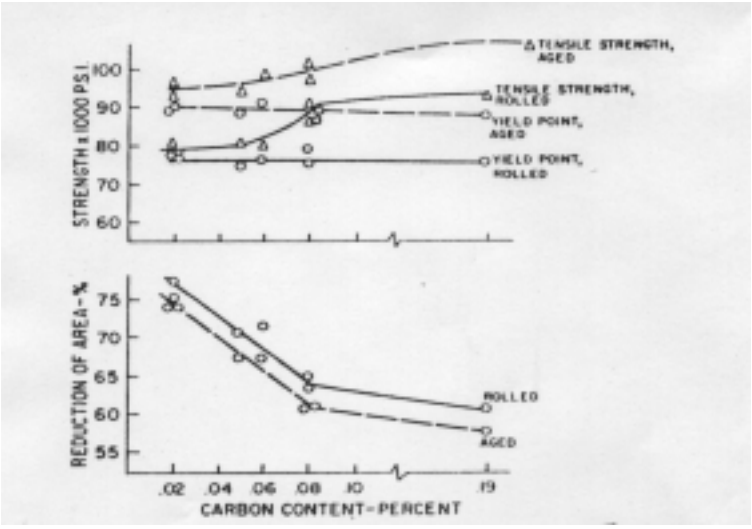
Once basic principles are observed, practical applications can be invented. However, the application is speculative, and no proof or detailed analysis exists to support the assumption.

In the mid-1960s, the laboratories of the International Nickel Company (INCO) initiated the development of a class of low-carbon, age-hardening Ni-Cu-Cb steels called "NiCuAge" steels. The work focused on the very low carbon, with changes in Ni, Cu, and Cb content and processing (hot working schedules and heat treatment) to establish micro-structure-mechanical property relationships. The combinations of strength, ductility, and processing characteristics exhibited by the Ni-Cu-Cb steels suggested a variety of applications in transportation, automotive, and oil field construction. Because of the low carbon content, the steel offered excellent formability and weldability in the fully strengthened condition.

The key concepts discovered at this stage were the importance of Ni and Cb additions to the copper steels. The Ni addition and the ratio of Ni-to-Cu were established as a means to prevent cracking during hot working. Researchers discovered that small additions of Cb significantly increased strength, provided grain refinement, and did not degrade any characteristics of the steel. At this stage, small laboratory melts (30 lb) were used for the alloy composition optimization.

Key References:

Hurley, J.L. and C.H. Shelton, "Age-Hardenable Nickel-Copper Steels," *Metals Engineering Quarterly,* ASM, May 1966.



Tensile Ductility of Ni-Cu Steel as Influenced by Carbon Content

Technology Readiness Level 3: Active Research and Development (R&D) Is Initiated

This includes analytical and laboratory studies to validate physically the analytical predictions of separate elements of the technology.

INCO continued the development of improved "NiCuAge" steel for improved weldability and low-temperature toughness in heavy section plates and forgings and, in 1972, marketed the steel designated IN-787 for offshore platforms and ship hull plates. The American Society for Testing and Materials (ASTM) Standard Specification A710, Grade A, based on IN-787 steel, was issued in 1975. Armco Steel Corporation produced a plate to ASTM A710, Grade A, under the trade name "NI-COP" steel.

The primary reason for preheat in the welding of High Yield Strength (HY)-80 and HY-100 steels is to mitigate underbead cracking (hydrogen related) in the hard, martensitic heat-affected zone (HAZ). The Navy High-Strength Low-Alloy (HSLA)-80, an optimized version of ASTM A710, Grade A steel, is a ferritic steel. The microstructure of the quenched and aged HSLA-80 plate product is generally an acicular ferrite. Ferritic steels are widely used in civil construction because of their excellent weldability.

In 1981, the Navy HSLA Steels Exploratory Development Program was initiated at David Taylor Research Center (DTRC), with ASTM A710, Grade A selected as the primary candidate. Because of the positive results emanating from the project, ASTM A710, Grade A, Class 3 steel was authorized as substitute for HY-80 steel on a production trial basis in CVN 71 in selected noncritical, nonwetted areas in 1983. Upon completion of the evaluation of ASTM A710 for Navy requirements, the modifications to ASTM A710 were incorporated in MIL-S-24645(SH), 4 September 1984, for HSLA-80 steel plate, sheet, and coil. The Naval Sea Systems Command (NAVSEA) certified HSLA-80 for surface ship construction and repair in thickness up to 1-1/4 inch, 16 February 1984. The evaluation of HSLA-80 properties, welding, and structural performance demonstrated that the very-low-carbon, copper precipitation-strengthened steel met the requirements of HY-80 steel and was readily weldable with no preheat (32 ºF minimum) using the same welding consumables and processes as those used for HY-80 steel fabrication. Since 1985, HSLA-80 steel has been used in CG 47 Class construction in increasing tonnage, in CVN 72 and follow-on ships, and in DDG 51 Class, LHD 1 Class, LSD 41 Class, and FFG 7 Class modifications.

Following the HSLA-80 program, a research and development (R&D) project commenced in 1985 to establish the feasibility of HSLA-100 steel as a replacement for HY-100 to reduce fabrication costs. A contract to AMAX Materials Research Center in 1985 initiated the laboratory alloy development for HSLA-100 steel. The objective for HSLA-100 was to meet the strength and toughness of HY-100 steel but to be weldable without the preheat requirements of HY-100, using the same welding consumables and processes as those used in welding HY-100. The project for the development of HSLA-100 steel in the laboratory alloy design phase used the principles of very low carbon, copper-precipitation strengthened steel successful for HSLA-80.

Fracture-process research on HSLA-80 steel indicated that a uniformly small grain size and wider distribution of small carbides would reduce the fracture transition temperature. In fact, HSLA-80 plates of 1-inch gage and less were typically a fine-grained, acicular ferrite microstructure with widely dispersed fine carbides and showed excellent low-temperature toughness. The aim of HSLA-100 alloy design was to produce a homogeneous, fine-grained, low-carbon martensite microstructure that dispersed the secondary transformation products. The alloy development effort to modify HSLA-80 steel microstructurally used laboratory-scale heats (50 to 100 lb) to study the effects of Mn, Ni, Mo, Cu, Cr, Cb, and C in hot rolled, quenched, and aged HSLA-100 plate. Laboratory plates in thicknesses of 1/4, 3/4, 1-1/4, and 2 inches of HSLA-100 exceeded the minimum strength and impact toughness requirements.

Microstructural analysis was conducted to develop composition ranges for heavy gage plate, meeting the strength and toughness requirements, where polygonal ("blocky") ferrite microstructures were not present. A regression analysis was conducted on the results for plates from 45 experimental melts to develop composition ranges for an Interim Specification for HSLA-100 Steel Plate. The Interim Specification was then used as the basis for a trial commercial production of HSLA-100 steel by domestic steel plate mills.

The copper content of HSLA-100 steel is higher than that in HSLA-80 [for additional precipitation strengthening (maximum solubility of copper in iron is near 2 percent)], and increased hardenability was achieved by increases in manganese, nickel, and molybdenum. Nickel, the greatest increase over that in HSLA-80, lowers upper shelf impact toughness but also lowers (improves) the impact toughness transition temperature. The microstructure of HSLA-100 steel was identified by optical and scanning electron microscopy as low-carbon martensite or a granular, low-carbon bainite, depending on plate gage—a significantly different metallurgy and microstructure than the ferritic HSLA-80 steel microstructures.

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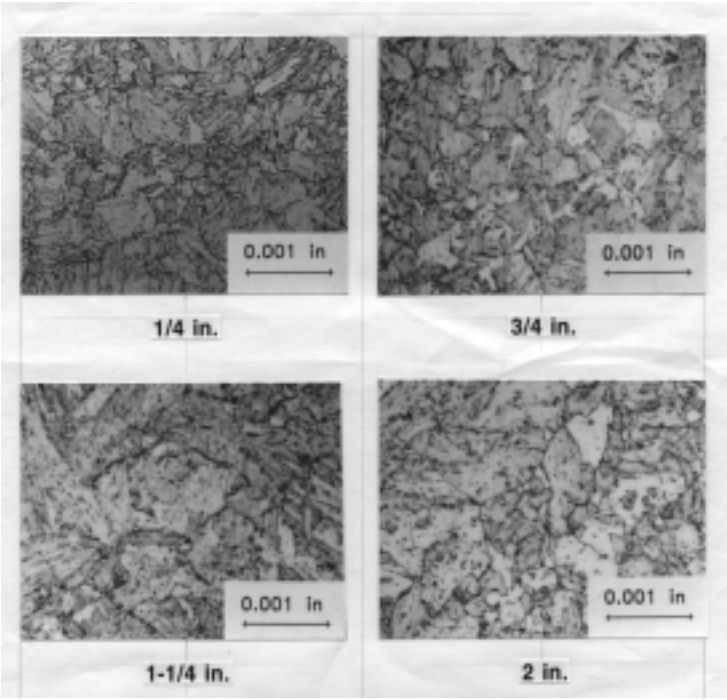

Experimental HSLA-100 Steel Plate Microstructures for a Range of Plate Thickness

Technology Readiness Level 4: Basic Technology Components Are Integrated

The basic components of the technology are integrated to establish that the pieces will work together.

For the trial plate production phase of the HSLA-100 steel project, an initial 150-ton production of HSLA-100 steel was melted and rolled by Phoenix Steel Corporation in 1986 to the interim specification, using conventional electric furnace and ingot casting practice, conducted to achieve a very-low-carbon composition. The minimum strength and toughness requirements of the interim specification were met in the initial production of HSLA-100 steel plate in gages from 1/4 to 2 inches. Optimum properties in HSLA-100 plate resulted from aging temperatures from 1150 to 1275 °F.

Upon receipt of HSLA-100 plate from the trial productions, an evaluation commenced to evaluate HSLA-100 steel plate and welding using the processes and procedures for HY-100 steel ship and submarine structural applications—but with reduced or no preheat. The evaluation of HSLA-100 steel plate properties and welding demonstrated that HSLA-100 steel met the mechanical property requirements of HY-100 steel and was weldable with reduced preheat requirements, using the same welding consumables as for HY-100 steel fabrication. When compared with HY-100 steel, the tensile and impact toughness properties of the plates met or exceeded the requirements.

The primary reason for preheating when welding the HY-series steels was to mitigate underbead cracking (hydrogen related) in the HAZ. The HSLA-100 precertification evaluation emphasized welding and weldability testing to demonstrate that HSLA-100 was more resistant to hydrogen cracking than HY-100 (to allow a relaxation of preheat requirements). The findings of the HSLA-100 steel welding and weldability evaluations are summarized as follows:

- The strength and toughness of weld metals deposited by the Shielded Metal Arc Welding (SMAW), Submerged Arc Welding (SAW), Pulsed Gas Metal Arc Welding (GMAW-P), and Short Circuiting Gas Metal Arc Welding (GMAW-S) processes, using the welding consumables qualified for HY-100 welding, met the requirements when welded over a broader range of operating conditions (heat inputs ranging from 22 to 65 kJ/in.) than for HY-100. No "hard" microstructures were indicated, and the Charpy V-notch toughness of the HAZ in HSLA-100 weldments was equal to or greater than the weld metal toughness.
- It was demonstrated that HSLA-100 fillet weld strengths were equivalent to HY-100 welds using the same process, filler metal, and fillet size.
- HSLA-100 plate, weld metal, and weld HAZ did not show any susceptibility to stress corrosion cracking exposed at –1,000 mV at or above stress corrosion

cracking threshold stress intensity values determined for HY-100, MIL-100S-1, and MIL-120S-1 weld metals.

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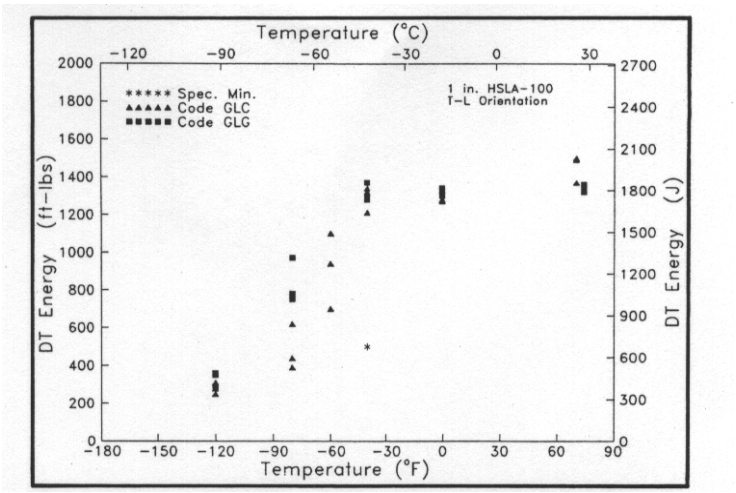
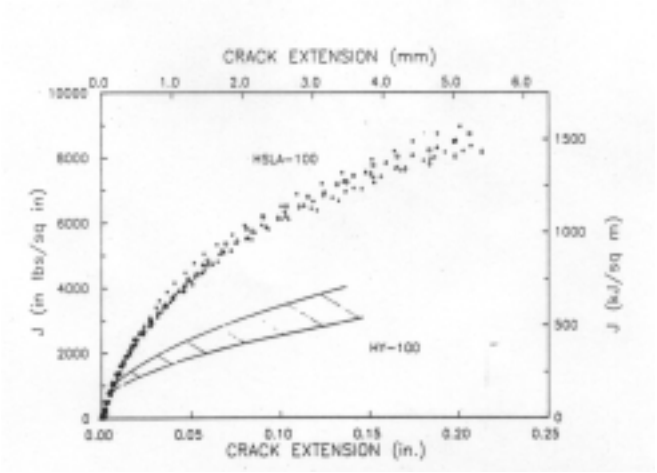
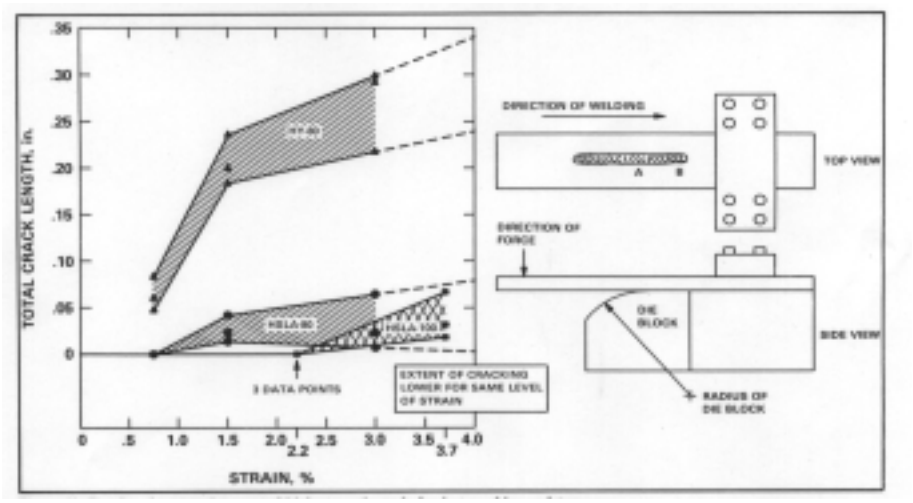


Dynamic Tear Test Results for HSLA-100 Steel Plates



Fracture Toughness Test Results of HSLA-100 and HY-100



Varestraint Weldability Tests of High-Strength Steels

Technology Readiness Level 5:
Technology Sufficiently Advanced For Simulation Tests

The fidelity of breadboard technology increases significantly enough to justify being ready for testing in a simulated environment.

Lukens Steel Company produced a second melt of HSLA-100 steel, again by electric furnace and ingot casting. Most of the plate produced from the heat was greater than 2 inches thick, primarily for ballistic resistance evaluation. The minimum strength and toughness requirements were met in plate thicknesses from 1/2 to 3-3/4 inches. A double austenitization and quench process was used for HSLA-100 steel plate in gages over 1-1/4 inches to refine the heavy-plate grain structure for optimum toughness. HSLA-100 plate from both productions to the interim specification was the primary material used in the certification program.

The certification evaluation included continued characterization of production HSLA-100 steel plate mechanical, physical, and fracture properties. However, the main focus was the evaluation of weldability and welding process limits for structures of high restraint, studies of fatigue properties, and effects of marine environments on HSLA-100.

The results of low-cycle fatigue crack initiation tests of HSLA-100 steel and weldments and high-cycle fatigue tests in air and seawater showed properties equivalent to HY-100 steel in every case. The steels showed similar fatigue crack growth rate properties. General corrosion, crevice corrosion, galvanic corrosion, and high-velocity seawater parallel flow and cavitation tests of HSLA-100 in seawater showed that the corrosion behavior of HY-100 and HSLA-100 steels was comparable.

Key References:

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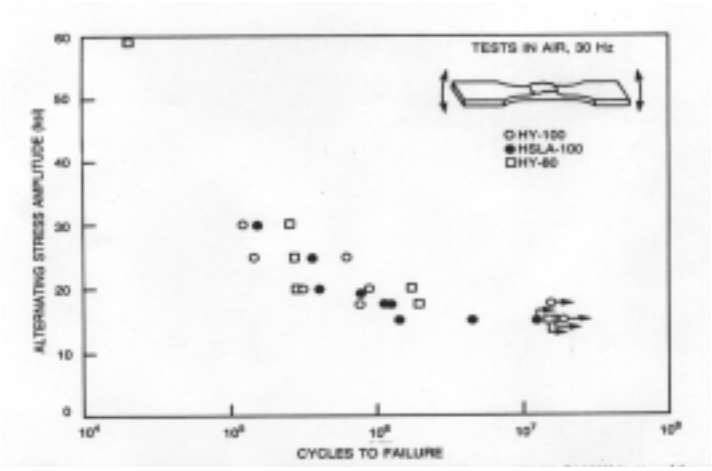
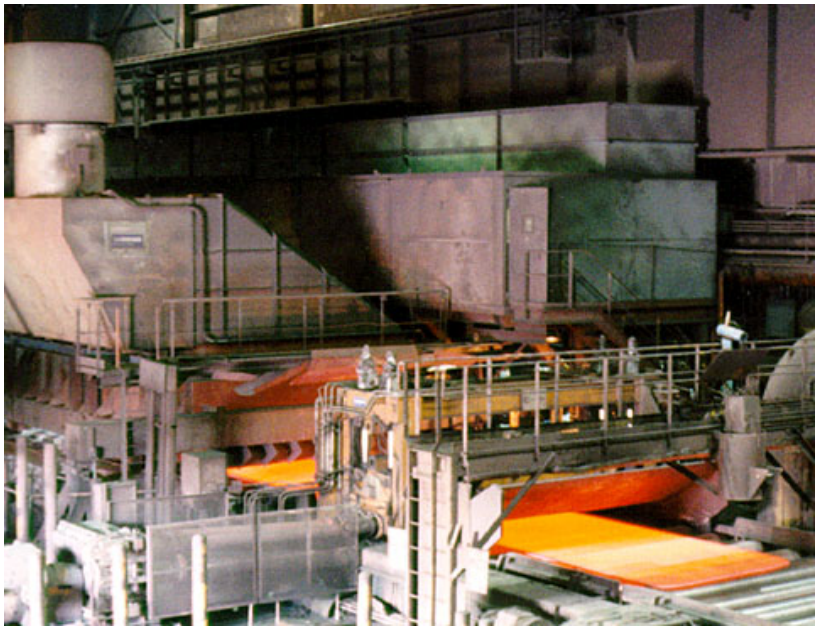
Werchniak, W., E.J. Czyryca, and D.M. Montiel, *Fatigue Properties of HSLA-100 Steel and Weldments,* DTRC/SME-89/113, September 1990.

Fatigue Test Results for HSLA-100, HY-100, and HY-80 Steel Weldments





Technology Readiness Level 6: Model/Prototype Tests

Representative model or prototype system, which is well beyond the breadboard tested at TRL 5 and is tested in a relevant environment.

The evaluation of HSLA-100 steel production plates concluded that the mechanical properties of production plate, welding and weldability screening tests, fatigue properties, and corrosion properties demonstrated that the system was viable for certification for combatant ship structure. Evaluation as a system by explosion bulge and crack-starter bulge tests, fragment penetration resistance tests, and ballistic property tests was demonstrated in the next phase.

Explosion bulge and crack starter explosion bulge tests of 2-inch thick weldments by GMAW, SMAW, and SAW of HSLA-100 steel were successfully conducted. The weldments were fabricated within the recommended preheat/interpass temperatures expected for HSLA-100 fabrication, exhibited no indications of hydrogen damage, and passed the explosion bulge test requirements.

In 1987, NAVSEA initiated projects at Electric Boat Corporation and Newport News Shipbuilding (NNS) to evaluate the weldability of HSLA-100 steel under various preheat conditions in a production environment. The results of the weldability evaluation demonstrated that HSLA-100 steel could be welded at up to 1.25-inch thick at 60 ºF minimum preheat, with the same processes and consumables being used for HY-80/100 steels.

Based on NNS' welding and weldability evaluations of HSLA-100 using HY-100 welding consumables, welding preheat/interpass temperature limits were established. Preheat was recommended for SAW and SMAW, based on the weld metal cracking tendencies noted for these flux-assisted processes in the weldability testing. For GMAW and SAW, difficulties were experienced in obtaining MIL-100S-2 and MIL-120S-2 wire electrodes (low hydrogen content) with acceptable wire-feed characteristics for elimination of preheat for heavy-gage plate welding. Research projects are in progress to develop welding consumables specifically for HSLA-100 to achieve preheat-free welding in heavy plate, highly restrained welds.

Ballistic evaluations demonstrated that HSLA-100 steel and GMAW (MIL-100S-1) weldments (fabricated without preheat) were equivalent to HY-100 steel and weldments in ballistic resistance. Both steels were comparable to Army Rolled Homogeneous Armor.

NNS completed weld qualification and weldability testing to conduct pulsed-arc GMAW and SAW of HSLA-100 in thicknesses greater than 1 inch through 1-5/8 inch at 60 ºF preheat using MIL-100S-2 electrode. NAVSEA approved the procedures. It should also be noted that Ingalls Shipbuilding Division (ISD) conducted weld qualification and weldability tests of HSLA-100 up to 1-inch gage using both HY-100- and HY-80-type welding consumables and processes.

The present material specification for HSLA-80 and HSLA-100 steel strip, sheet, and plate is MIL-S-24645A, with Amendment 1 of 24 September 1990. HSLA-100 was certified by NAVSEA for surface ship construction in thicknesses up to 4 inches, 13 March 1989.

Key References:

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Wallace, D.T., *HSLA-100 Weldability Evaluation,* Newport News Shipbuilding and Drydock Company, Report No. E.80-7, Contract No. N00024- 85-C-2056, June 1988.

Wallace, D.T., *HSLA-100 Weldability Tests for CVN-73 Material Substitution for HY-100 Steel,* Newport News Shipbuilding and Drydock Company, Report No. E.80 (S11D)-1, Contract No. N00024-88-C- 2044, February 1989.

Explosion Bulge Test of HSLA-100 2-inch Thick Weldment

Fragment Penetration Resistance HSLA-100 Test Weldment

Technology Readiness Level 7: Prototype Near or at Planned Operational System

TRL-7 is a major step from TRL 6, requiring the demonstration of an actual prototype in an operational environment.

The fabrication of a series of structural performance models was completed under shipyard welding conditions. Holding bulkhead panel models, foundation models, and a full-scale foundation were evaluated and demonstrated satisfactory structural performance.

The Electric Boat Division [General Dynamics Corporation] fabricated the full-scale foundation and a small, heavy-gage tank model. NNS partially completed the fabrication of a full-scale hard tank; however, a funding shortage precluded tests. In these shipyard fabrication exercises, all weld cracking was related to SMAW and SAW consumables (where cracking occurred even when HY-100 preheat temperatures were used) or to improper welding practices. No HAZ cracking occurred in HSLA-100.

Hydrostatic tests of full-gage bulkhead panel models are an extreme test of plating-to-stiffener strength and HAZ ductility. The HSLA-100 panel models exceeded anticipated holding pressure levels, withstanding over twice the holding pressure of identical HY-100 panel models. A series of foundation beam elements (full-scale) and the full-scale SSN 688-type AC foundation were installed and tested on a floating shock platform. The structures were subjected to a series of underwater explosion (UNDEX) shock tests. For a series of 3 UNDEX events, the structural response of the HSLA-100 items indicated no cracking or excessive deformation in any structural joint.

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HSLA-100 Steel/LC-100 Weld Metal
Box-Tank Fatigue Model
Overall View of Model Exterior/End Hatch Open

HSLA-100 Holding Bulkhead Panel Model:
Before Test (Left) and After Hydrostatic Test to Rupture (Right)

Technology Readiness Level 8:
Technology Demonstrated In Operation

Technology has been proven to work in its final form and under expected conditions.

In 1989, NAVSEA certified HSLA-100 steel for surface ship construction in thicknesses up to 4 inches. At that time, the *USS JOHN C. STENNIS* (CVN 74) was approved, indicating that HSLA-100 steel was a qualified substitute for HY-80/100 steel in CVN construction. Fabrication was to be conducted in accordance with MIL-STD-1689A(SH), *Fabrication, Welding, and Inspection of Ships Structure*. The experience base for welding HSLA-100 steel was too limited to allow the wholesale substitution for all HY-80/100 steel in the unrestricted areas of the carrier. Therefore, an implementation plan for incorporation was submitted, and NAVSEA approved this plan.

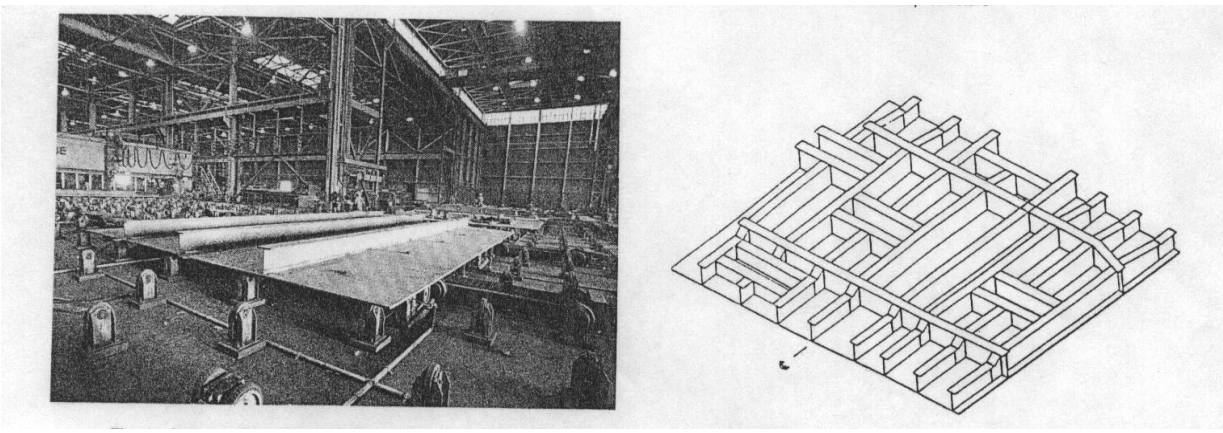
The CVN 74 main deck was the chosen area for HSLA-100, and approximately 770 LT were earmarked. The thicknesses in this area were 7/8-inch and 1-inch thick HSLA-100. The fabrication results were excellent. A total of 16,656 inches of butt joints in the 7/8-inch plate were welded, with only 8 inches requiring repair. In the 1-inch plate, 16,524 inches of butt joints were welded, and no defects were found. Since the ship was under construction at the time of the implementation plan, the total tonnage inserted into CVN 74 was limited to 1,250 LT, mostly above main deck.

NNS used HSLA-100 steel during CVN 74 construction. Approximately 700 tons of HSLA-100 steel plate in 7/8- and 1-inch thicknesses were used for main deck panel assemblies with longitudinal and transverse stiffeners without preheat (65 to 80 ºF shop temperature). One hundred percent magnetic particle inspection was performed on all HSLA-100 butt welds. In 1,400 feet of 7/8-inch thick HSLA-100 butt weld inspected by MT, only 2 repairs (8 inches total) were required, not related to hydrogen-type defects. The same length of 1-inch thick HSLA-100 butt weld inspected by magnetic particle inspection showed no defects. A total of 1,250 tons of HSLA-100 were used in CVN 74, with over 4,000 feet of weldment inspection requiring 32 inches total repair (less than 0.01 percent).

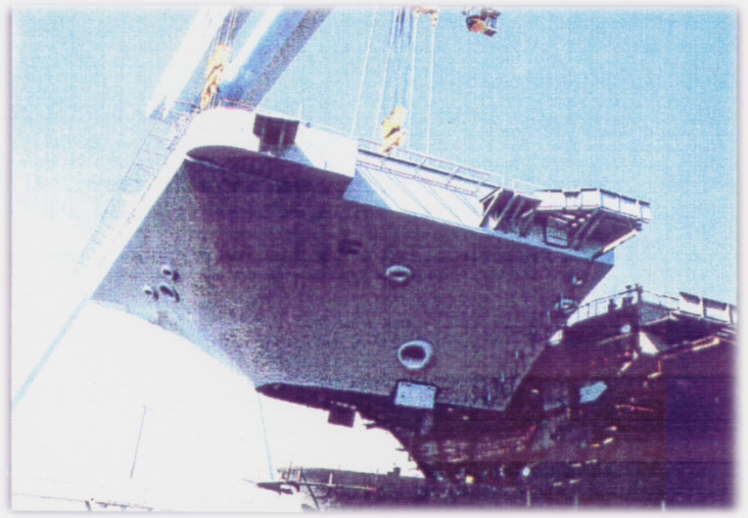
NNS completed weld qualification and weldability testing to conduct pulsed-arc GMAW and SAW of HSLA-100 in thicknesses greater than 1 inch through 1-5/8 inch at 60 ºF preheat using MIL-100S-2 electrode. NAVSEA approved the procedures. It should also be noted that ISD conducted weld qualification and weldability tests of HSLA-100 up to 1-inch gage using both HY-100- and HY-80-type welding consumables and processes. The flight deck of the *USS BATAAN* (LHD 5) was successfully fabricated with HSLA-100 plate (in place of HY-100 steel) for cost savings, as were subsequent vessels of the same class.

Key References:

Christein, J.P. and J.L. Warren, "Implementation of HSLA-100 Steel in Aircraft Carrier Construction - CVN 74," *Journal of Ship Production*, Society of Naval Architects and Marine Engineers, 1994.



CVN 74 HSLA-100 Steel Main Deck Panel Fabrication



Technology Readiness Level 9:
Implementation of the Technology in Service

Actual application of the technology in its final form and under mission conditions.

Because of the experience gained on CVN 74, wholesale changes to HSLA-100 were made on CVN 75. Approximately, 10,500 LT of HSLA-100 were inserted into CVN 75. Most of the replacement was for decks and bulkheads and some built-up stiffeners. The HSLA-100 stiffeners were short spans with heavy web/flange members. HSLA-100 steel was selected to replace HY-100 for fabrication cost reduction, and, as a consequence, HSLA-100 steel has been used in place of HY-100 in the construction of *USS JOHN C. STENNIS* (CVN 74), *USS HARRY S. TRUMAN* (CVN 75), and *USS RONALD REAGAN* (CVN 76).

On CVN 76, NAVSEA 08 approved the substitution of HSLA-100 for HY-80/100 structures outside the primary shield tank, opening another area for substitution. On CVN 77, expended use of HSLA-100 plate continues. NNS expects to qualify reduced preheat for welding up to 2 inches, adding over 4,000 LT of HSLA-100 where significant fabrication cost reduction is gained over HY-100 in this thickness range. Depending on complexity of the structure, estimated cost savings, for HSLA-100 vs. HY-100 fabrication in CVN 74 construction range from $500 to $3,000 per ton of fabricated structure.

The table below summarizes the tonnage of HSLA-100 steel plate used to date in construction of U.S. Navy combatant ships. The continued expansion of the use of HSLA-100 steel is planned for CVNX (CVN 78) design, including the heavy plating and foundation in the propulsion area.

Class	Vessels	LT
CVN 68	CVN 74	2,080
	CVN 75	11,600
	CVN 76	12,500
	CVN 77	12,500
LHD 1	LHD 5	1,180
	LHD 6	1,200

ACRONYMS[5]

ASM	American Society for Metals International
ASTM	American Society for Testing and Materials
CG	Carrier Group
CVN	Aircraft Carrier, Nuclear
CVNX	Aircraft Carrier, Nuclear, Experimental
DDG	Guided Missile Destroyer
DTNSRDC	David Taylor Naval Ships Research and Development Center
DTRC	David Taylor Research Center
FFG	Guided Missile Frigate
GMAW-P	Pulsed Gas Metal Arc Welding
GMAW-S	Short Circuiting Gas Metal Arc Welding
GMLRS	Guided Multiple Launch Rocket System
HAZ	heat-affected zone
HSLA	High-Strength Low-Alloy
HY	High Yield Strength (steel)
IMU	Inertial measurement Unit
INCO	International Nickel Company
ISD	Ingalls Shipbuilding Division
LHD	Amphibious Assault Ship
LSD	Dock Landing Ship
LT	long ton
NAVSEA	Naval Sea Systems Command
NNS	Newport News Shipbuilding
OTC	Offshore Technology Conference
RLG	Ring Laser Gyro
SAW	Submerged Arc Welding
SMAW	Shielded Metal Arc Welding
SME	Society for Mining, Metallurgy, and Exploration
TM	Technical Manual
TRL	Technology Readiness Level
UNDEX	underwater explosion

5 These acronyms are for Appendix E (pp. E-1 through E-32).

APPENDIX F
SERVICE TECHNOLOGY READINESS ASSESSMENT (TRA) PROCEDURES AND FORMATS

This appendix provides procedures used and documented by the Services.

Army: Sample Technology Maturity Assessment Format[6] F-3
Navy: (Will Provide When Available)
Air Force: (Will Provide When Available)

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6 In light of the change to DoD 5000.2-R contained in the pending USD(AT&L) memorandum (see Appendix D of this document), this is the recommended format for Technology Maturity Agreements (TMAs). The reader will notice that the Army refers to a TMA as a "Technology Maturity Assessment."

Sample Technology Maturity Assessment Format
This is a sample format for a Technology Maturity Assessment (TMA).

TITLE PAGE

(SYSTEM TITLE)

TECHNOLOGY MATURITY ASSESSMENT

Date

AUTHENTICATION PAGE

Prepared By:

_____ DATE:_____ _____ DATE: _____

Name Name
Job Title Job Title
Organization Organization

Approved By:

_____ DATE:_____

Name
Job Title (APM or higher)
Organization

TABLE OF CONTENTS PAGE

(SYSTEM TITLE)
Technology Maturity Assessment

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ASSESSMENT BODY

(SYSTEM TITLE)
Technology Maturity Assessment

1.0 PURPOSE

This document provides a TMA for the (SYSTEM TITLE) program in support of the Milestone (MS) (B or C, as appropriate) acquisition decision process. The assessment will identify and demonstrate the degree to which critical technologies are mature and capable of meeting the program objectives.

A listing of acronyms is found at the end of this document.

2.0 PROGRAM OVERVIEW

The following paragraphs briefly define the (SYSTEM TITLE) program, its objectives, and the detailed program and system descriptions.

2.1 Objective

The (SYSTEM TITLE) program will achieve (desired capability/result) by fielding advanced technology to (brief description of desired capability)…

2.2 Program Description

The (SYSTEM TITLE) mission is to …

The proposed technology transition/upgrade began because (describe why the proposed effort was conducted) …

The current proposal is to field (describe performing organization(s), what is to be done, and when, where, and how it will be done)…

Future modifications/block upgrades are expected to provide…

2.3 System Description

The (upgraded or proposed new SYSTEM TITLE) is based on (describe system/technology heritage) … . Note: Heritage technology may or may not be the basis for pursuing the new system.

The current fielded system/technology status is …

Subsystems, components, and proposed technical advancements are described as follows [system Work Breakdown structure (WBS) at Attachment 1]:

(include figures and tables as necessary).

3.0 Assessment

This section details the process used for the TMA of the (SYSTEM/TITLE) program… .

3.1 Process Definition

Describe process to identify critical technologies and systems, define appropriate Technology Readiness Levels (TRLs) and standards corresponding to those levels and assess technologies (conduct analyses, show qualification by similarity, or demonstrate maturity to desired standards). Provide justification that analyses and/or tests conducted do in fact demonstrate attainment of desired performance. (Introduction here provides context and overview for following sub-sections.)

a. Define critical technologies: Those vehicle technologies, components, or subsystems, the success or failure of which most significantly affect the ability of a (SYSTEM TITLE) to meet the system requirements as identified by [the Operational Requirements Document (ORD), the System Performance Specification, and so forth].

b. Identify critical technologies, components, or subsystems in the (SYSTEM/TITLE) WBS (see Attachment 1).

c. Define levels to be used in TRL Assessment per DoD 5000.2-R and extracted from Government Accounting Office (GAO) Report NSIAD-99-162, *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes,* as shown in Appendix A: select desired TRL range (5–7, 6–8, and so forth) under consideration, justify choice of this range as appropriate for this phase of the program.

d. Assess critical technologies and assign readiness levels desired and achieved to date (see Figure x). (This is an overview. Provide detail in following section.)

Subsystem Title	Critical Technologies	TRL Desired at Current Decision Point	TRL Achieved at Current Decision Point
Subsystem A	… …	…. ….	…. ….
Subsystem B	…	….	….
Subsystem C	…	….	….
… .	…	….	….

Figure x. (SYSTEM TITLE) Critical Technologies

3.2 Evaluation

Based on the previous steps for the TMA, the following sections briefly describe the levels desired and achieved by each critical element.

Appendix A provides the current TRL definitions used by the Army. Augmenting this list are the following accepted definitions for brassboards and breadboards.

Breadboard *- An experimental device (or group of devices) used to determine feasibility and to develop technical data. It normally will be configured for laboratory use only to demonstrate the technical principles of immediate interest. It may not resemble, nor be intended for use, as the projected end item.*

Brassboard *- An experimental device (or group of devices) used to determine feasibility and to develop technical and operational data. It normally will be a model sufficiently hardened for use outside of laboratory environments to demonstrate the technical and operational principles of immediate interest. It may resemble the end item, but is not intended for use as the end item.*

Critical information for each technology is to be summarized in a Technology Maturity Chart (TMC). Appendix B provides an illustrative TMC. More detail is expected in its preparation, using the ORD, System Performance Specification, or other such documentation that specifies what the warfighter expects (Best Estimated Need). The TMC in Appendix B has two main columns: Attributes and Objectives. The "Attributes" column is broken down into four major categories: Performance (e.g., for an inertial sensor, bias stability, drift rate, scale factor, accelerometer dynamic range), Physical (e.g., size, weight, volume, required power), Environmental (e.g., temperature range, vibration/power spectrum density; shock; humidity range; waterproof; immersion depth), and Programmatic (e.g., test/measurement environment, affordability). The Objective column is subdivided into four columns: Best Estimated Need, Current, Program Mid-Point, and Program End. The first and second columns under Objectives have space for the insertion of numbers/metrics. The third and fourth columns under Objectives have space for the insertion of numbers/metrics and a qualitative risk assessment (Low, Medium and High) of the program's ability to meet each respective attribute. The bottom of the chart will have an overall TRL assessment for the second, third, and fourth columns under Objectives, respectively. The purpose of this chart is to provide information on the component/subsystem quality necessary to achieve the cited TRL level, as a function of program deadlines. Individual technology charts will be inserted into the report at the end of section 3.2.

The report text in the following sections provides background and defends the selected attributes and objectives. The technology proponent is expected to attach supporting technical documentation (e.g., test results) to validate the assessments provided in this attachment.

3.2.1. Subsystem A

Technology A1:

Justify selected attributes and objective TRLs
Defend selection of TRL performance standards/tests/environment
Discuss results achieved
Evaluation result: The TRL is therefore assessed as (number rating). (Discussion as required)

Technology A2:

3.2.2. Subsystem B

….

3.2.3. Subsystem C

….

3.3. System-Level Technology Readiness

This section should address the technology readiness of the entire system, incorporating the individual technologies discussed in Section 3.2, to include the implications of integration with existing/legacy systems. This section must provide confidence that the entire system can meet its specified requirements for the program decision point under consideration.

3.4 Summary

The *(SYSTEM TITLE)* program has performed a TRL Assessment for all of the critical technologies identified in the WBS, with results summarized in Figure xx. *(IF APPLICABLE, as for upgrades)* All other elements of the *(SYSTEM TITLE)* were assessed at the readiness level nine since there is no change from the current fielded *(SYSTEM TITLE)*.

Technology	Assessment
(Subsystem Title) (Technology/Component A) (Technology/Component B) …	(Overall rating) (number rating) (number rating) …
(Subsystem Title) (Technology/Component C) (Technology/Component D) …	(Overall rating) (number rating) (number rating) …
(Subsystem Title) (Technology/Component E) (Technology/Component F) …	(Overall rating) (number rating) (number rating) …
Overall System Rating	(Overall Rating)

Figure xx. Summary

4.0 CONCLUSIONS

(State conclusions regarding technology readiness – briefly summarize justifications above)

ACRONYMS

DoD	Department of Defense
GAO	Government Accounting Office
MS	Milestone
NSIAD	National Security and International Affairs Division (GAO)
ORD	Operational Requirement Document
R&D	research and development
TMA	Technology Maturity Assessment
TMC	Technology Maturity Chart
TRL	Technology Readiness Level
VV&A	Verification, Validation and Accreditation
WBS	Work Breakdown Structure

Attachments

Attachment 1
(SYSTEM TITLE) WBS

WBS Level	Description
1	...
1.1....	...
2	...
3...	...

Appendix A. TRL Definitions

TRL	Description
1. **HW/S**: Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development (R&D). Examples might include paper studies of a technology's basic properties.
SW: Functionality conjectural	Lowest level of software readiness. Basic research begins to be translated into applied R&D. Examples might include a concept that can be implemented in software or analytic studies of an algorithm's basic properties.
2. **HW/S/SW**: Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. Applications may be speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
3. **HW/S**: Analytical and experimental critical functions and/or characteristic proof of concept	Active R&D is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
SW: Analytical and experimental critical functions and/or characteristic proof of concept	Active R&D is initiated. This includes analytical studies to produce code that validates analytical predictions of separate software elements. Examples include software components that are not yet integrated or representative but satisfy an operational need. Algorithms are run on a surrogate processor in a laboratory environment.
4. **HW/S:** Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared with the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.
SW: Functionality demonstrated in a laboratory environment	Basic software components are integrated to establish that they will work together. They are relatively primitive with regard to efficiency and reliability compared with the eventual system. System software architecture development is initiated to include interoperability, reliability, maintainability, extensibility, scalability, and security issues. Software is integrated with simulated current/legacy elements as appropriate.

Appendix A. TRL Definitions (Continued)

TRL	Description
5. **HW/S**: Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that it can be tested in a simulated environment. Examples include "high- fidelity" laboratory integration of components.
SW: Functionality and performance demonstrated in a relevant environment	Reliability of software ensemble increases significantly. The basic software components are integrated with reasonably realistic supporting elements so that it can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of software components. System software architecture is established. Algorithms are run on a processor(s) with characteristics expected in the operational environment. Software releases are “Alpha” versions and configuration control initiated. Verification, Validation and Accreditation (VV&A) initiated.
6. **HW/S:** System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in technology’s demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment, or in a simulated operational environment.
SW: Functionality and performance demonstrated in a realistic simulated (live/virtual) operational environment	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in software-demonstrated readiness. Examples include testing a prototype in a live/virtual experiment or in simulated operational environment. Algorithm is run on a processor or in the simulated operational environment. Software releases are “Beta” versions and are configuration controlled. Software support structure in development. VV&A in process.
7. **HW/S:** System prototype demonstration in an operational environment	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment, such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
SW: Functionality and performance demonstrated in an operational test environment	Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as a command post or air/ground vehicle. Algorithms are run on processor of the operational environment integrated with actual external entities. Software support structure in place. Software releases are in distinct versions (e.g., Version 2.0). Frequency and severity of software deficiency reports do not significantly degrade functionality or performance. VV&A completed.

Appendix A. TRL Definitions (Continued)

TRL	Description
8. **HW/S:** Actual system completed and "flight qualified" through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, TRL 8 represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
SW: Functionality, performance and quality attributes* validated in an operational	Software has been demonstrated to work in its final form and under expected conditions. In most cases, this TRL represents the end of system development. Examples include test and evaluation of the software in its intended system to determine whether it meets design specifications. Software releases are production versions and are configuration controlled in a secure environment. Software deficiencies are resolved rapidly through the support structure.
9. HW/S: Actual system "flight proven" though successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of system development. Examples include using the system under operational mission conditions.
SW: Functionality, performance, and quality attributes* proven in an operational environment through successive successful accomplishment of mission operations	Actual application of the software in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of system development. Examples include using the system under operational mission conditions. Software releases are production versions and are configuration controlled. Frequency and severity of software deficiencies are at a minimum.

*Quality attributes include reliability, maintainability, extensibility, scalability and security

TRL Definitions

Breadboard: Integrated components that provide a representation of a system/subsystem and can be used to determine concept feasibility and to develop technical data. Typically configured for laboratory use to demonstrate the technical principles of immediate interest. May resemble final system/subsystem in function only.

"High Fidelity": Addresses form, fit, and function. High-fidelity laboratory environment would involve testing with equipment that can simulate and validate all system specifications within a laboratory setting.

"Low Fidelity": A representative of the component or system that has limited ability to provide anything but first-order information about the end product. Low-fidelity assessments are used to provide trend analysis.

Model: A reduced scale, functional form of a system, near or at operational specification. Models will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.

Operational Environment: Environment that addresses all the operational requirements and specifications required of the final system to include platform/packaging.

Prototype: The first early representation of the system that offers the expected functionality and performance expected of the final implementation. Prototypes will be sufficiently hardened to allow demonstration of the technical and operational capabilities required of the final system.

Relevant Environment: Testing environment that simulates the key aspects of the operational environment.

Simulated Operational Environmental: Environment that can simulate all of the operational requirements and specifications required of the final system or a simulated environment that allows for testing of a virtual prototype to determine whether it meets the operational requirements and specifications of the final system.

Technology Maturity

Technology Title: Inertial Sensors

POC
Name: John Doe
Phone #: XXX-YYY-ZZZZ

Attributes	Objectives					
	Best Estimated Need	Current	Program Mid-Point Status	Program Mid-Point Risk	Program End Status	Program End Risk
Performance						
Rate Gyro drift	10^0/hr	500^0/hr	200^0/hr	L	50^0/hr	H
Accelerometer Dyn. Range	1E+07	1E+03	1E+05	L	1E+06	H
Physical						
Gyro size	2 cu.in.	4 cu.in.	3 cu.in.	M	3 cu.in.	M
Environmental						
Temperature Max/Min.	-25 - 115^0C	RM	RM - 100^0C	L	0 - 115^0C	L
G-Load	1000	10	100	L	500	L
Vibrations (Power spectrum)	Unknown	Untested	Untested		50% power Spectrum Test	M
Programmatic						
Test Environment	Field Test	Lab	Lab		Simulated Field	
Unit Cost (By calculation)	$3K/unit	$15K/unit	$15K/unit		$5K/unit	
Overall TRL Level	NA	3	4		5	

EXAMPLE

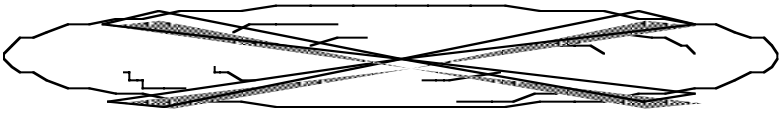
APPENDIX G
TECHNOLOGY READINESS ASSESSMENT (TRA) EXAMPLES

Several actual TRAs that have been submitted for milestone decisions are provided for information and reference.

Army: UH-60M Utility Helicopters, 6 March 2001 …… G-3
Navy: Cooperative Engagement Capability (CEC), 3 January 2002 …… G-25
Air Force: (Will Provide When Available)

UH-60M

TECHNOLOGY READINESS LEVEL ASSESSMENT



Utility Helicopters

6 March 2001

Prepared By:

_____DATE:_____DATE:_

MELLISA BARNETT
UH-60M Systems Engineer
Prod Eng Div, ED, AMCOM RDEC

ERIC EDWARDS
UH-60M Project Engineer
UH-60M RECAP/UPGRADE

Approved By:

_____DATE_____

MARK D. LUMB
LTC, IN
APM, UH-60M RECAP/UPGRADE

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UH-60M
Technology Readiness Level Assessment

1.0 PURPOSE

This document provides a Technology Readiness Level (TRL) Assessment for the UH-60M program in support of the Milestone (MS) B acquisition decision process. The TRL Assessment will identify and demonstrate the degree to which critical technologies are mature and capable of meeting the program objectives.

2.0 PROGRAM OVERVIEW

The following paragraphs briefly define the UH-60M program: its objectives and the detailed program and system descriptions.

2.1 Program Objective

The UH-60M program will recapitalize/upgrade the existing fleet of UH-60A/L aircraft to meet Block 1 requirements identified in the Operational Requirements Document (ORD) for Recapitalization of the UH-60 Black Hawk Utility Helicopter Fleet. The ORD requirements provide capabilities for digitization/situational awareness, provide for increased lift and range requirements over the UH-60A model, extend the service life of the aircraft, and increase operational readiness over the current UH-60A model. The Utility Helicopters Program Manager's Office (UH PMO) will meet these requirements by recapitalizing the airframe and qualifying, testing, and integrating mature technologies into the UH-60 helicopter. UH-60 aircraft designated to perform the Medical Evacuation (MEDEVAC) mission will integrate the UH-60Q/HH-60L medical Mission Equipment Package (MEP) into the UH-60M platform. New-production UH-60 helicopters will incorporate the UH-60M Engineering Change Proposal (ECP).

2.2 Program Description

The UH-60 Black Hawk mission is to project and sustain the force by providing air assault, general support, command and control (C2), and MEDEVAC capabilities. It was designed to replace the Vietnam-era UH-1 and to fill the need for a utility helicopter that would transport an entire infantry squad or carry double the UH-1's external load at higher airspeeds, with greater survivability, and in adverse weather and more severe climatic conditions. The Black Hawk is a twin turbine engine, single rotor, semi-monocoque fuselage, rotary wing helicopter capable of transporting cargo, 11 combat troops, and weapons during day, night, visual, and instrument conditions. The main and tail rotor systems consist of four blades each, with the capability to fold the main rotor blades manually, scissor the tail rotor paddles, and fold the tail pylon assembly for deployment, transport, or

storage. A movable, horizontal stabilator assembly is located on the lower portion of the tail rotor pylon to enhance flight characteristics.

Twenty-two percent of the UH-60A helicopters in the fleet were over 20 years old at the end of FY00 and 66 percent had exceeded their service half life. Increased operational tempo and the technological age of the airframe, components, and systems are adversely impacting the UH-60 and resulting in increased operation and support (O&S) costs and decreased reliability and maintainability. The UH-60 does not have the necessary digital avionics architecture to meet interoperability communication requirements. Existing communication and navigation suites do not meet evolving International Civil Aviation Organization (ICAO) and Federal Aviation Administration (FAA) traffic management requirements planned for implementation beginning in 2003. Current UH-60A/L navigation systems do not provide the precision required to insert troops and equipment during future combat (land and over water) operations, especially in darkness and adverse weather conditions.

In 1998, the U.S. Army Aviation Center Director of Combat Developments began the development of an ORD for UH-60 Black Hawk Recapitalization/Upgrade. During this same time frame, the U.S. Army Aviation and Missile Command (AMCOM) chartered a utility helicopter fleet modernization study to address how to best meet the challenges faced by the aging fleet. The Utility Helicopter Fleet Modernization Analysis, which concluded in January 1999, was led by a General Officer Steering Committee (GOSC), which reached a consensus recommendation for the path ahead. The GOSC consensus was that while a pure UH-60 modernized fleet is the desired approach, it is currently unattainable because of affordability constraints. Therefore, an evolutionary tiered modernization approach should be pursued. Elements of the recommended strategy, specific to the UH-60 Black Hawk fleet, are synopsized as follows:

- Modify 255 UH-60A/L aircraft to meet the UH-60 Modernization ORD Block 2 requirements (digitized cockpit, increased lift, reduced O&S) for Force Package (FP) 1 air assault units
- Modify 860 UH-60A/L aircraft in FP 1, FP 2–4, and Table of Distribution and Allowance (TDA) units to a UH-60M configuration, to meet the Block 1 requirements of the UH-60 Modernization ORD
- Modify 357 UH-60A/Q and HH-60L aircraft to the UH-60M MEDEVAC Black Hawk (UH-60M platform with medical MEP).

The ORD for Recapitalization/Upgrade of the UH-60 Black Hawk Utility Helicopter Fleet, signed in January 2000 and updated in September 2000, calls for increased capabilities as technology matures through the use of tiered, evolutionary requirements. In the near term, Block 1 requirements address immediate operational challenges associated with the aging UH-60 fleet. Requirements include digitization/situational awareness, extension of the aircraft life, reduction of fleet O&S costs, and increased operational readiness. Block 2 requirements address additional increases in lift and range, digitization, reductions in O&S costs, and increased survivability. Meeting Block 2 requirements is dependent on technology advances.

Block 1 takes advantage of existing aeronautical and digital technologies to recapitalize/upgrade the fleet. Existing UH-60A/Ls are recapitalized/modernized into UH-60M aircraft that include airframe structural improvements, a propulsion upgrade for the UH-60A, and a digital cockpit. Immediate payoff is realized by maintaining the average fleet age at about 15 years while reducing O&S costs. The O&S payback is a result of replacing the UH-60A T700-GE-700 engines (about 60 percent of the fleet) with more reliable UH-60L T700-GE-701C engines. The UH-60L engine also provides significant lift capability improvement over the UH-60A. Digital avionics and communications will allow the Black Hawk to operate on the digital battlefield and will reduce pilot fatigue while improving situational awareness.

Block 2 is initiated once the advanced propulsion capabilities of the common engine program are available. The common engine program, an advanced technology program executed by the Aviation Applied Technology Directorate (AATD), will provide 3,000 shaft horsepower (shp) with reduced fuel consumption. The Army's Apache program and the Navy's Sea Hawk program may also procure these engines. Along with the increased lift and range, the Block 2 aircraft will contain increased digitization and improved aircraft survivability. The Block 2 program will be pursued when technology becomes available to meet performance requirements under a separate acquisition process.

While technology constrains the ability to meet the ORD Block 2 lift/range requirements in the near term, the need exists now to modify existing Black Hawks to meet digitization/situational awareness requirements, extend the life of the aircraft, reduce O&S costs, and increase operational readiness.

2.3 System Description

The UH-60M can be produced from the assembly line or recapitalized/upgraded from an UH-60A or UH-60L aircraft. The UH-60M is based on the UH-60L Lot 21 configuration, with additional improvements to the airframe, electrical system, main rotor blades, Flight Control Computer (FCC), and cockpit/avionics. Specifically, the UH-60M configuration will have the following improvements.

a. The avionics incorporate the following components: communications/navigation MIL-STD-1553 data bus, Control Display Unit (CDU), Multi-Function Displays (MFDs), stormscope, and hardware and software to allow the crew to communicate digitally via the Improved Data Modem (IDM). The cockpit improvements include a moving map and the ability to present the data of primary flight instruments on the MFDs.

b. The UH-60M includes a Cockpit Voice Recorder (CVR)/Flight Data Recorder (FDR). The CVR/FDR will record all crew intercom voice, radio voice, and data messages. The CVR/FDR will be equipped with crash protection and a locator beacon.

c. The current Stability Augmentation System (SAS)/Flight Path Stabilization (FPS) computer is replaced with the Dual-Use Application Program (DUAP) digital Advanced Flight Control Computer (AFCC). The analog components of the flight control system remain unchanged. Figure 1 illustrates UH-60M cockpit improvements and benefits of items a–c.

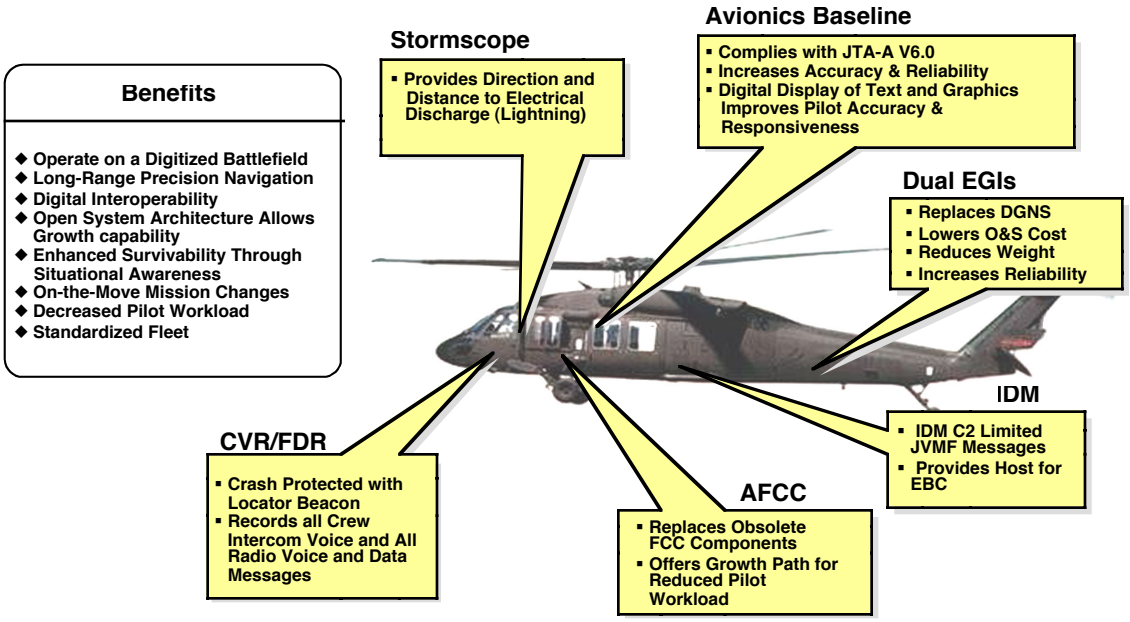


Figure 1. Cockpit Improvements

d. The UH-60M will use the Wide Chord Blade (WCB). This blade offers increased lift and will help offset the lift lost because of the increased mission weight of the UH-60M. The advanced composite main rotor blades consist of a graphite/fiberglass spar with a swept anhederal blade tip and have 16-percent wider chord than the current titanium blades.

e. The engine exhaust system includes an improved Hover Infrared Suppression System (HIRSS). The T700-GE-701C engines currently fielded on the UH-60L aircraft will be used for the UH-60M program. An Improved Durability Gearbox (IDGB), rotor-head, and controls will also be incorporated from the UH-60L program.

f. The UH-60M includes the Crashworthy External Fuel System (CEFS). The Extended Range Fuel System (ERFS) delivers fuel from external fuel tanks into the main fuel tanks, thereby providing any External Stores Support System (ESSS)-capable UH-60 helicopter a substantially larger range of operation. The ERFS consists of two 230-gallon crashworthy external, ballistic-resistant fuel tanks; two BRU-22A ejection racks for each ESSS-removable provisions kit; a jettison subsystem; and the necessary adapter, electrical harnesses, and tube assemblies to complete the interface with the ESSS. The fuel system consists of the lines from the main fuel tanks, firewall-mounted selector valves, prime/boost pump and fuel tanks, and engine-driven suction boost pumps. In each tank, the UH-60M also contains electrically operated submerged fuel boost pumps that provide pressurized fuel if the engine fuel pressure drops below the minimum operating pressure. Figure 2 illustrates the propulsion improvements and benefits of items d–f.

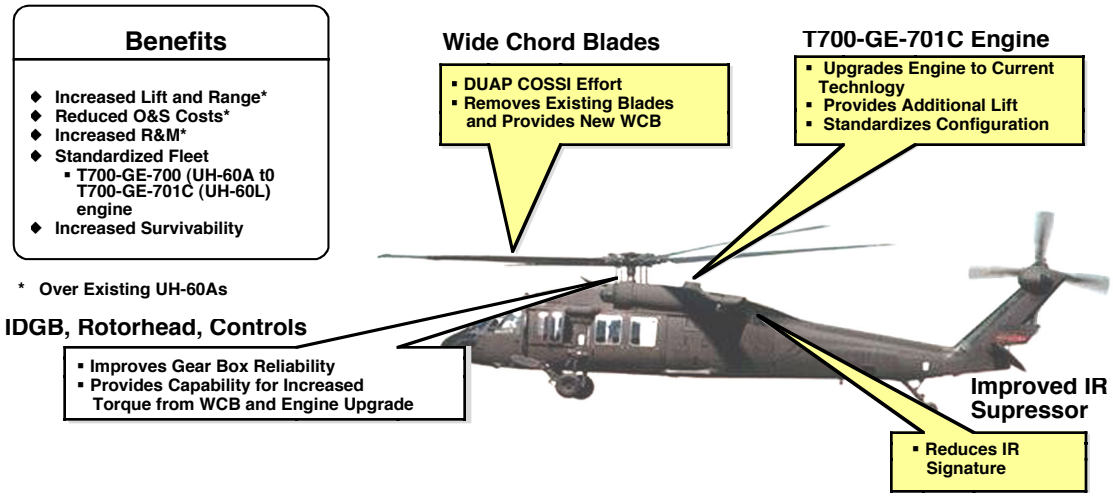


Figure 2. Propulsion Improvements

g. Airframe improvements include refurbishment or replacement of cabin components and troop seats and refurbishment of tailcone, stabilator, vertical pylon, airframe tuning devices, and crew seats. Major airframe load paths are strengthened to accommodate the increased WCB capability and the aircraft usage spectrum modified to reflect growth in mission weight. For those aircraft not currently equipped, the ESSS will be added to incorporate hard points for external stores and an improved ESSS fuel system. The transition access door will be used for the UH-60M program.

h. Electrical wiring is replaced to meet the Electromagnetic Environmental Effects (E3) requirements and accommodate new electrical systems design. Figure 3 illustrates airframe improvements and benefits of items g and h.

3.0 TECHNOLOGY ASSESSMENT

This section details the process used for the TRL Assessment of the UH-60M Recapitalization/Upgrade program.

3.1 Process Description

The TRL Assessment examines the UH-60M program concepts and defines the technology requirements of the program in order to determine technology maturity. As part of the program risk determination, technology maturity is defined as the degree to which critical technologies have been demonstrated as capable of meeting the program objectives. As part of the UH-60M Milestone B documentation for System Development and Demonstration, the UH PMO has performed an Integrated Risk Assessment, which is based on similar principles identified by program documentation, inputs from experienced acquisition personnel, and the application of widely accepted Department of Defense (DoD) risk management techniques. Using the IRA process approach as a basis, the TRL Assessment consists of the following steps:

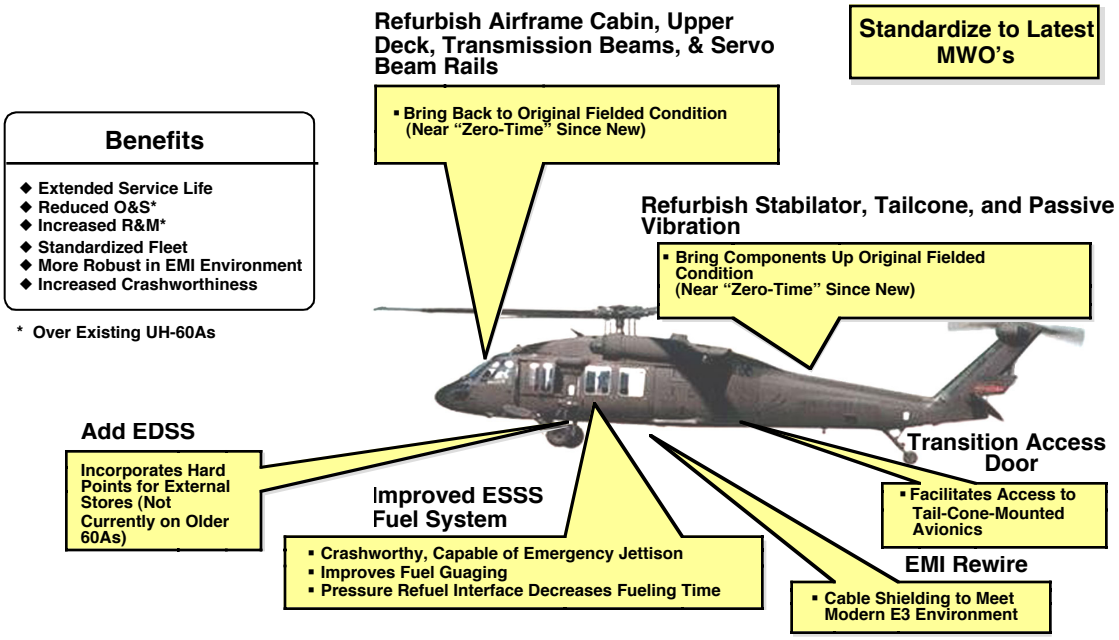


Figure 3. Airframe Improvements

a. Define Critical Technology

Those vehicle technologies, components, or subsystems whose success or failure most significantly affect the ability of a fully integrated UH-60M to meet the Block 1 key performance parameters (KPPs) as identified by the ORD and the System Performance Specification AVNS-PRF-10002.

b. Identify critical technologies in the UH-60M Work Breakdown Structure (WBS), (see Attachment 1)

Based on the objectives of the UH-60M program, improvements to the airframe, propulsion system, cockpit digitization, and cockpit integration (hardware and software) were chosen as the critical technology elements as shown in Figure 4.

c. Define levels to be used in TRL Assessment per October 2000 draft version of DoD 5000.2-R and extracted from Government Accounting Office (GAO) Report NSIAD-99-162, *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes*, as shown in Figure 5

d. Assess critical technologies and assign readiness levels.

3.2 Evaluation

Based on the above steps for the TRL Assessment, the following sections briefly describe the levels assigned to each critical element according to these definitions:

- TRL 7: Assigned to components that are currently undergoing qualification testing for an Army rotorcraft program but have not been fielded on the UH-60 platform except for qualification and testing.

Cockpit Digitization	Stormscope Dual EGIs CVR/FDR AFCC IDM
Propulsion	CEFS WCB T700-GE-701L Engine IDGB, Rotorhead, and Controls Improved HIRSS
Airframe	Standardization Refurbishment Refurbishment of Tailcone, Stabilator, and Passive Vibration Transition Access Door Electromagnetic Interference (EMI) Rewire Improved ESSS

Figure 4. UH-60M Critical Technologies

TRL	Definition	Description
1	Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples include paper studies of a technology's basic properties.
2	Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof of detailed analysis to support the assumption. Examples are still limited to paper studies.
3	Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology.
4	Component and/or breadboard validation in a laboratory environment	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared with the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.
5	Component and/or breadboard validation in a relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include "high-fidelity" laboratory integration of components.

Figure 5. TRL Definitions

TRL	Definition	Description
6	System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment.
7	System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
8	Actual system completed and "flight qualified" through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this is the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9	Actual system "flight proven" through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.

Figure 5. TRL Definitions (Continued)

- TRL 8: Assigned to qualified components of other fielded UH-60 systems (UH-60Q).
- TRL 9: Assigned to components currently fielded on UH-60L platform.

3.2.1 Cockpit Digitization

The stormscope (see Figure 6) provides relative direction and distance to electrical discharge. The stormscope consists of an antenna that is mounted on the bottom of the aircraft, a receiver computer that continuously monitors itself through built-in test features, and a display screen on the instrument panel of aircraft. Modes of operation include 360- and 120-degree weather mapping, time and date, and navigation display. The current designation for the stormscope is the BF Goodrich WX 1000, which is fielded on the UH-60Q and the HH-60L. The WX 1000 is a commercial off-the-shelf (COTS) item that satisfies the performance specification requirements of the UH-60M and has been approved for inclusion in the UH-60Q. Therefore, the TRL is 8.

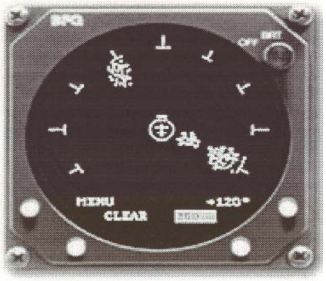
The Embedded GPS/INS (EGI) is a tri-Service effort (led by the United States Air Force). The objective is to provide an integrated navigation solution for aircraft equipped

Products: WX-1000 Series

The WX-1000, WX-1000 AN/AMS-2 (military version), WX-1000+ and the WX-1000E models include a deluxe range of user features, for a variety of applications. No other airborne instrument, including weather radar, gives a more precise presentation of thunderstorms.

Key WX-1000 features:

- Operation in 25, 50, 100 and 200 nmi ranges
- Display of airspace in 120° (forward) and 360° (surrounding) views
- Acquires & stores lightning data in all ranges simultaneously
- Clear function to help determine storm severity
- Automatic and pilot initiated self-test programs
- Self diagnostics with error messages
- Can display up to six programmable checklists
- Real-time digital clock display for time, day & date
- Stopwatch timer and elapsed time counter functions
- High resolution 3" ATI - size display



WX-1000 360° view
Stormscope® gives the whole picture, displaying 360° of weather and navigation information.

Figure 6. Stormscope Characteristics

with a MIL-STD-1553 digital data bus. The EGI embeds a five-channel GPS receiver into a ring laser gyro Inertial Navigation System (INS), making the total system lightweight and low mean time to failure. The EGI is the objective, fully digitized Global Positioning System (GPS) solution for scout/attack helicopters and has successfully flown on the CH-47 and the MH-60K. The AH-64 program is currently demonstrating/qualifying an updated version of the EGIs. For these reasons, the TRL for Dual EGIs is 7.

The CVR/FDR provides recording of crew internal and external communication (voice and data) and aircraft systems in-flight data, which can be used to analyze flight mishaps. The CVR/FDR is a COTS component that will be tailored to meet the system requirements of the UH-60M. The CVR/FDR technology is mature and well demonstrated in helicopters. A wide selection of commercially available CVR/FDR component solutions has been tailored to the rotary wing environment, and the technology has been demonstrated on the MH-60K and countless civil aviation aircraft. Performance requirements for the UH-60M program are equivalent to minimum FAA requirements for commercial aircraft CVR/FDR components. Qualification efforts are currently ongoing for the MH-60K and MH-47E fleets of aircraft. Therefore, the TRL is 7.

The AFCC is a product of the Department of Defense (DoD) Cost and Operation and Support Savings Initiative (COSSI) program to qualify a commercially developed FCC for use in the military environment. The AFCC is a form, fit, and function replacement to the existing flight control computer, which contains obsolete components no longer available from the manufacturer. These obsolete components are replaced with plastic encapsulated modules, which are based on mature technology. The new AFCC architecture is based on the SH-60 and S-92 commercial systems. Design modifications include cooling fins to replace fans, reduced power requirements, lighter weight, plug in cards reduced

from five to three, and alphanumeric displays replace "fault ball" fault indicators. ECP cut-in of the AFCC for the new production UH-60 aircraft is scheduled for calendar year 2001 following completion of qualification testing. The TRL is 7.

The IDM provides an interface between tactical radios and the aircraft's MFDs or the CDUs. The IDM provides four half-duplex radio channels and is compatible with several digital data protocols. PM-AEC is further enhancing the capability of the IDM to include hosting of a Joint Variable Message Format (JVMF) parser and, eventually, the Embedded Battle Command (EBC) software. The former will provide the UH-60M with the capability to send and receive C2 messages over the Tactical Internet (TI), whereas the latter will provide situational awareness from TI servers located on the digital battlefield. The benefit of using the IDM in this fashion on Army Aviation platforms is that the mission equipment processors within the respective Army aircraft will not be burdened with the overhead of parsing the message traffic and converting it from their various protocols. The IDM has been flown on the UH-60Q and the HH-60L but has not been used for interoperability. It is currently flying on the OH-58D and the AH-64. Qualification of the IDM 303 is ongoing. The TRL is 7.

3.2.2 Propulsion

The CEFS is a product of a Cooperative Research and Development Agreement (CRADA) intended to improve the crashworthiness capability and reduce the ballistic vulnerability of the existing ERFS. The CEFS is based upon a noncrashworthy fuel system that is fielded on rotary aircraft. Vehicle integration/flight test demonstration is planned. Qualification efforts are ongoing, with functional testing scheduled to begin in February 2000. The TRL is 7.

The WCB (see Figure 7) is the product of a DoD DUAP COSSI program to qualify a commercially developed main rotor blade for use in the military environment. The WCB consists of a composite spar, 16-percent increase in blade chord over current UH-60 blade, improved airfoils/anhederal tip, and cross section and strike protection identical to S-92. Qualification testing is ongoing. The TRL is 7.

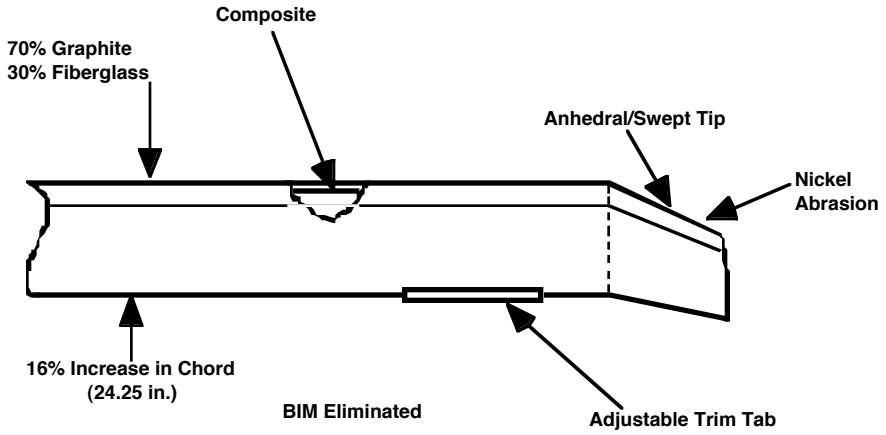


Figure 7. Wide Chord Blade

The T700-GE-701C engine is currently fielded on the UH-60L with over 400 aircraft fielded (each with 2 engines). For the UH-60M program, engines on the UH-60A aircraft will be upgraded from 700 engines to 701C engines. This statement is also true for the IDGB, rotorhead, and controls. The TRL is 9.

The improved HIRSS is the product of a CRADA to establish IR performance improvements realized with the implementation of advanced materials and discrete design modifications to the HIRSS currently installed on the UH-60 fleet. Development test and analysis efforts have been completed and establish the system IR suppression performance, demonstrate the positive impact of the design modifications on installed engine horsepower performance, and evaluate favorable reductions in engine back pressure. The material and suppression technologies resulting in the improved suppressor performance have been demonstrated and applied to a currently fielded product. Although the ORD does not require this capability, the currently fielded HIRSS meets performance requirements. System flight test demonstrations have been completed, with no significant issues noted. System evaluation for the General Electric HIRSS 2000 and the Sikorsky Aircraft Advanced Infrared System. The TRL is 7.

3.2.3 Airframe

The refurbishment of the airframe cabin, upper deck, transmission beams, servo beam rails, and potentially a new cabin section use no new technologies and to minimize schedule risks, the UH-60M program is avoiding use of any exotic material or new technology. Upper deck refurbishment and replacement of the transmission beams are required to correct the history of cracking in this area of UH-60 fielded aircraft. Whether there will be a new cabin section or refurbishment of the old cabin will be decided during System Development and Demonstration. The TRL is 9.

Standardization to Lot 21 Maintenance Work Orders (MWOs) is, by definition, being done on the current version of the UH-60L aircraft. These MWOs have been incorporated into new production units of the Lot 21 configuration. The TRL is 9.

The refurbishment of the tailcone, stabilator, and passive vibration is currently being done on UH-60A/Ls. The TRL is 9.

The transition access door will facilitate the access to the avionics equipment installed in the tail pylon area of the aircraft. Currently, the maintenance personnel must access this equipment through the crew cabin aft bulkhead on the UH-60A/Ls. This modification is being done on the UH-60Q. The TRL is 9.

EMI rewire requires no new technology, and the materiel solution for the UH-60M is currently fielded wiring or that on the MH-60K. The TRL is 9.

Improved ESSS provides new crashworthy fuel tanks with jettisonable capability and improved gauging and control. The ESSS provides hardpoints to older UH-60As to allow installation of the ESSS. The improved ESSS incorporates no new technology and is currently fielded on the UH-60L. The TRL is 9.

3.3 Summary

The UH-60M program has performed the TRL Assessment for the critical technologies identified in the WBS. Figure 8 summarizes the results. All other elements of the UH-60M WBS were assessed at the readiness level TRL 9 since there is no change from the current fielded UH-60 aircraft.

Technology	TRL Assessment
Cockpit Digitization	
Stormscope	8
Dual EGIs	7
CVR/FDR	7
AFCC	7
IDM	7
Propulsion	
CEFS	7
WCB	7
T700-GE-701C	9
IDGB, Rotorhead, and Controls	9
Improved HIRSS	7
Airframe	
Standardization	9
Refurbishment	9
Refurbishment of Tailcone, Stabilator, and Passive Vibration	9
Transition Access Door	9
EMI Rewirine	9
Improved ESSS	9

Figure 8. Summary

A complete history of documentation to support these TRL levels can be found in matrix format in Attachment 2. [**Editor's Note:** *Attachment 2 is not included in this appendix.*]

4.0 CONCLUSIONS

The UH-60M program has been structured to reduce program risk to the extent considered practical and without compromising requirements defined by the user. Significant risk reduction has been accomplished in the early stages of the UH-60M program, and much more is required during the System Development and Demonstration (SDD) phase of the program. These activities have been considered in early stages of the UH-60M program and are thoroughly documented in the Integrated Risk Assessment (IRA) and the Risk Management Plan (RMP) for the program.

To minimize the overall program risks, the UH-60M program has planned and performed risk-mitigation activities in the following areas:

- System Integration Laboratory
- Leveraging other UH-60 efforts (Digital Map and CDU)
- Software Engineering Institute (SEI) Capability Maturity Model (CMM) Level III capability
- Integrated schedules/Critical Path Analysis (CPA)
- Trade studies
- Risk-reduction contract
- IRA
- Combined Test Team
- Modeling and simulation (M&S)
- Early user demonstrations
- Cost as an independent variable/award fee structure
- Depot Partnership Study
- Earned Value Management System
- Service Life Assessment Program
- Low rate initial production (LRIP), which allows additional schedule ramp-up to full-rate production (FRP).

Through early identification and the use of these tools and activities, the UH-60M program has minimized risk through the use of demonstrated capabilities.

The UH-60M program has been defined and structured to identify and control risk. Extensive program planning has been accomplished, which involved the appropriate representatives from the UH PMO, the contractor, and the user. Contract requirements and management plans define a process that will ensure success. The TRLs identified in this assessment are well within the acceptable range to proceed into the System Integration and Demonstration phase.

ACRONYMS

AATD	Aviation Applied Technology Directorate
AFCC	Advanced Flight Control Computer
AFCS	Advanced Flight Control System
AM	amplitude modulation
AMCOM	Aviation and Missile Command
ANVIS	Aviator's Night Vision Imaging System
C2	command and control
CDU	Control Display Unit
CEFS	Crashworthy External Fuel System
CMM	Capability Maturity Model
COSSI	Cost and Operation and Support Savings Initiative
COTS	commercial off-the-shelf
CPA	Critical Path Analysis
CRADA	Cooperative Research and Development Agreement
CVR	Cockpit Voice Recorder
DoD	Department of Defense
DUAP	Dual-Use Application Program
E3	Electromagnetic Effects Environment
EBC	Embedded Battle Command
ECP	Engineering Change Proposal
EGI	Embedded GPS Inertial Navigation System
EMI	electromagnetic interference
ERFS	Extended Range Fuel System
ESSS	External Stores Support System
FAA	Federal Avionics Administration
FCC	Flight Control Computer
FDR	Flight Data Recorder
FLIR	forward-looking infrared
FM	frequency modulation
FP	Force Package
FPS	Flight Path Stabilization
FRP	full-rate production
FY	Fiscal Year
GAO	Government Accounting Office
GFE	government-furnished equipment
GOSC	General Officer Steering Committee
GPS	Global Positioning System
HF	high frequency
HIRSS	Hover Infrared Suppression System
HUD	Heads Up Display
HUMS	Health and Usage Monitoring System
ICAO	International Civil Aviation Organization
IDGB	Improved Durability Gearbox
IDM	Improved Data Modem

IFF	identification friend or foe
ILS	Instrument Landing System
INS	Inertial Navigation System
IR	Infrared
IRA	Integrated Risk Assessment
JVMF	Joint Variable Message Format
KPP	Key Performance Parameter
LRIP	low rate initial production
M&S	modeling and simulation
MEDEVAC	Medical Evacuation
MEP	Mission Equipment Package
MFD	Multi-Function Display
MS	Milestone
MWO	Maintenance Work Order
NSIAD	National Security and International Affairs Division (GAO)
O&S	operation and support
ORD	Operational Requirements Document
R&M	reliability and maintainability
RMP	Risk Management Plan
SAS	Stability Augmentation System
SDD	System Development and Demonstration
SEI	Software Engineering Institute
shp	shaft horsepower
TACAN	Tactical Air Navigation
TDA	Table of Distribution and Allowance
TI	Tactical Internet
TRL	Technology Readiness Level
UH PMO	Utility Helicopters Program Management Office
UHF	ultrahigh frequency
VADR	Voice And Data Recorder
VHF	very high frequency
VOR	VHF Omni-directional Radio-range
WBS	Work Breakdown Structure
WCB	Wide Chord Blade

Attachment 1

UH-60M Work Breakdown Structure

WBS Level	Description
1	UH-60M
1.1	Air Vehicle
1.1.1	Air Frame
1.1.1.1	Fuselage
1.1.1.2	Landing Gear
1.1.1.3	Transmission
1.1.1.4	Life Support/Environmental Systems
1.1.1.5	Flight Controls
1.1.1.6	Secondary Power Systems
1.1.1.7	Electrical System Integration
1.1.1.8	Hoist/Cargo System
1.1.1.9	Propulsion Systems
1.1.1.A	Rotor Systems
1.1.2	Communications/Identification
1.1.2.1	Intercom
1.1.2.2	Radio Systems
1.1.2.3	IFF Transducer
1.1.2.4	Communication Security
1.1.2.5	Improved Data Modem (IDM)
1.1.2.6	VHF-FM Radio
1.1.2.7	UHF-AM Radio
1.1.2.8	HF Radio
1.1.2.9	VHF-AM Radio
1.1.2.A	Emergency Control Panel
1.1.3	Navigation/Guidance
1.1.3.1	Radar Navigation
1.1.3.2	TACAN Navigation Set
1.1.3.3	VORs/ILS Navigation
1.1.3.4	Electronic Altimeter Set
1.1.3.5	INS
1.1.3.6	Stormscope
1.1.3.7	Low Freq Auto Direction Finder System
1.1.3.8	Personnel Locator System
1.1.3.9	GPS
1.1.4	Automatic Flight Control System
1.1.4.1	AFCS Avionics
1.1.4.2	AFCS Servos
1.1.5	Survivability Equipment
1.1.6	Data Displays and Controls

UH-60M Work Breakdown Structure (Continued)

1.1.6.1	Multi-Function Display
1.1.6.2	CDU
1.1.6.3	Data Concentrator Unit
1.1.6.4	Data Transfer System
1.1.6.5	Multifunction Slew Controller
1.1.6.6	ANVIS HUD
1.1.6.7	FLIR
1.1.6.8	Fuel Management System Controls
1.1.7	Armament
1.1.8	Auxiliary Equipment
1.1.9	Integration/Assy/Test/Checkout
1.1.A	Propulsion-GFE Engine
1.1.B	Air Vehicle Application Software
1.1.B.1	MFD Software
1.1.B.2	CDU Software
1.1.B.3	Data Concentrator Unit Software
1.1.C	Air Vehicle System Software
1.1.C.1	MFD Display
1.1.C.2	CDU
1.1.C.3	Data Concentrator Unit
1.1.D	Aircraft Data Recorders
1.1.D.1	FDR
1.1.D.2	CVR
1.1.D.3	HUMS
1.1.E	Non-Recurring Avionics Sys Integration
1.2	Training
1.3	Data
1.4	System Test and Evaluation
1.5	System Engineering/Management
1.5.1	Program Management
1.5.2	Systems Engineering
1.5.3	Integrated Manufacturing
1.6	Logistics
1.7	Aircraft Kits

COOPERATIVE ENGAGEMENT CAPABILITY (CEC) TECHNOLOGY READINESS LEVEL ASSESSMENT

Performed by: Office of Naval Research (ONR-35)

3 January 2002

Prepared by: CAPT A. J. Cetel, USN Date: 27 December 2001

Approved by: Dr. Eli Zimet, ONR 35 Date: 28 December 2001

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Cooperative Engagement Capability (CEC) Technology Readiness Level Assessment

1.0 PURPOSE

This document articulates the results of the Technology Readiness Assessment (TRA) performed by the Office of Naval Research (ONR-35) on the critical technologies embedded in the CEC Program. In accordance with DoD 5000.2-R, dated June 2001, and Deputy Under Secretary of Defense for Science and Technology (DUSD(S&T)) Memo, dated 5 July 2001, this assessment was based upon the Technology Readiness Level (TRL) descriptions and the technology maturity associated with each critical technology.

2.0 PROGRAM OVERVIEW

The CEC has been evaluated in a series of stressing demonstrations and certified by the Operational Test and Evaluation Force (OPTEVFOR) as operationally effective and operationally suitable through one of the most complex operational evaluations ever performed by the U.S. Navy. In addition, prior at-sea evaluations in operational environments have also been successful in reducing the risk and preparing for operational evaluation (OPEVAL) (see Figure 2-1).

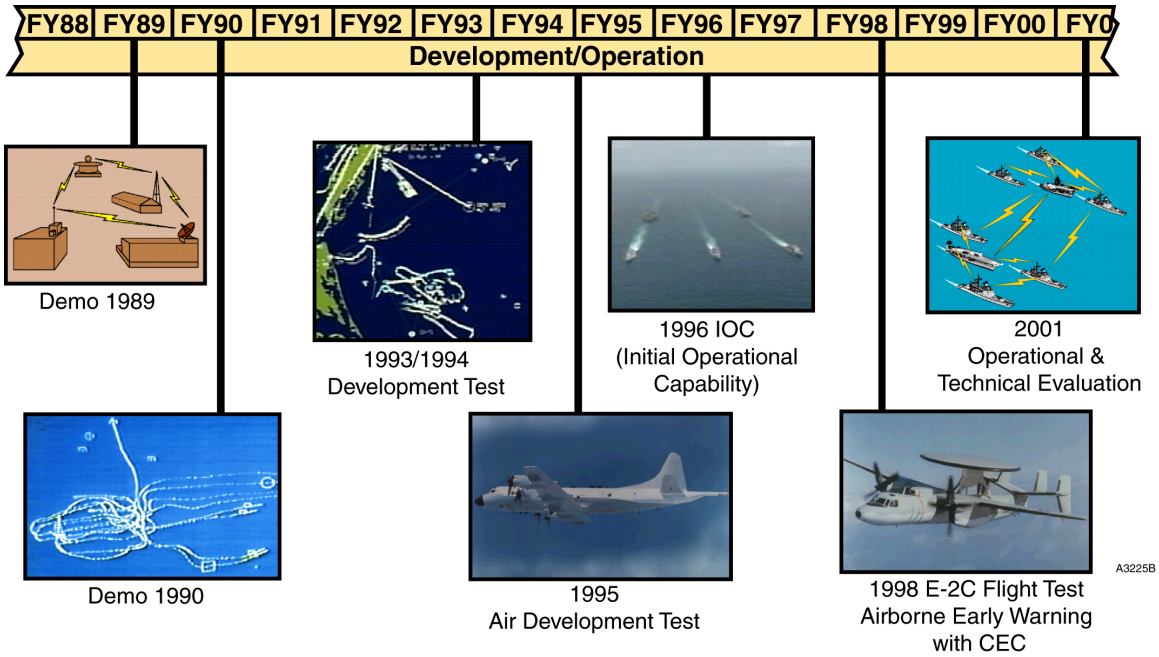

Figure 2-1. Preparations for Operational Evaluation

2.1 Program Objective

The CEC system has demonstrated its capability to develop a coherent, composite view of the battlespace that is shared by all network participants in real time. In addition, the system has shown its ability to facilitate buying back the battlespace lost to the evolving threats that were envisioned in the initial days of CEC. Each of these demonstrations has involved stressing threats in adverse environments consistent with the wartime environment in which the system was designed to operate. The results of each of these demonstrations have shown an ability to maintain a coherent view of the battlespace on each CEC node while facilitating the engagement and destruction of threats that have not previously been achievable. The introduction of CEC into operational units will significantly enhance the ability of Naval forces to engage a wide range of threats, with a high probability of negation in the open ocean and littoral environments.

2.2 Program Description

CEC is a system of hardware (see Figure 2-2) and software that allows ships to share radar data on air targets. Radar data from individual ships and E-2C aircraft within a battle group (BG) are transmitted to other ships in the group via a line-of-sight (LOS) Data Distribution System (DDS). Each ship uses similar data processing algorithms resident in its cooperative engagement processor (CEP), resulting in a composite aircraft and missile track on each ship—a track that is essentially the same. An individual ship can launch a surface-to-air missile (SAM) at a threat aircraft or antiship missile (ASM) within its engagement envelope, based on composite track data resident within the CEC system, even though that ship may not have that track within its organic air search radar system. CEP-equipped units, connected via the DDS network, are known as Cooperating Units (CUs).

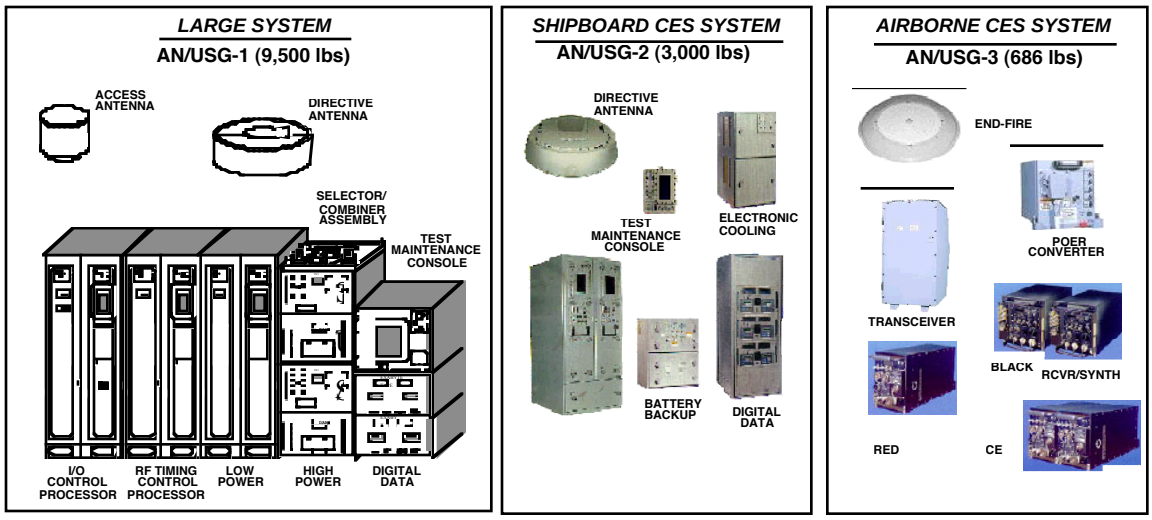

Figure 2-2. CEC Hardware System

2.3 System Description

The shipboard CEC terminal consists of the CEP subsystem and the DDS, which includes an antenna subsystem, receiver/synthesizer subsystem, red processor subsystem, and a black processor subsystem. A CEC terminal also has ancillary equipment, such as:

- A data processing cabinet to house the below-decks subsystems and power conditioners
- An environmental control unit to power and cool the antenna subsystem
- A test maintenance console (TMC) for remote status and maintenance monitoring
- A battery backup converter (BBC) to maintain certain functions during power interruptions
- A digital data recorder to record system events for off-line analysis
- CEP input/output (I/O) converters to interface with various platform-unique weapon systems and sensors.

Figure 2-3 is a block diagram of a CEC terminal's major subsystems. In this figure, solid line arrows represent data flow and dotted line arrows represent control flow. Figure 2-4 illustrates the physical characteristics of the CEC equipment.

a. The shipboard CEC implements a Shipboard Active Aperture Antenna (SBAA) for data transmission and reception. The shipboard CEC also includes direct current/direct current (DC/DC) converters, Cesium time standard, receiver/synthesizer, CEP I/O converter, BBC, and the Data Processing Terminal (DPT) cabinet containing the CEP and DDS red and black processor subsystems and receiver/synthesizer subsystem. Figure 2-4 depicts the typical shipboard CES equipment configuration's interfaces to the auxiliary subsystems.

b. The DPT provides a centralized common equipment suite (CES) equipment location, which houses the CES' main processing subsystems. The DPT is physically configured into a split layout. The left drawer contains the equipment on the red side of the TEMPEST boundary (i.e., the CEP main and I/O circuitry, the CEP expansion logic, and DDS red processor). The right drawer contains the receiver/synthesizer, black processor, Cesium time standard, and a designated growth rack. The foundation base plate contains the Power Conditioner subsystem. The ship's cooled water system provides primary cooling water at 40–50 °F. flowing at 8.0 gpm with a pressure drop of 10 psig.

c. The CEP obtains sensor data and mission control data and shares this information with other network CEPs. Using this collective information, the CEP produces a composite air/surface picture for the area surrounding the BG. The interface between the CEP and DDS red processor is an Ethernet connection. All host combat system interfaces with the CEP, including sensor and combat

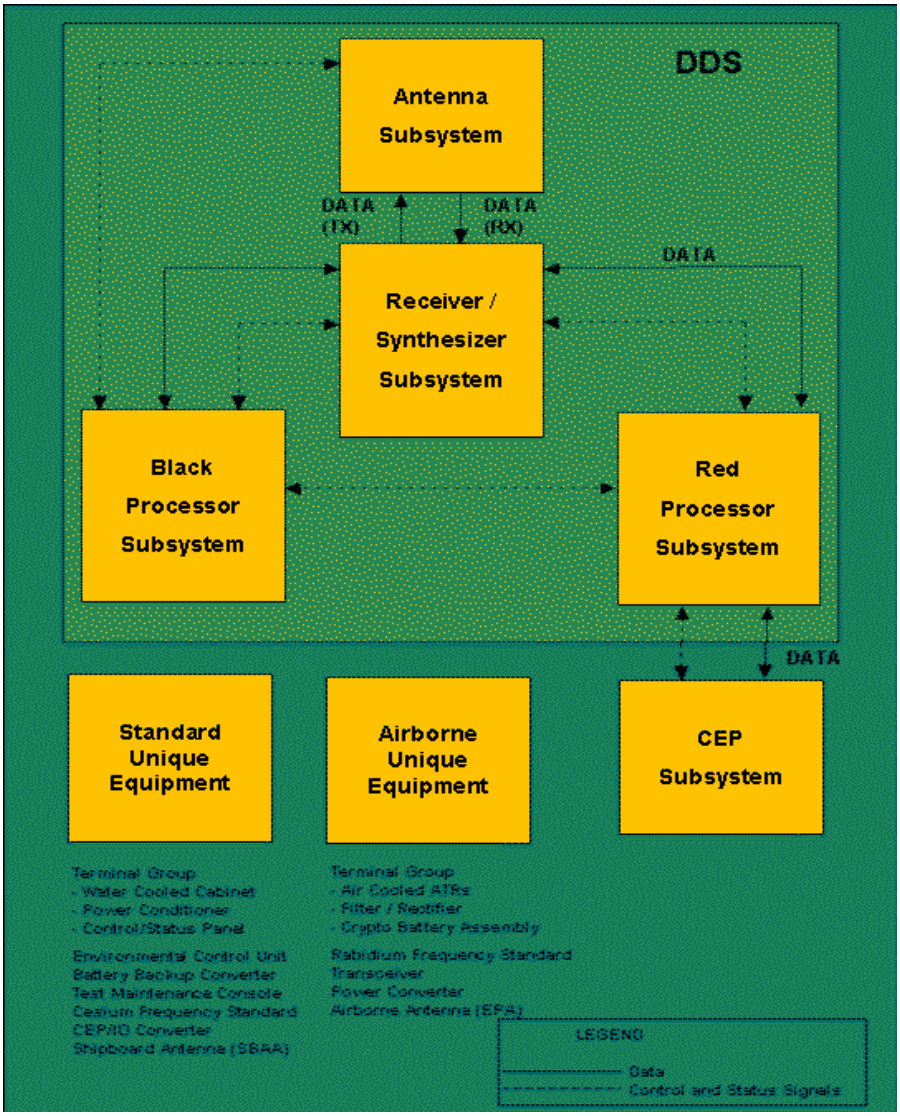

Figure 2-3. CEC System Block Diagram

system, are routed through a CEP I/O Converter (CIOC) box. The CIOC provides the translation between the multiple host combat system interface and the CEP's Ethernet interface. CEP display and operator controls are provided at the combat system's operator consoles via a separate Ethernet interface. Many of the commands that the CEP issues can also be executed from a touch screen display on the TMC or DPT control panel.

d. The CEP processing architecture is a collection of coupled microprocessor and interface boards, interconnected by a combination of commercial microcomputer buses [Versa Module Europa (VME) and Ethernet]. These functions are divided into "kernel" and "adaptive" processing functions. The kernel processing functions represent those functions present in the CEP for all configurations, and the adaptive processing functions are those specific processing functions that change depending on the platform class for which the CEP is configured.

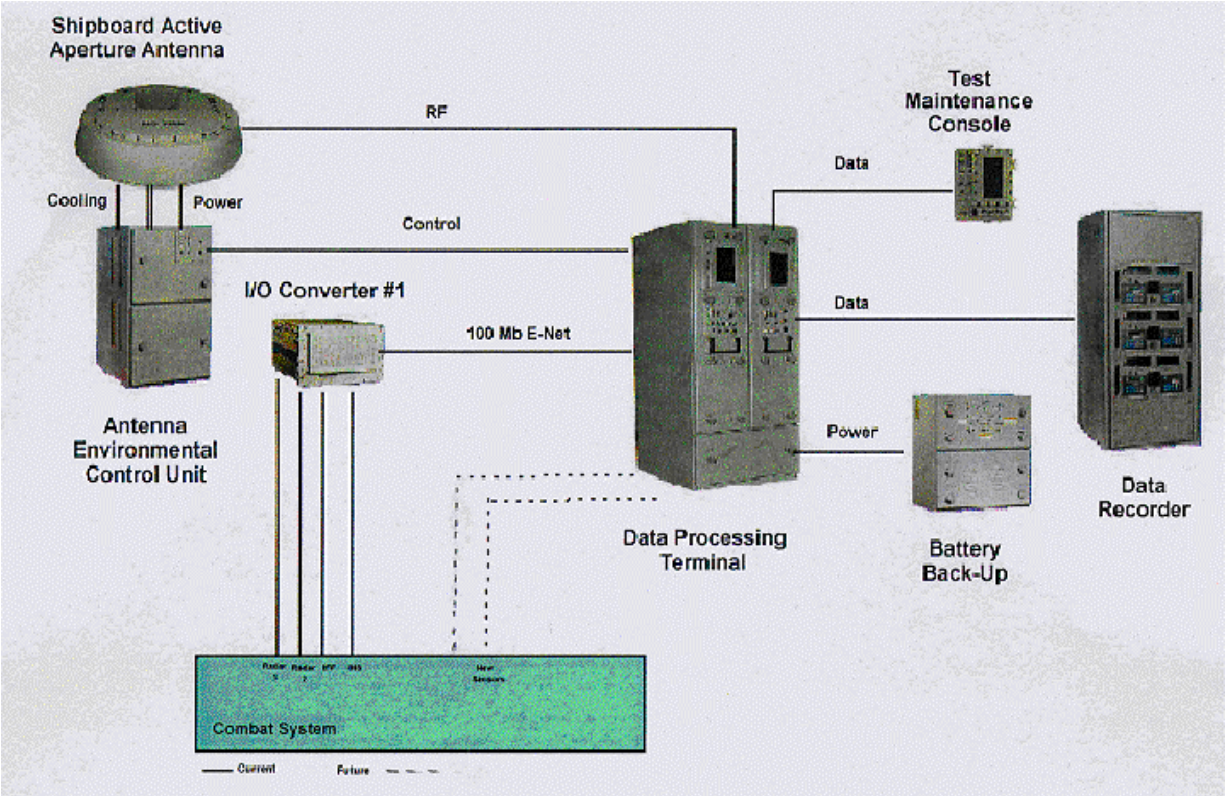

Figure 2-4. Shipboard CES Typical Configuration

e. The CEP has a dedicated capability for future growth designed into the initial manufacturing phase to allow interfacing with additional program applications, weapons system equipment, or sensor features not currently addressed or identified. The first use of this growth capability is to house special Ship Self Defense System (SSDS) components.

f. The DDS red processor provides for processing classified or sensitive data. It has a direct Ethernet interface to the CEP and communicates with the black processor and receiver/synthesizer subsystems through fiber-optic links. The fiber-optic interfaces ensure that classified information held by the red processor memory cannot be transmitted in the clear because of a malfunction of either the equipment or the computer program. Normal data transmissions via DDS are encrypted. An embedded CDH cryptographic chip set physically mounted on the embedded crypto card in the red processor provides encryption and decryption functions and required timing and resynchronization terms. Figure 2-5 is a block diagram of the red processor

g. The black processor provides terminal control for all DDS communications and performs control functions, but it does not process or store any unencrypted classified information. It communicates with the red processor over an optical interface designed to prevent the inadvertent transfer of classified data. The beam controller that provides pointing commands to the antenna is contained in the black processor. Figure 2-6 is a block diagram of the black processor.

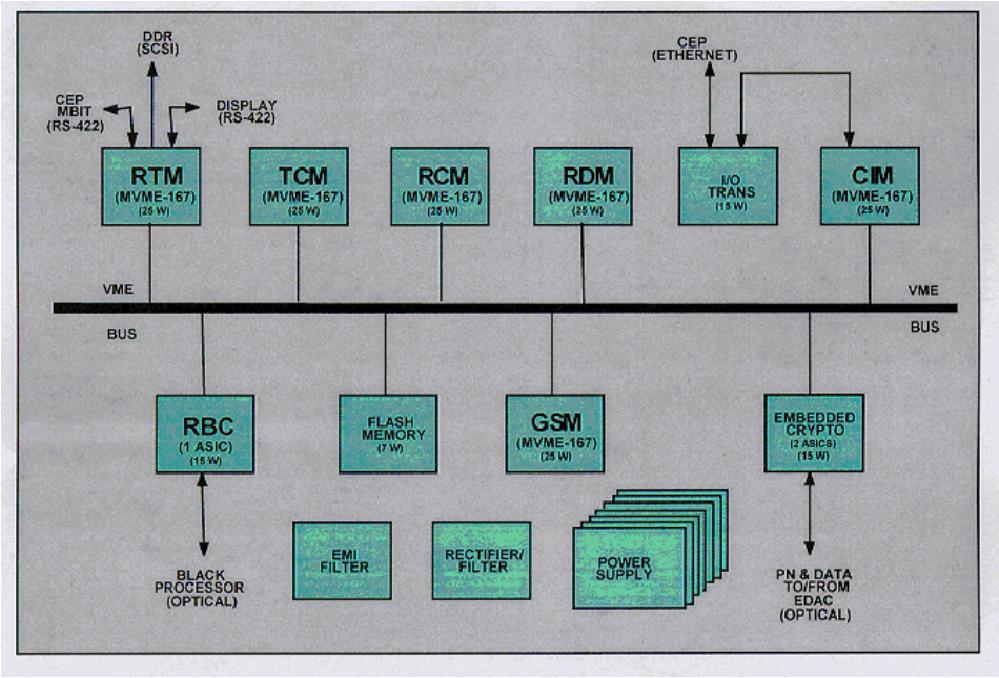

Figure 2-5. Red Processor Block Diagram

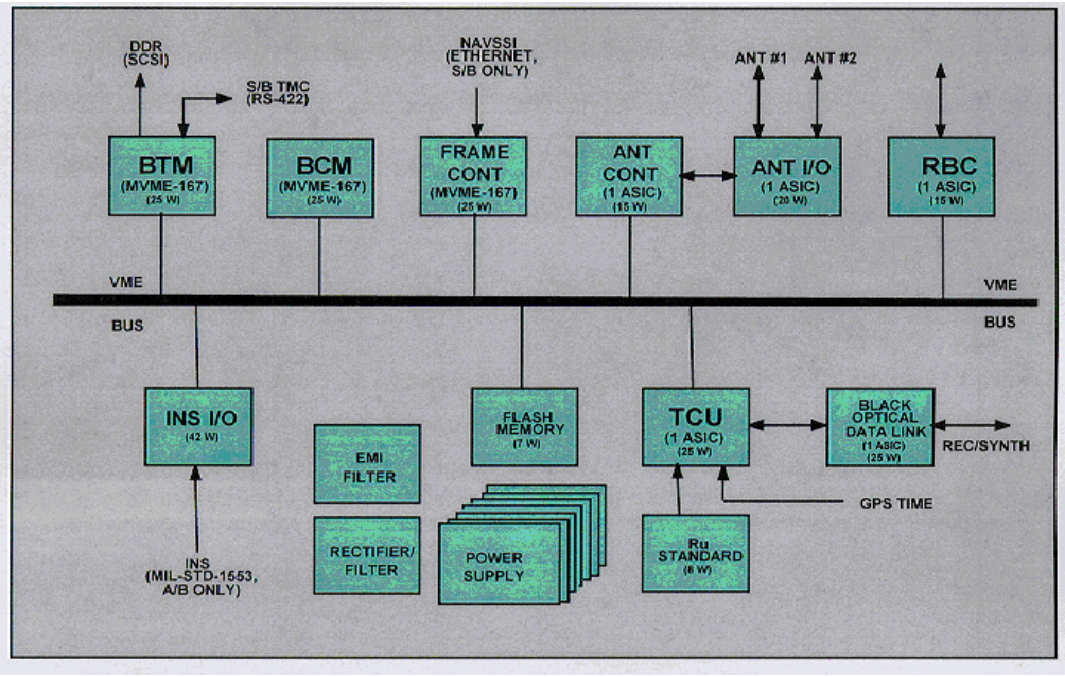

Figure 2-6. Black Processor Block Diagram

h. A Cesium frequency standard is used on shipboard terminals to provide an accurate and stable reference frequency for the DDS's master clock and the time-of-day clock within the Timing and Control Unit (TCU). The Cesium standard is sufficiently stable to meet CEC system timing requirements for extended shipboard missions.

i. The BBC provides full system protection during momentary power loss, fluctuations, or interruptions (100 msec to 8 sec in duration). The BBC uses 270 V DC from the power conditioner for charging and ensuring system protection and provides battery backup to the crypto and time-of-day circuits for up to 1.5 hours. This feature provides increased system reliability and eliminates the need for a separate battery for crypto or the Cesium frequency standard.

j. The SBAA is a cylindrical, polyalphaolefin (PAO) liquid-cooled antenna used for transmitting and receiving normal communications and is designed to be mounted on a standard 17-inch diameter mast. The antenna's radiating elements are configured into five evenly spaced rows of elements around the cylinder. The top row can be used to form an omni-directional receive capability. Normally, a 90-degree sector of the antenna is excited. Commutating the 90-degree sector of the array and "fine tuning" the direction of the beam via electrical phase shifting within the 90-degree sector allows azimuth scanning. Elevation scanning is accomplished by electrical phase shifting within the 90-degree sector. When transmitting, the radio frequency (RF) is divided among the active elements within the 90-degree sector, with different amounts of phase shift injected into the paths of the signals going to those antenna elements. The amount of phase shift and power fed to each element is controlled so that signals radiated by the different elements will reinforce each other in the desired transmission direction but cancel each other in other directions. Most of the radiated power is concentrated and formed into a pencil-like beam.

   The same principle of phase reinforcement and cancellation is used for reception. The received signals from different elements are phase shifted by various amounts before being added together to form a composite signal. The phase shifts applied to the different elements are chosen so that signals arriving from the desired direction reinforce each other and signals arriving from other directions cancel each other.

   To maximize the required radio LOS coverage, the SBAA is mounted as high as possible but generally not less than 120 feet above the ship's waterline. Location (in a single antenna installation) must be such that the radio LOS to the horizon is not blocked for 360 degrees (190 degrees azimuth for each antenna if a dual antenna system is required) and is unobstructed from +70 degrees (up) to –30 degrees (down). The antenna is mounted to within ±1 degree of horizontal for gain and polarization purposes. In addition, mechanical alignment for bearing reference is required to be within 2 degrees of the ship's centerline.

   The SBAA uses a dry air supply to maintain an internal positive operating pressure for corrosion protection. During installation, the internal area is purged for 15 minutes to remove built-up humidity or condensation.

k. The Antenna Environmental Control Unit (AECU) provides conditioned and regulated power, including 270 V DC, to the antenna electronics. It houses the liquid cooling system controller that maintains and controls the antenna internal

temperatures using shipboard-supplied cooling water at 40–50 °F flowing at 9.0 gpm with a pressure drop of 10 psig. In addition, the AECU contains electromagnetic interference (EMI) filters, power conditioners and a Liquid Heat Exchanger Assembly (LHEA) consisting of a heat exchanger, pump, isolation valves, and control panel and controller for the AECU. One AECU can supply cooling and power for both antennas in a two-antenna installation if the cable that runs between the SBAAs and the AECU is kept to a specified length.

l. Although primary operational control of the CEC is via combat system console interfaces to the CEP, the TMC is designed as the primary man-to-machine interface for maintenance purposes. The TMC ensures maintenance technicians/operators can communicate via touch screen with the DDS and CEP. The TMC contains system status and fault indications, an audible alarm, control switches, maintenance and recording controls, and battleshort, reload, and reset capabilities.

m. The CIOC provides the ability for the CEP to communicate with numerous systems on different platforms via a 100BaseT Ethernet connection and with the platform's sensors and combat system over various Naval Tactical Data System (NTDS) interfaces (NTDS Types A–E). Although the standard shipboard installation is one unit, the capability exists to accommodate up to six CIOCs, depending on ship requirements.

3.0 TECHNOLOGY ASSESSMENT

This section details the assessment process and summarizes the information associated with the TRA of the CEC. Since the OPEVAL and the acquisition decision is for the USG-2 shipboard CEC system and the CEC System Baseline 2.0, this assessment focused on those shipboard elements. It is clear that the basic technologies of the airborne system, USG-3, are the same as the shipboard system and, thus, would have the same TRL.

The key references used in this assessment were:

- DoD 5000.2-R, dated 10 June 2001
- DUSD(S&T) Memo dated 5 July 2001
- CEC Operational Requirements Document (ORD) (Draft Revision), dated 21 September 2001
- CEC Risk Management Plan for CEC System Baselines 1.0., 2.0, and 2.1
- CEC TECHEVAL(DT-IIH) Analysis Control Board (ACB) Report, dated 31 May 2001
- CEC OPEVAL Report, COMOPTEVFOR ltr 3980 (1415-OT-IIA4) Ser714/S026, dated 7 September 2001
- Acquisition Strategy (PMS-465 Draft), dated 26 November 2001

- CEC System Specifications for Cooperative Engagement Capability – Rev D-WS-32890, dated 21 April 2000
- Independent Assessment of CEC Technology - ASN(RDA) 1998
- Acquisition Strategy for Cooperative Engagement Capability – Approved 16 November 2000.

3.1 Process Description

In determining how to execute this TRA, ONR-35 selected a small group of technical experts. Some had no direct association with the program, and others were the appropriate CEC Program experts. The assessment team was lead by Captain A.J. Cetel, USN from ONR-35, which collected data and assessment inputs from and/or obtained comments on the assessment product from personnel in the following organizations:

- Massachusetts Institute of Technology (MIT)/Lincoln Laboratory (LL)
- Johns Hopkins University/Applied Physics Laboratory (JHU/APL), the CEC Technical Direction Agent (TDA)
- Raytheon Corporation, CEC Prime Contractor
- Office of Naval Research (ONR)
- CEC Program Office, PMS-465
- Anteon Corporation, CEC Technical Support
- Noesis Incorporated, ONR-35 Technical Support.

The first step in this TRA was to define "critical technologies": those technologies that are imbedded in CEC components or subsystems and that make CEC operate as designed and tested. The following were the determined critical technologies:

CEP	▪ Motorola 5100 series reduced instruction set computer (RISC) processors ▪ Fusion algorithms
DDS	▪ Antenna array – GaAs transmit/receive (T/R) modules ▪ 68040 processors ▪ CDH chipset (CTIC-DS101 Hybrid) ▪ Network algorithms

In reviewing the TRL assessment criteria [stipulated by the Office of the Secretary of Defense (OSD)] that were applicable for a program going through a Milestone III decision, the following were appropriate:

TRL 7. System prototype demonstration in an operational environment.	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.
TRL 8. Actual system completed and "flight qualified" through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
TRL 9. Actual system "flight proven" through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.

[Source: DUSD(S&T) Memo, dated 5 July 2001]

It was against these criteria that the TRA concerning the critical technologies was made.

3.2 Evaluation

3.2.1 Operating System Critical Technology Assessment (TRL-9)

Since the CEC system is dominated by computer programs, it is important to ensure initially that the operating system in the DDS and the CEP are stable and are not unique.

The operating system used in the CEP and DDS is VxWorks®. VxWorks® is the fundamental run-time component of the Tornado II embedded development platform and the most widely adopted real-time operating system (RTOS) in the embedded industry. VxWorks® is available on all popular central processing unit (CPU) platforms and, thus, is clearly "off-the-shelf." The VxWorks® RTOS is found in a multitude of applications and markets, including:

- **Data networking:** Ethernet switches, routers, remote access servers, asynchronus transfer mode (ATM) and frame relay (FR) switches
- **Industrial:** test and measurement equipment, robotics, computer numeric(al) control (CNC) equipment, process control systems
- **Medical:** Magnetic Resonance Imaging (MRI) scanners, Positron Emission Tomography (PET) scanners, radiation therapy equipment, bedside monitors
- **Digital imaging:** printers, digital copiers, fax machines, multifunction peripherals, digital cameras
- **Transportation:** automotive engine control systems, traffic signal control, high-speed train control, anti-skid testing systems
- **Telecommunications:** private branch exchange (PBX) and ACDS, CD switching systems, cellular systems, xDSL and cable modems

- **Aerospace:** avionics, flight simulation, airline cabin management systems, satellite tracking systems
- **Computer peripherals:** X terminals, I/O control, redundant array of inexpensive or independent disks (RAID) data storage systems, network computers
- **Multimedia:** professional video editing systems, video conferencing
- **Consumer electronics:** PCS Data Access Service (PDAS), set-top boxes/ TV, screen phones, audio equipment, car navigation systems, in-flight entertainment systems.

Assessment of each of the major elements of CEC follows.

3.2.2 CEP Critical Technology Assessment

3.2.2.1 Computer, Power PC Processor Card-Power 4B-166-32 (TRL-9)

The Power 4B-166 is a 166-MHz PowerPC-604e-based 6U VME Engine designed for embedded and real-time computing applications in IBM systems. The IBM PowerPC 604e Microprocessor runs at 166 MHz internally and interfaces to the external memory system at 66 MHz. It has 32 to 288 Mbytes of dynamic random access memory (DRAM) and 8 Mbytes of Flash memory[7]. V•I Computer[8] has committed to developing products to support the industry's migration toward "openness." Current products adhere to significant new industry standards (IEEE-1396 PCI/PMC standard for mezzanine cards and IEEE-1275 Boot Firmware Standard), ensuring longevity of design and continued third-party hardware and software support. V•I Computer has issued an End-of-Life Buy (EOLB) letter for that configuration of the Power 4B. EOLB orders must have been placed by 31 July 1998, allowing for spares and full support of the technical evaluation (TECHEVAL) and OPEVAL systems.

The OPEVAL proved the performance of this processor, and, thus, it is assigned TRL-9. As industry upgrades components and processors, so must a commercial off-the-shelf (COTS)-based system such as CEC. This planned upgrade of the CEP processor is to a 5100 series RISC processor and will be implemented for future production.

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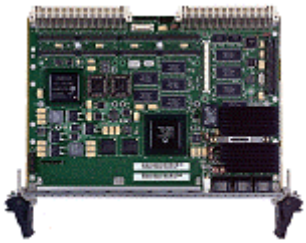
7 Flash memory refers to a memory chip that holds its content without power, but must be erased in bulk. The term comes from its ability to be erased *in a flash*.

8 V•I Computer was acquired by SBS Technologies in 1998.

3.2.2.2 Motorola 5100 series RISC Processors (TRL-9)



The MVME5100 is a high-performance VME processor module with supercomputing levels of performance in a scalable, single-board computer. It is widely used as a replacement for the 68040 processor. This module features the Motorola Computer Group (MCG) PowerPlus II architecture with a Motorola MPC7400 with AltiVec™ technology for algorithmic-intensive computations. Based on an integrated PCI bridge–memory controller application-specific integrated circuit (ASIC) designed by MCG, PowerPlus II has the memory performance of 582 MB/s memory read bandwidth and 640 MB/s burst write bandwidth. The MVME5100 meets the needs of contractors servicing the military and aerospace industry. It is offered in two temperature grades: commercial (with operating temperatures of 0 to 55 °C) and extended (with operating temperatures of –20 to 71 °C). CEC uses the extended version. Other contractors using this processor include:

Product Name	Company Name
Adapters for PMC and PC-MIP Modules	ACT/Technico
Add up to 2 GB on a PMC - PMCStor	ACT/Technico
Architecture and System Design and Integration	ACT/Technico
Conformal Coating for Motorola VMEbus boards	ACT/Technico
Disk and Storage Solutions	RAMiX Incorporated
Embedded Managed Switches (EMS)	RAMiX Incorporated
Fast Ethernet Controllers 10/100 (PMC/CompactPCI)	RAMiX Incorporated
FibreXpress(R) Network	Systran Corporation
Gigabit Ethernet Controllers (PMC/CompactPCI)	RAMiX Incorporated
GoAhead WebServer	GoAhead Software
Green Hills(r) Optimizing Compilers	Green Hills Software, Incorporated
Hard Hat Linux	MontaVista Software, Inc.
High Density VMEbus DSP Resource Board	Voiceboard Corporation
Host Bus Adapters	RAMiX Incorporated
INTEGRITY(tm) Real-Time Operating Systems	Green Hills Software, Incorporated
LynxOS	LynuxWorks, Inc.
Memory Solutions (PMC/CompactPCI/VME)	RAMiX Incorporated
MULTI(r) Integrated Development Environment	Green Hills Software, Incorporated
MultiSpan VMEbus T1/E1 Digital Span Network IF	Voiceboard Corporation
P2 Breakout Boards (BoBs)	ACT/Technico

PMC Expansion Solutions (VME and CompactPCI)	RAMiX Incorporated
Serial Interface (PMC/CompactPCI)	RAMiX Incorporated
TAXI interface	RAMiX Incorporated
ThreadX(r) Real-Time Operating System	Green Hills Software, Incorporated
Tornado Tools 3 for VxWorks AE	Wind River
Unmanaged Embedded Switches	RAMiX Incorporated
VME64x SuperSpan T1/E1 Network Interface	Voiceboard Corporation
VxWorks	Wind River
VxWorks AE	Wind River

3.2.2.3 CEP Fusion Algorithm (TRL-9)

The fusion algorithm in version 2.0 of CEC has evolved over decades. Initial fusion efforts were developed and tested at JHU/APL in the late 1970s and have evolved to the current CEC version developed by Raytheon. Current computer program status is as follows (see Appendix A for details):

	PRI 1	PRI 2	PRI 3	PRI 4	PRI 5
CEP OPEN TRs					
CEP TACTICAL (8.7.0)	0	*3	145 (5)	73 (1)	86 (7)
CEP MAINTENANCE (5.10.0)	0	0	0	0	34
CEP PBIT (5.9.1)	0	0	0	0	19
CEP STARTUP (5.7.0)	0	0	0	0	10

( ) Enhancement TRs
*** Includes 3 AEGIS-only TRs (N/A to CV/CVN/LHD)**

3.2.3 DDS Critical Technology Assessment

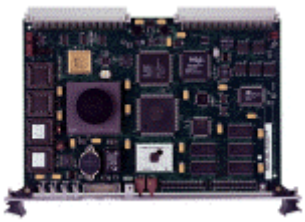
3.2.3.1 Antenna Array – GaAs T/R Modules (TRL-9)

The active array SBAA uses state-of-the-practice GaAs T/R modules that are used in high-power military applications, land-based cellular phone relay/substation sites, and point-to-point commercial business communications. Component maturity characteristics of T/R module performance are power, bandwidth, power-added efficiency, and reliability. These all are specified at a given frequency and define the operating maturity of these

components. The T/R modules used in the OPEVAL SBAA equipment have mature (not state-of-the-art, but truly "off-the-shelf") characteristics at the CEC operating frequencies.[9]

The Low Cost Planer Array (LCPA), which is planned for cost-reduction purposes, uses the same transistor technology but exchanges the T/R modules for separate transmit and receive devices. By doing this, Raytheon will eliminate the complex circulation issues of T/R modules [e.g. placement on circuit board and loss (attenuation) characteristics]. In a radar-oriented ONR Science and Technology effort (1997/1998), a successful contractor effort (five participating contractors) reduced the production cost of x-band radar T/R modules to $300 each through innovative design. In part, Raytheon built upon this effort for its production of low-cost, high-yield high-power amplifiers (HPAs) used in cellular phones and for the T/R modules in the CEC LCPA.

3.2.3.2 MVME167 (68040) Processor (TRL-9)



Motorola's MC68040 microprocessor offers the combination of functionality, flexibility, and performance for the COTS-based CEC system. It is used widely and forms the basis of the Motorola MVME167 single-board computer, which combines the 68040 microprocessor with the memory management and floating-point units to achieve 26 million instructions per second (MIPS) at 25 MHz and 40 MIPS at 33 MHz.

The list of other contractors using this product follows. It is noteworthy that the other contractors using this product are similar to those using the follow-on Series 5100 processor. This indicates the "normal" evolution from the 68040 processor to the 5100 series.

Product Name	Company Name
ACT/Technico Transition Modules	ACT/Technico
Architecture and System Design and Integration	ACT/Technico
Conformal Coating for Motorola VMEbus boards	ACT/Technico
GoAhead WebServer	GoAhead Software
Green Hills(r) Optimizing Compilers	Green Hills Software, Incorporated
High Density VMEbus DSP Resource Board	Voiceboard Corporation
MULTI(r) Integrated Development Environment	Green Hills Software, Incorporated
MultiSpan VMEbus T1/E1 Digital Span Network IF	Voiceboard Corporation
P2 Breakout Boards (BoBs)	ACT/Technico
ThreadX(r) Real-Time Operating System	Green Hills Software, Incorporated

[9] Although "operating maturity" is used here, "production maturity" in terms of IC yield-per-wafer is also an element maturity characteristic. Because they are so closely coupled, entering into production maturity discussion in this document would only be a digression.

Tornado Tools 3 for VxWorks AE	Wind River
VME64x SuperSpan T1/E1 Network Interface	Voiceboard Corporation
VxWorks	Wind River

3.2.3.3 CDH Chipset(CTIC-DS101 Hybrid)(TRL-9)

The CDH Chipset used in the DDS of CEC is a standard National Security Agency (NSA)-approved product designed as part of the Teledyne Microelectronics Hayfield multi-chip module (MCM). Hayfield is a software programmable information security (INFOSEC) MCM designed for description of TRAP Data Dissemination System (TDDS) broadcasts. Hayfield MCMs provide multi-channel decryption, over-the-air rekey (OTAR), power transient detection, built-in test (BIT), an external control status interface, and other features appropriate for the CEC system. Specifications used in development/manufacture/ performance are NSA Standards to include NSA DS-101E, *Interface Protocol of Electronically Keyable INFOSEC Equipment/System*, and CSESD-11, *Communications Security Equipment System Document for Fill Devices KYK-13, KYX-15, KOI-18*. This chipset is widely used with NSA-controlled specification drawings, thus clearly indicating a high level of technology readiness.

3.2.3.4 DDS Network Algorithms (TRL-9)

The fusion algorithm in version 2.0 of CEC has evolved over decades. Initial fusion efforts were developed and tested at JHU/APL in the late 1970s and have evolved to the current CEC version developed by Raytheon. Current computer program status is as follows (see Appendix A for details):

	PRI 1	PRI 2	PRI 3	PRI4	PRI 5
OPEN TRs					
DDS TACTICAL (8.3.1)	0	*5	12	0	39
DDS MAINTENANCE (6.9.1)	0	0	0	0	27
DDS STARTUP (4.0.0)	0	0	0	0	6

( ) Enhancement TRs
*** Includes 3 AEGIS-only TRs (N/A to CV/CVN/LHD)**

3.3 Evaluation Summary

The overall TRA was based upon USG-2 surface system technologies that were tested in the OPEVAL system. The USG-3 airborne system has the same mature foundation technologies and, thus, will have the same TRL if that system passes OPEVAL next year.

The dominant factor that resulted in the TRL-9 assessment was the successful completion of OPEVAL as specified by the Commander, Operational Test and Evaluation

Force (COMOPTEVFOR) in the final OPEVAL Report. The background information stated in this assessment indicates how widely the technology elements are used in the commercial and military sectors.

The final assessment is as follows:

CEP Assessment

Data Processors – V•I Computer Power PC Processor Card Power 4B-166-32	– OPEVAL successful – Standard COTS product for IBM Power PCs	TRL-9
Data Processors – Motorola 5100 series RISC Processors	– OPEVAL successful – Standard COTS replacement product for 68040 processors	TRL-8
Fusion Algorithms	– OPEVAL successful – Proven design; low number of Trouble reports remaining	TRL-9

DDS Assessment

CDH Chipset (CTIC-DS101 Hybrid)	– OPEVAL successful – Standard NSA product used for COMSEC	TRL-9
Antenna Array GaAs T/R Modules	– OPEVAL successful – Mature designs for T/R modules	TRL-9
Data Processors DDS-68040	– OPEVAL successful – Standard COTS product using industry standard chip sets	TRL-9
Network Algorithms	– OPEVAL successful – Proven design; low number of Trouble reports remaining	TRL-9

4.0 CONCLUSIONS

CEC was developed based upon an excellent concept: a COTS baseline coupled with a regularly scheduled COTS refresh. Through the successful OPEVAL of this system with COTS technology embedded and the COTS evolution that has already taken place, it is clear that this is being effectively executed.

ACRONYMS

ACB	Analysis Control Board
AECU	Antenna Environmental Control Unit
ASIC	application-specific integrated circuit
ASM	antiship missile
ATM	asynchronus transfer mode
BBC	battery backup converter
BG	battle group
BIT	built-in test
CDH	COMSEC/TRANSEC Integrated Circuit (CTIC) DS-101 Hybrid
CEC	Cooperative Engagement Capability
CEP	cooperative engagement processor
CES	common equipment suite
CIOC	CEP I/O Converter
CNC	computer numeric(al) control
COMOPTEVFOR	Commander, Operational Test and Evaluation Force
COMSEC	communications security
CPU	central processing unit
CTIC	COMSEC/TRANSEC Integrated Circuit
CU	Cooperating Unit
DC	direct current
DDS	Data Distribution System
DPT	Data Processing Terminal
DRAM	dynamic random access memory
DUSD(S&T)	Deputy Under Secretary of Defense for Science and Technology
EMI	electromagnetic interference
EOLB	End-of-Life Buy
FR	frame relay
gpm	gallons per minute
HPA	high-power amplifier
I/O	input/output
IC	integrated circuit
IEEE	Institute of Electrical & Electronics Engineers
INFOSEC	information security
IOC	initial operational capability
JHU/APL	Johns Hopkins University/Applied Physics Laboratory
LCPA	Low Cost Planer Array
LHEA	Liquid Heat Exchanger Assembly
LL	Lincoln Laboratory
LOS	line-of-sight
MCG	Motorola Computer Group
MCM	multi-chip module
MHz	megahertz

MIPS	million instructions per second
MIT	Massachusetts Institute of Technology
MRI	Magnetic Resonance Imaging
NSA	National Security Agency
NTDS	Naval Tactical Data System
ONR	Office of Naval Research
OPEVAL	operational evaluation
OPTEVFOR	Operational Test and Evaluation Force
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OTAR	over-the-air rekey
PAO	polyalphaolefin
PBX	private branch exchange
PDAS	PCS Data Access Service
PET	Positron Emission Tomography
psig	pounds per square inch gauge
RAID	redundant array of inexpensive or independent disks
RF	radio frequency
RISC	reduced instruction set computer
RTOS	real-time operating system
SAM	surface-to-air missile
SBAA	Shipboard Active Aperture Antenna
SSDS	Ship Self Defense System
T/R	transmit/receive
TCU	Timing and Control Unit
TDA	Technical Direction Agent
TDDS	TRAP Data Dissemination System
TECHEVAL	technical evaluation
TMC	test maintenance console
TRA	Technology Readiness Assessment
TRANSEC	transmission security
TRL	Technology Readiness Level
VME	Versa Module Europa

APPENDIX A:
COMPUTER PROGRAM TROUBLE REPORTS – "OPEN"

The following are descriptions of the key "open" Computer Program Trouble Reports (TRs) for the CEC System.

CEP:

TR No.	Short Title	Status
12883/ CEP-4404 TOR 4165	Message drops in CGAI lead to processor (DDS_IF) being declared down	Under investigation. Unable to reproduce.
12351/ CEP-3713 TOR 3702	CND if track number reassignment premature	AEGIS only. Scheduled for B/L 2.0.16 delivery. Safety issue.
13843/ CEP-5230	BL6PH3 DDG integration requires change in navigational interface	AEGIS only. Scheduled for B/L 2.0.16 delivery.

DDS:

TR No.	Short Title	Status
12767/ 4475 DSTac01744	Net control traffic shut off after a DIR ACQ to node already in network	Fixed in 9.7.0. Will be delivered as part of B/L 2.0.16.
12813/4490 12815/1350 DSTac01745	Fatal error building transmit frame causes HC to fall out of network	Fixed in 9.7.0. Will be delivered as part of B/L 2.0.16.
12814/ 4491 DSTac01746	HC locks up in nonactive test state	Fixed in 9.7.0. Will be delivered as part of B/L 2.0.16.
13795/ 4646 DSTac01760	In battleshort, DDS (BL 2.1) cannot bootup with NAVSSI interface active	Fixed in 9.7.0. Will be delivered as part of B/L 2.0.16.
13959/ 4694 DSTac01763	Add processing of the FODMS NAVSSI INS Message to DDS Tactical 2.0	AEGIS only. Fixed in 9.7.0. Will be delivered as part of B/L 2.0.16.

[21] DoD Integrated Product and Process Development Handbook

DoD

Integrated Product and Process Development

Handbook

OFFICE OF THE UNDER SECRETARY OF DEFENSE
(ACQUISITION AND TECHNOLOGY)
WASHINGTON, DC 20301-3000

DoD
Integrated Product and Process Development Handbook

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Chapter 1 Introduction

Integrated Product and Process Development (IPPD) evolved in industry as an outgrowth of efforts such as Concurrent Engineering to improve customer satisfaction and competitiveness in a global economy. In May 1995, consistent with the Department of Defense (DoD) efforts to implement best commercial practices, the Secretary of Defense directed "a fundamental change in the way the Department acquires goods and services. The concepts of IPPD and Integrated Product Teams (IPTs) shall be applied throughout the acquisition process to the maximum extent practicable."

During the summer of 1995, the Office of the Secretary of Defense (OSD) surveyed over 80 government and industry organizations regarding their IPPD policies and practices. Using those survey results, OSD published the *DoD Guide to Integrated Product and Process Development* (Version 1.0), dated February 5, 1996 (hereinafter called the *DoD Guide to IPPD*). The *DoD Guide to IPPD* was developed to provide a general understanding of DoD's perspective on IPPD.

In March 1996, DoD published major rewrites of *DoD Directive 5000.1, Defense Acquisition Directive*, and *DoD Instruction 5000.2*—now *DoD Regulation 5000.2-R, Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs*. The 5000.1 Directive states policies and principles for the management of all DoD acquisition programs and identifies the Department's key acquisition officials and forums. It repeats the Secretary of Defense's dictum to implement IPPD and IPTs "to the maximum extent practicable." The 5000.2-R regulation describes the DoD acquisition process for MDAPs and MAIS acquisition programs incorporating IPPD principles. It defines IPPD as—

> A management technique that simultaneously integrates all essential acquisition activities through the use of multidisciplinary teams to optimize the design, manufacturing and supportability processes. IPPD facilitates meeting cost and performance objectives from product concept through production, including field support. One of the key IPPD tenets is multidisciplinary teamwork through Integrated Product Teams (IPTs).

This handbook expands upon the government and industry guidance provided in the *DoD Guide to IPPD* by providing suggestions and examples of specific ways to implement IPPD. Like the *DoD Guide to IPPD*, it is non-directive. It suggests solutions to difficulties that might be encountered in IPPD implementation and explains tools and techniques that can be used throughout a product's life cycle. It is not, however, an in-depth application manual for specific tools, nor does it attempt to cover all of the tools available—only representative ones from many different categories. The reader, once aware of such tools and their significance, can perform further research using the links (Internet World Wide Web URLs or addresses and phone numbers) that are included in this handbook as sources of additional or updated information.

This handbook also is not meant to be definitive on the new acquisition initiatives other than in their relationship to IPPD. For example, much has been written on topics such as risk management and Cost as an Independent Variable (CAIV) that will not be repeated here. However, links to additional information on these topics are provided.

This handbook cannot force the cultural change necessary to accomplish IPPD; this must be done through leadership from the highest levels of management. What this handbook can do is suggest methods and specific tools that programs can utilize to implement IPPD. For that reason, the text is

interspersed with specific examples of tools and actual implementation examples from acquisition programs and industry.

1.1 Relevant Terms

IPPD

In addition to the definition stated above, the DoD further defines IPPD as, "A management technique that integrates all acquisition activities starting with requirements definition through production, fielding/deployment and operational support in order to optimize the design, manufacturing, business and supportability processes." IPPD, as a multidisciplinary management technique, uses design tools such as modeling and simulation, teams, and best commercial practices to develop products and their related processes concurrently.

Integrated Product Teams

An Integrated Product Team (IPT) is a multidisciplinary group of people who are collectively responsible for delivering a defined product or process. The IPT is composed of people who plan, execute, and implement life-cycle decisions for the system being acquired. It includes empowered representatives (stakeholders) from all of the functional areas involved with the product—all who have a stake in the success of the program, such as design, manufacturing, test and evaluation (T&E), and logistics personnel, and, especially, the customer. Because the activities relative to a system's acquisition change and evolve over its life cycle, the roles of various IPTs and IPT members evolve. When the team is dealing with an area that requires a specific expertise, the role of the member with that expertise will predominate; however, other team members' input should be integrated into the overall life-cycle design of the product. Some teams may assemble to address a specific problem and then become inactive or even disband after accomplishing their tasks. The Boeing 777 experience supported the continuation of IPTs throughout the entire program acquisition. Having IPT members with experience on the program was a primary factor in providing continuity, reducing the program's overall schedule, and requiring minimal program training.

This handbook addresses program-level, or execution-level, IPTs. Oversight IPTs—Overarching IPTs (OIPTs) and Working-Level IPTs (WIPTs)—are addressed in *Rules of the Road: A Guide for Leading Successful Integrated Product Teams*.

Rules of the Road can be found at http://www.acq.osd.mil/ar/ipt.htm

Systems Engineering

Systems engineering is a problem-solving process used to translate operational needs and/or requirements into a well-engineered system solution. It too is an interdisciplinary approach, although IPPD is broader because it includes not only engineers, technical specialists, and customers, but also business and financial analysts. Systems engineering creates and verifies an integrated and life-cycle balanced set of system product and process solutions that satisfy stated customer needs.

Customer

The IPPD approach is driven by the customer's need. The ultimate customer is the operational user of the system. As discussed above, appropriate members of the user organization participate actively on development teams, working to optimize the fielded system's ability to meet their requirements.

Stakeholders

A stakeholder is an organization or functional activity that has a stake in the decision at hand or the outcome of the program. The term stakeholder also is used for the empowered working-level representatives of that organization or functional activity that serve on IPTs. As such, stakeholders are important decision makers. They control the resources and collectively have the know-how to get the job done. The term stakeholder is used throughout this handbook in both senses of the word, as appropriate.

Processes

Three types of processes are referred to in this document.

1. "Top level," overarching processes such as Systems Engineering and Test and Evaluation. These are commonly referred to as "functional," and their operation is the responsibility of the traditional seats of functional power in an organization. The functional organization of these processes establishes and ensures the effective application of a function's governing, generic principles and practices. The functional organizations are the keepers of technical purity for their function but do not individually control the IPPD approach.
2. "Development" processes or processes that facilitate the making of a product. These include the application and tailoring of the traditional functional disciplines with a home office, as well as processes that do not have a functional organization office, such as integration. These processes are not delivered to the customer (although the results of their work are) and they are driven by the needs of the particular product being developed. Examples include Integration, Production, Computer Support, and Modeling and Simulation.
3. "Deliverable" processes that will actually be delivered to the customer in order to support the product, or perhaps the delivered process is the product. Examples include the support, training, and maintenance processes. As with development processes, it is reasonable to think of the deliverable processes as "products," and deliverable processes such as these usually are assigned to an IPT. Sometimes the processes are not actually delivered but implemented, e.g., total contractor support is not "delivered" to the government but is used or implemented by the end item user.

1.2 IPPD Tenets

The DoD Guide to IPPD lists 10 basic tenets for the implementation of IPPD. For purposes of this document, the 10 tenets are grouped into the following main principles that will be stressed throughout this handbook.

1.2.1 Customer Focus

Customer focus is accomplished by including the customer in decision making and on multidisciplinary teams (Section 2.1.1 and Chapter 3). Conducting tradeoff studies during the requirements definition and development processes also ensures that the design remains consistent with customer needs. The specific tradeoff analysis process that is focused on reducing and controlling life-cycle cost, while meeting the customer needs, is called Cost as an Independent Variable (CAIV) (Sections 2.2.2 and 7.4). Quality Function Deployment (QFD) (Section 2.2.2 and 7.1.1) is also an effective method for defining customer requirements.

1.2.2 Concurrent Development of Products and Processes

Concurrent development of products and processes refers to the simultaneous development of the deliverable product and all of the processes necessary to make the product (development processes) and to make that product work (deliverable processes). These processes can significantly influence both the acquisition and life-cycle cost of the product. Process examples include the manufacturing processes needed to fabricate the product, the logistics support processes needed to support the product, or, for a data collection system, the process to collect and disseminate the information gathered. Emphasizing the design of these processes at the same time the product is being designed ensures that the product design does not drive an unnecessarily costly, complicated, or unworkable supporting process when the product is actually produced and fielded. Not developing the processes concurrently with the product results in utilizing an inefficient manufacturing and support process or causing a redesign of the product, which could potentially wipe out any other cost reductions achieved through the application of other IPPD principles.

From an engineering viewpoint, concurrent development of products and processes to satisfy user needs is known as systems engineering. In IPPD, the systems engineering approach to designing a product is expanded to include all stakeholders—those developing not only the product but all product-related processes as well (e.g., business processes such as financial, contracting, etc.). Multidisciplinary teamwork and an emphasis on real-time and open communication are key to accomplishing this concurrent development. Multidisciplinary teamwork is implemented in an IPPD environment usually through the use of IPTs. Members of an IPT are empowered to make decisions for their respective organizations and keep them informed of the product and process decisions. An enhanced communication environment, where all program information is in a format available to all stakeholders in real time (Section 2.1.1 and Chapter 5), is of primary importance to the effectiveness of the IPTs.

1.2.3 Early and Continuous Life-Cycle Planning

Early and continuous life-cycle planning is accomplished by having stakeholders, representing all aspects of a product's life-cycle, as part of the multidisciplinary teams. Early life-cycle planning with customers, functional representatives, and suppliers lays a solid foundation for the various phases of a product and its processes. Key program activities and events should be defined so that progress toward achievement of cost-effective targets can be tracked, resources can be applied, and the impact of problems, resource constraints, and requirements changes can be better understood and managed. Early emphasis on life-cycle planning ensures the delivery of a system that will be functional, affordable, and supportable thoughout a product's life cycle.

1.2.4 Proactive Identification and Management of Risk

IPPD is not a ”design now-test later” approach to product and process development. Proactive identification and management of risk is accomplished in many ways in the IPPD environment. By using the multidisciplinary teamwork approach, designers, manufacturers, testers and customers work together to ensure that the product satisfies customer needs. DoD endorses a risk management concept that is forward-looking, structured, informative, and continuous. The key to successful risk management is early planning and aggressive execution. IPPD is key to an organized, comprehensive, and iterative approach for identifying and analyzing cost, technical, and schedule risks and instituting risk-handling options to control critical risk areas. IPTs develop technical and business performance measurement plans with appropriate metrics (Chapter 4) to monitor the effectiveness and degree of anticipated and actual achievement of technical and business parameters. Modeling and simulation tools (Chapter 6) are used to simulate, test, and evaluate the product prior to starting production. Robust design (Section 7.3.5) methods are used to minimize problems in manufacturing and operations. Event-driven scheduling (Section 2.2.3.2) is used to integrate all development tasks and to ensure that a task is not started until all prerequisite tasks are complete.

1.2.5 Maximum Flexibility for Optimization and Use of Contractor Approaches

There are many ways to accomplish IPPD. IPPD is a management approach, not a specific set of steps to be followed. The Government acquisition community recognizes that it must allow contractors the flexibility to use innovative, streamlined best practices when applicable throughout the program. Thus, it cannot specify specific steps for the contractor to follow. The DoD leadership’s recent instructions that acquisitions will now be performance-driven, not process-driven, help in maximizing flexibility for the optimization and use of contractor approaches. These instructions allow the contractor more latitude in developing bid proposals and conducting their processes. For example, DoD’s efforts to reduce the use of military specifications and standards allows contractors to adapt their fabrication processes and management techniques for optimal use on the product being developed. Chapter 2 presents steps for applying IPPD, but these are general instructions to define the approach, not an exact procedure.

More information on DoD initiatives to help optimize the use of contractor approaches can be found at http://www.acq.osd.mil/ar/#activities
Or go directly to the Single Process Initiative website at http://www.acq.osd.mil/ar/single.htm
or the Perofrmance-Based Business Environmant at http://www.asc.wpafb.af.mil/az/jacq/pbbe/pbbe.htm

The next chapter discusses how IPPD tools and techniques are applied throughout the acquisition process.

Chapter 2 Application of IPPD in the DoD Acquisition Process

The acquisition process is typically divided into five stages; the first four formal phases are separated by milestone decision points. The five stages are—

- Phase 0: Concept Exploration (CE)
- Phase I: Program Definition and Risk Reduction (PDRR)
- Phase II: Engineering and Manufacturing Development (EMD)
- Phase III: Production, Fielding/Deployment, and Operational Support (PFDOS)
- Demilitarization and Disposal (DD)

However, not all programs go through the same number of phases. The number of phases and decision points are tailored to meet the specific needs of an individual program based on such things as the adequacy of proposed risk management plans and the urgency of the user's need. Tailoring is conducted to minimize the time it takes to satisfy an identified need consistent with common sense and sound business practices.

The cost to implement product changes increases as a program moves from the earlier to the later phases of its life cycle (Figure 2-1). IPPD's greatest potential for leverage during the acquisition process, therefore, occurs in the early stages of development, when the program is most flexible. It is at this early stage that an analysis of life-cycle issues and cost/performance tradeoff studies can provide a life-cycle balanced approach and prevent costly changes later in the product's life cycle. For a major program, this period would be in Phases 0 and I. Accordingly, this chapter discusses these phases in detail. For a modification or upgrade to an existing program, even though it may not have formal DoD acquisition phases and milestones associated with it, the sequence of events is the same. Therefore, regardless of the type of requirement the customer defines—a new system or an upgrade to an existing system—the activities described in this chapter apply.

This chapter starts with an explanation of how to set up an IPPD program. It looks closely at Phase 0, the phase in which IPPD principles are applied to their greatest advantage in a program, and Phase I with emphasis on: evaluating contractor proposals; monitoring contractor tradeoff studies, design, risk management, and demonstration efforts; and preparing for the transition to the next phase. The chapter does not address subsequent acquisition phases in detail, because similar IPPD techniques apply to all subsequent phases.

2.1 Getting Started

Whatever the phase of development of a program, implementing IPPD follows some basic considerations. The structure and processes for implementing an IPPD approach need to be defined based on the activities that need to be performed and whether the government or contractors will be performing those activities. This involves: identifying all stakeholders necessary to accomplish the activities; forming IPTs and defining their goals, tasks, and responsibilities; and training all stakeholders in the IPPD approach. Metrics need to be defined to

measure progress in meeting the program goals. After the activities and stakeholders are defined, the structure and processes are determined by addressing such issues as collocation,

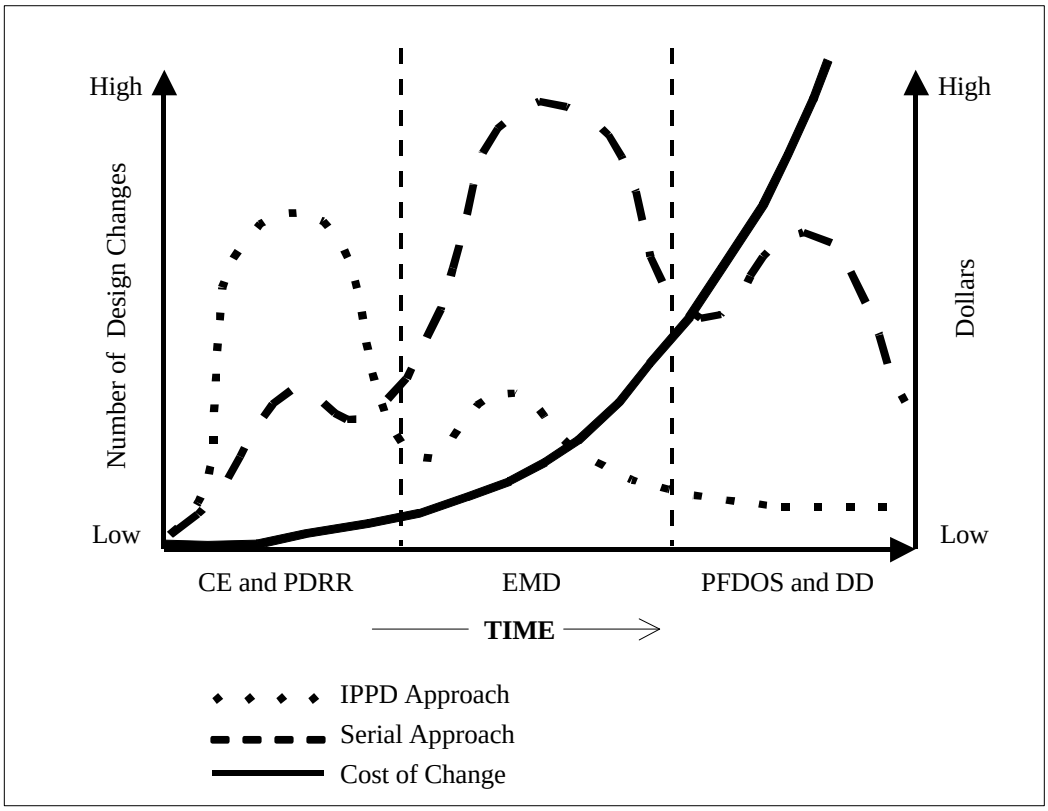


Figure 2-1. Traditional Serial Approach versus IPPD and Cost of Change

communication, and level the of computer sophistication for efficient information. The issues of software interoperability and security also need to be addressed at this time. A procedure for recording processes, activities, decisions and their rationale, along with a system for easy retrieval of the information, lays a solid foundation for efficient operation and communication in the IPPD environment. This process also needs to be developed as one of the early steps in developing an IPPD environment.

2.1.1 Identify Activities and Stakeholders

The first step in applying IPPD to a program is identifying the activities and the various stakeholders that need to be involved. Activities include the specific tasks (studies, design/performance/cost tradeoffs, contract/subcontractor management, cost estimating/budgeting/tracking, design, integration, manufacturing, test and evaluation, etc.) that must be performed in order to deliver the product to the customer. Activities will vary depending on the type of program—new start or mod. Stakeholders include government acquisition personnel, customers, engineering and test personnel, support personnel (e.g., maintainers and logisticians), and contractor personnel. When there is uncertainty about the need to represent a specific function, it should be included initially and removed later if its involvement is not needed.

2.1.2 Determine Range of Contractor Involvement

Many times a significant amount of open communication and trust is needed in order for IPPD and IPTs to successfully work at the program level. In other words, every member of the program team (government and industry) needs to work from the same information and toward the same overall program goals. The degree to which this open communication can occur depends on several factors like the competitive nature of a particular program and it must be within the statutory boundaries of acquisition laws. As long as these criteria are met, the amount of integration across the government/ industry boundary is unlimited.

Contractor involvement ranges from providing unofficial advice to actually conducting the research and generating solution options. At each stage in a program, the appropriate roles of contractor and government personnel need to be determined. Often activities may start within the government but transfer later to a contractor. Three scenarios describe the range of contractor involvement.

1. *Contractor as Lead*
   In this scenario, two or more contractors are awarded contracts to develop unique solutions to a set of government requirements. The contractors propose solutions and the government selects one or more of them to continue into subsequent phases. The government manages the contracts and participates in the contractor-led IPTs to the extent permissible by the rules governing competition. In some cases, this may mean the government simply monitors the performance of the industry teams. However, there have been successful cases recently where, in a competitive situation, government team members have been assigned to help contractor-led IPTs. Such participation brings the government perspective to the contractor team, where government team members actively participate in formulating the team strategy and approach. Government individuals participating in such a manner need to follow strict rules to preserve the competitive nature of the contract. One such rule is that these government team members must be shielded from any source selection data for competing teams, even though these government team members are usually not part of the Source Selection Evaluation Team. Even with the rules well-defined, finding the right individuals can be difficult, because they should be highly qualified with excellent judgment and a solid background in acquisition policies and procedures—individuals whom the contractors will trust to help them. Levels of government expertise need to be balanced across the teams.

2. Formal Support
   In this scenario, one or more contracts are awarded to collect and assemble data on various potential solutions. The government conducts the tradeoff study analyses to determine the most likely solution(s), if any, that warrant continuation through later phases. The government remains engaged with the industry teams to gain insight into the data collected and facilitate the manipulation of the data when the tradeoff study analyses are conducted. Depending on the government's follow-on plans, there may or may not be competitive considerations in this type of activity. Often the industry teams collecting the data are prohibited from bidding on any follow-on work and, in these cases, there can be open communication with very little worry about competition secrecy. If, however, the industry teams are able to bid on the follow-on work, this is a competitive situation and all communications and industry involvement must be handled accordingly.

3. Informal Support
   In this scenario, contractors informally support activities conducted using the in-house expertise and resources entirely within the government. Industry becomes an interested observer and can provide insight and support as needed by the government.

Activities described in the following sections could be performed by the contractor or by government personnel as appropriate to the program and the activities being performed.

2.1.3 Define the Program/Team Structure

After the activities and stakeholders are identified, the next steps are to decide on a program structure and form the IPTs. The IPTs need to be structured in a coherent manner to define the relationship between top-level and sub-tier teams. Depending on the type of program, at the initiation of Phase 0, some well-defined programs may need the teams to be fully structured while other less-defined programs will just need the teams to be structured around the near-term tasks to be accomplished. If the latter, a more detailed team structure will need to be built as the program takes on more definition.

IPTs are usually formed around the key products and processes associated with the program. A Work Breakdown Structure (WBS) is a management tool that identifies and integrates hardware, software, services, data, and facilities and is based on key products and processes in a product-oriented tree structure. If the program has created a WBS, it is a useful tool for identifying how the IPTs should be structured. It makes sense to concentrate control and responsibility at the most important levels of the WBS, particularly around high-risk tasks or those tasks on the critical path. One can look to the WBS levels in forming the IPTs, making sure, however, that all life-cycle concerns are addressed in the IPTs. If a WBS has not been created, the key products and processes that will be required for the program should be identified and organized into logical groupings. These groupings provide an alternative structure for setting up the IPTs. Furthermore, one can consider the staffing that will be required to create integrated, multidisciplinary teams and draw up a notional IPT organization, complete with numbers of people and tentative responsibilities. There may be insufficient personnel to create the initial structure, and WBS elements may need to be consolidated and combined (or key products and processes regrouped) to make the organization fit the available personnel. After this process has been iterated, one can settle on a reasonable organization for the program that retains as much of the product and process orientation for the IPTs as is practical. Since a WBS usually is closely aligned with the cost accounting system, aligning IPTs with the WBS often makes it easier for the IPTs to monitor and take responsibility for cost.

Information on the WBS can be found in MIL-HDBK 881 at
http://www.acq.osd.mil/pm/newpolicy/wbs/wbs.html

Another option for IPT structure is to use the IEEE Std 1220-1994 on Systems Engineering. This standard proposes the use of a Systems Breakdown Structure (SBS), defined as “a hierarchy of elements and related life-cycle processes used to assign development teams, conduct technical reviews, and to partition out the assigned work and associated resource allocations to each of the tasks necessary to accomplish the objectives of the project.”

For more information on IEEE standards go to http://standards.ieee.org/

Defining product-oriented IPTs is reasonably straightforward. These IPTs are focused on the key deliverable products that the customer expects to receive. Defining process-oriented IPTs is not as easy. Process IPTs at the program level commonly address two types of processes. As discussed in Chapter 1, a *development* process is used to develop a balanced product but is not actually delivered to the customer, e.g., integration, test and evaluation, software development, or production. These critical development processes must be conducted, and it may be useful to form IPTs to manage and improve these processes during the development. The program office makes this decision based on the size of the task and the importance of the process to customer satisfaction. *Deliverable* processes are actually delivered to the customer, e.g., support, training, and maintenance processes. For some programs the only deliverable may be a process. As with development processes, the program office decides whether to form an IPT for these deliverable processes.

Process-oriented IPTs are also sometimes referred to as “functional” IPTs since they are responsible for managing a function, like test and evaluation or systems engineering. It is important to remember that these IPTs should remain multidisciplinary, regardless of the terminology applied to them. Care must be taken when using process-oriented IPTs so that their single-function nature doesn't end up recreating the traditional "stovepipe" approach. Team membership needs to include all concerned stakeholders and its goals should be closely linked with the goals of the other teams and the project as a whole.

Most programs find it appropriate to have both product and process IPTs. The most common process IPT is one formed to integrate all the deliverable product outputs of the other IPTs into a coherent and effective system. Common names for this IPT include “Systems Engineering and Integration IPT” or “Analysis and Integration IPT.” This team is responsible for the overall integration of the efforts of the individual product IPTs, ensuring communication among the teams and effective application of accepted systems engineering principles to the development of the program's product. Their product is an integration process, measured by the success or failure of the integrated product to meet total system requirements at the optimum balance of cost, schedule, and performance.

Specific guidance on a single type of organization to use for all DoD acquisition projects is not possible. Every program has unique objectives and operating environments. Program managers must determine their unique program goals and constraints and ensure that the program structure is organized around those goals.

IPT Organization Examples

Examples of the integrated product and process structure are the Patriot PAC-3 Missile program and the Joint Strike Fighter (JSF) program. The primary IPTs of the Patriot PAC-3 represent the major products and the major processes required for a successful acquisition of those products.

Product IPTs	Process IPTs
Missile	Performance and Simulation
Seeker	Test and Evaluation
Command and Launch System	Production

The Systems Engineering Directorate of the JSF program is organized around IPTs that range from Airframe and Flight Systems (product) to Advanced Cost Estimating and Systems Test (processes).

The Standard Missile-3 (SM-3) program, however, has an IPT structure organized according to traditional functional processes. This organization is intended to optimize existing contractor infrastructure without disruptions to the program.

2.1.4 Define Team Goals, Responsibilities, and Relationships

After the IPT structure is defined and membership assigned, the following IPT-related program issues need to be addressed.

- Define team goals for each specific IPT and common goals for all IPTs
- Define the reporting structure and working relationship of all IPTs in relationship to each other
- Define the level of empowerment of all IPTs
- Define the relationship between government and contractor personnel on IPTs
- Define measures by which to gauge IPT performance (metrics)

The first four issues are discussed in Chapter 3, Team Best Practices for IPTs. The last one is elaborated further in Section 2.1.8 and in Chapter 4, Metrics.

The best way to accomplish these actions is to document them in team charters. All charters should be signed by the team members and approved by a higher level authority. The IPT charters need to be frequently reviewed as an acquisition program progresses to ensure that it remains in line with changing program goals. See Section 3.4.1 for further discussion of team charters.

2.1.5 Train Participants in IPPD Principles

Successful institutionalization and implementation of IPPD within DoD depend on well-trained participants at all levels. Industry lessons learned show that initial and continued investment in personnel training positively affects IPPD implementation. Participants must have a clear understanding of the DoD philosophy of IPPD, the tools available for its implementation, and the skills, such as team building, required for its success. Therefore, it is imperative that all members who have a stake in the IPPD approach, from top-level management to worker-level participants, be well trained in IPPD principles. Different levels of management need different types of training, focused on their part of the approach, e.g., top-level management needs to be trained on methods of empowerment.

This document is an overview of IPPD and should not be construed as a training guide, although it may be used to supplement training. Some IPPD and IPT training is best carried out in a classroom setting with qualified instructors. In this setting students are exposed not only to the

tools of IPPD, but also to the development of the team dynamics required to successfully implement IPPD. Individual training materials on IPTs and IPPD methods and tools are also available to be used as required and appropriate. DoD is developing IPPD training for its acquisition personnel both in the classroom and with individual, self-directed, interactive CD instruction. Team training is discussed in further detail in Section 3.6.

Information on training provided by the Defense Acquisition University (DAU) can be found at http://www.acq.osd.mil/dau/

To obtain a copy of the Navy's IPT Learning Campus CD, contact the Navy Acquisition Reform Office at (703) 602-5506 or go to http://www.acq-ref.navy.mil/ipthome.html

Training Example: LPD 17 Amphibious Transport Dock Ship Program

To break with traditional ship design methods and to design a new ship in a concurrent engineering process resulting in a fewer number of later-phase changes, the Amphibious Transport Dock Ship (LPD 17) program manager decided that extensive IPPD training was required. The LPD 17 program first conducted IPPD training as a government team and then with the major subcontractors' team (i.e., Avondale, Hughes, Bath, Intergraph). This training included team building skills as well as IPPD principles. Key to the success of the program's training methods was the program manager's commitment to completing this training prior to the start of any design activity.

2.1.6 Determine Collocation and Integration Requirements

A cornerstone of the IPPD management technique is the integration of all stakeholders into a cohesive working unit. In traditional acquisition and development involving a sequential handoff of tasks, location of the various people was not a major concern. Today's IPPD approach makes real-time integration of a program's various functions essential. Exact mechanisms and procedures for enabling team interaction vary. The most obvious way to accomplish this integration is collocation of the stakeholders. Collocation enables sharing information at the lowest levels, learning across functions, and team building. In the ideal IPPD setup, the stakeholders work not only at the same facility, but also in the same room. In the real world, however, collocation of all the stakeholders is not always possible—or even desirable. Moreover, in large programs, the number and size of IPTs precludes meaningful collocation. As with everything else in the program, a cost-effective solution is needed and the cost (dollars, impact on other programs, loss of contact with home office, etc.) of relocating the team members must be weighed against the benefits (faster communications, better integration, quicker response times, etc.) of collocation.

In practice, most programs have found that integrating all stakeholders into a cohesive unit is neither simple nor inexpensive. An adequate budget must be available from the start of the program for personnel relocation or for investment in communication assets if collocation is determined to be impracticable. Since large distances can separate teams and possibly team members, physical collocation of all teams and team members often is not possible. Virtual teaming technologies such as teleconferences, e-mail, Internet homepages, and common data bases will be required. See Chapter 5 for further information on these types of technologies.

Another approach is to use a mix of virtual teaming technologies supplemented by periodic on-site team meetings. Although there is a cost associated with bringing together IPTs that are not collocated for such meetings, the face-to-face interaction for important milestones can be invaluable. This approach, however, can be negatively impacted should reductions in travel funds become necessary due to cuts in program funding.

Collocation Examples

LPD 17

The LPD 17 program office had five shipbuilders collocated with them during the ship's contract design and specification development stage prior to RFP issuance and Milestone II. This collocation aided in the producibility of the contract design package and acquisition streamlining, as well as the ship specification efforts.

The program office was collocated at the site of the chosen prime contractor (Avondale) along with representatives from the Avondale alliance teammates. The team of government LPD 17 and Avondale-alliance personnel is located in the same building, working literally side by side.

Collocation has resulted in significant cycle time reductions. Issues are addressed on a real-time basis rather than through the mail system (drafting the issue, staffing it in some other location, and then drafting and mailing a response back).

Joint Strike Fighter

The JSF program charter called for a joint solution to meet the needs of both the Air Force and the Navy. Recognizing the importance of developing a consensus among the Services, senior leadership staffed the joint program office with equal representation from both Services. In an effort to better understand the requirements and ensure optimum use of program resources, program leadership collocated both warfighter and technologist in the program office. As a result, in less than 2 years the program has effectively identified the critical tasks and leveraging technologies necessary to pursue a preferred weapon systems concept that meets both Services' needs.

For further information on the JSF program see http://www.jast.mil

2.1.7 Provide for Communication

Communication is critical to IPPD success. In an IPPD environment, all stakeholders need to have access to the most current information on the program. With stakeholders frequently geographically separated, an integrated set of communication tools to enable team members to communicate in real time is ideal. Communication tools range from telephone networks and fax machines to video teleconferencing (VTC) systems and wide area computer networks—the options are expanding every day. And all of these options have various costs and benefits, depending on the program's situation. Therefore, planning related to information management, communication networks, and methods of formal communications should take place at the beginning of all acquisition/development programs.

Communication can be divided into three areas: personal, business, and product development.

1. *Personal* communications relate to day-to-day communication and exchange of documentation or correspondence between individuals. Examples include telephone calls, faxes, e-mail, electronic file transfers, and teleconferences, with or without video.
2. *Business* communications relate to solicitations, Requests for Proposals/Quotations (RFPs/RFQs), proposals, contracts, status reports, and other similar types of communications. Most of these have traditionally been performed using paper copies. Due in part to the Federal Acquisition Streamlining Act (FASA) of 1994, which requires that business transactions be performed via electronic means, most of these transactions now take place electronically. Electronic business transactions and information exchanges help make possible the IPPD requirement for real-time availability of information to all stakeholders.
3. *Product Development* communications relate to the exchange of engineering models and data bases—information about the product and process being developed. This communication is defined not only as communication between personnel, but also as communication between software applications. The use of a common shared data base containing information about the product and process being developed is of prime importance.

2.1.7.1 Electronic Support for Communication

At the high end of electronic support for communication are computerized tools that span the whole life cycle and seamlessly share data across the various functional areas of the program. The results of this integration are the greater availability of the data, more confidence in the data, more ways to use the data, and the ability to present the data in forms that are useful and understandable to a wider range of stakeholders. Computerized tools, due to their complexity, need extensive up-front planning that addresses applications, the degree of complexity of the system, interoperability of the software, and the level of security. But their complexity also introduces a cost associated with their implementation that needs to be balanced with the benefits they provide. A common-sense approach is needed in planning for their use, taking into account the types of systems the government and contractors already have in place and both the near-term and life-cycle costs.

The discussion below provides some tips on planning related to these computerized communication requirements.

- *Applications Needed*
  The first step in determining the developmental environment is to determine the requirements for electronic data. Then one can identify what kind of software applications are needed and whether these applications need to be accessed from a single site or from multiple locations. Software applications can range from traditional computer-aided engineering (CAE) models and simple data bases listing design data, performance data, functional decompositions, risk management information, etc., to integrated virtual environments. Traditional methods often involve manually loading data from one application into another, while an ideal virtual environment uses the same data set for all

applications. Fully integrated computing environments combine data and models from all aspects of a design into one seamless system where individuals from different functions (e.g., designers, manufacturers, maintainers, purchasing agents) can access the data in formats tailored to their needs.

- *System Complexity*
  Program specifics, such as the complexity of the system, the degree of analysis needed to proof the system, the relative price of engineering changes, and the potential risk events, should all be considered when deciding on the level of complexity of the development environment. While a more complex environment will cost more to set up, the time savings and error reduction—and, as a result, the program savings— can be substantial.

- *Software Interoperability*
  When software tools for management, engineering, and production first appeared, they were extremely limited in their scope and in their ability to interact with other programs. In general, they only dealt with a single function during a single life-cycle phase, and used proprietary data formats on a single, stand-alone computer. They were expensive to purchase and to update. Transferring data from one tool to another often meant translating, reentering, and verifying data. IPPD evolved from concurrent engineering, expanding the concept beyond engineers to include business analysts, customers, and suppliers. For all these functions to operate in an integrated manner, trusted, modern information systems that integrate engineering, schedule, and financial analysis are required. One way to enhance interoperability is to use the same software at all sites. An alternative is to use a server at one site with access from wherever needed. Because IPTs encompass multiple organizations (e.g., government and contractors), the potential exists for software incompatibility between systems at different sites. Another option for minimizing software non-interoperability is to adopt standardized protocols, such as the Department of Commerce's Common Interface Standard or DoD's Continuous Acquisition and Life-Cycle Support (CALS) standards.

- *Security*
  An IPPD environment utilizing enhanced communications requires built-in security measures that prevent unauthorized access to program data. These measures should not interfere with the ability of team members to communicate. Because such security measures can be difficult and expensive (both in incorporation and in data loss due to a nonsecure system) if incorporated late, security of communications needs to be considered when setting up the communications network.

Chapter 5, Integrated Information Environment, has more detailed discussion on the advantages of using a common data base, system complexity, interface standards, security of electronic communications, the use of the Internet, and other paperless business transactions.

Communication Example: Joint Strike Fighter

The JSF program (which has some geographically dispersed elements) uses paperless processes. It emphasizes electronic processes as the standard means of communication and exploits the Internet for efficient, real-time dissemination of program information, including information related to program procurement solicitations.

For further information on the JSF program, see http://www.jast.mil.

2.1.8 Define Program Metrics

Metrics, or standards of measure that form the data base for the application of statistics and mathematical analysis, constitute an important tool in the IPPD environment. When properly defined and used, metrics can permit timely assessments predictive of ongoing processes and the monitoring of resource consumption. Metrics should be easily measured, exportable, simple to use, support the program processes, and be cost effective. The tools and metrics aren't necessarily different from those used in a non-IPPD environment, but the expectations from using them do change. Many activities are done earlier and results are seen sooner in the program. The metrics should reflect this. Metrics are used at all levels of a program's structure, preferably representing key measures of output rather than input or activity metrics. Many metrics, such as those relating to cost, schedule, and performance, can be used throughout the program's life cycle, while others may be tied to one portion of the program. Regardless of when they are used in the program, the timeliness of the information—both for calculating the metric and in the information the metric provides—is an important consideration. In performance-based contracting, the contractor should develop metrics to measure actual performance against contractually required performance. The IPTs should have cognizance of these metrics.

Chapter 4 defines what metrics are, describes their essential properties and types, and outlines a nine-step process for developing metrics.

2.1.9 Record Processes, Activities, and Decisions

Recording IPPD-related processes, activities, and decisions is essential for program stability and communication integrity. Key processes can be recorded as local operating instructions, process narratives, or other suitable forms. Descriptions should be clear, concise, and allow flexibility within the process. Key program and team activities, action items, and decisions can be documented as meeting minutes, a separate program historical file, or any other formal system, such as an IPPD-focused management information system that allows automated access by all stakeholders. Such a system—

- Provides an historical record of activities and decisions
- Documents tradeoff studies, cause-and-effect analyses, and similar activities
- Promotes team-oriented information and communication
- Facilitates evaluation of metrics and lessons learned

Effective recording of processes, activities, and decisions coupled with an efficient retrieval process for the information affords stakeholders and team members a clear understanding of program workings. Such information facilitates risk management, future decision making, and a review of lessons learned. The process of documenting decisions also reduces the ramp-up for assigned personnel, which is an issue that needs to be considered by organizations with a high percentage of military personnel. For example, describing all concepts explored and the reasons why they were accepted or rejected, makes it possible to reevaluate these concepts as requirements develop.

2.2 Phase 0, Concept Exploration

In broad terms, the objectives of the Concept Exploration phase are fourfold: (1) to perform concept studies to investigate different solutions, (2) to evaluate these different concepts, (3) to perform tradeoff studies, and (4) to define the requirements for the remainder of the acquisition program. IPPD activities involve organizing the different functions to work concurrently and collectively so that all aspects of the life cycle for the various concepts are examined and a balanced concept emerges.

During this phase the acquisition program is defined in broad technical and programmatic terms. Phase 0 often starts with a very small government group overseeing government and/or government and contractor-performed Concept Exploration. A government program office may or may not formally exist prior to Milestone I.

During this phase of Concept Exploration, the government must decide what the industry role will be. Concept studies may be performed by a contractor. Consistent with an IPPD approach, any solicitation for contract proposals for these studies needs to request offerors to describe how their processes support the key tenets of IPPD, i.e. customer focus, concurrent product and process development, life-cycle analysis, and the proactive identification and management of risk. But the solicitation and resulting contract should not direct an offeror to adopt any particular business, management, or technical process. These key concepts should be reinforced and expanded upon in Phase I and/or follow-on contract efforts.

Although a formal Acquisition Strategy is not required during Phase 0 (DoD 5000.2-R, Section 3.3), a strategy needs to be sufficiently evolved to envision future opportunities for technical and contracting competition. Actions taken should neither impede future competition nor create potential organizational conflicts of interest.

Additional discussion of this topic is included in the section on Phase 1.

2.2.1 Define Requirements/Preferred Concepts

The acquisition process starts with a Mission Needs Statement (MNS) and possibly a threat assessment. The MNS expresses, in broad operational terms, the deficiencies in current capabilities and opportunities available to provide new capabilities. It should be stressed that the MNS should not specify the needs in terms that could limit its possible solution. The threat assessment, which is prepared and updated outside of the program acquisition function, is most useful as a reality check to ensure that the concept being considered is needed and that it satisfies a valid requirement. Using these documents as guidance, both government and contractor IPTs should first concentrate on different concepts to satisfy the MNS and then developing these concepts for analysis.

2.2.2 Analyze Concepts, Conduct Tradeoff Studies, and Define System Requirements

After the concepts have been developed, the next step is to analyze each concept in terms of performance, cost, schedule, and risk and then to conduct tradeoff studies. Advantages and disadvantages of each concept should be examined and documented. The application of risk

management processes (planning, assessment, handling, and monitoring) is particularly important during Concept Exploration, because this is when various program alternatives are evaluated, CAIV objectives are established, and the acquisition strategy is developed.

The proactive identification and management of risk is initiated at this point by commencing a risk management process and formulating a risk management plan. Because of the pervasive nature of risk and the impact of risk-handling plans on other program plans and actions, the IPPD concept of including all stakeholders is fundamental to successful risk management, with IPTs playing a key role. The tasks associated with each candidate concept need to be detailed sufficiently by knowledgeable and experienced personnel so that critical and high-risk efforts are identified as realistically as possible, even though it is very early in the program's life cycle. Risk management in the IPPD environment is based on the systems engineering or concurrent engineering methodology where all aspects of the program, from conception to disposal, are examined early on in relation to each other. Most risk management approaches have in common the practice of integrating design (performance) requirements with other life-cycle issues such as manufacturing, operations, and support. The risk assessment performed on these candidate concepts, and at all subsequent stages of the program, is required for all major milestone decisions and contractual commitments and should continue throughout the program so that risk management activities can be included in program planning and budgeting.

See the Acquisition Deskbook, Risk Management Organizational Structure, for more information on risk management and IPTs at http://www.deskbook.osd.mil

Part of the customer focus goal is to give the customer the best value in terms of both performance and cost. Cost objectives are established at this stage using an IPPD approach with extensive customer involvement to ensure the objectives are realistic. Using CAIV analysis, an acquisition strategy can determine high-cost drivers and evaluate whether a change in requirements could yield a significant improvement in life-cycle cost while still meeting mission needs. CAIV analysis results in tradeoff studies for cost and performance and the generation of cost/performance curves. Cost data used should include the costs of potential program impacts due to risk and risk management.

See the Acquisition Deskbook at http://www.deskbook.osd,mil for a discussion of CAIV and Chapter 7 for more information on cost modeling.

In an IPPD environment modeling and simulation can be used to maximum advantage in acquiring early learning and reducing risk. Various modeling and simulation techniques can create virtual prototypes that make it possible to address producibility, maintenance and support, environmental and other life-cycle considerations in the Concept Exploration phase. These techniques can help create affordable multiple concept designs that fully apply IPPD principles by helping in the tradeoff study process.

See Chapter 6 for more information on modeling and simulation tools.

Following the tradeoff studies, the next task is to document the operational requirements of the item being developed/acquired based on the tradeoff studies performed in conjunction with the customer. This is traditionally documented as an Operational Requirements Document (ORD). An ORD contains operational performance parameters for the proposed concept/system that defines the system capabilities needed to satisfy the mission need. In the IPPD environment, the ORD represents the requirements for all phases of the concept or system's usage and defines

these requirements in performance-based terms resulting from the CAIV analysis and cost/performance tradeoff studies. This whole process is iterative, requiring two-way communication with the customer to come up with the right set of top-level requirements. New data sometimes emerges during development that forces reexamination of the original ORD requirements, e.g., a particular requirement turns out to be more expensive or harder to achieve than originally thought. Once the top-level requirements are defined, the program continues conducting tradeoff studies at lower and lower levels throughout the development to ensure that the right answer is achieved at each level.

To give designers the necessary flexibility to design the best system, the ORD should contain the minimum number of requirements necessary and should be described in terms that specify the functions the system must perform without unduly constraining the system design (these are commonly called “performance-specification requirements”). Getting early and continuous customer input and participation throughout the process of determining system requirements can ensure completeness of the ORD and are essential for defining key performance parameters (KPPs), which are extracted from the ORD for the acquisition program baseline (APB). A key performance parameter is that capability or characteristic so significant that failure to meet the threshold can cause the concept or system selection to be reevaluated or the program to be reassessed or terminated. More information on KPPs is contained in Section 4.2.2.

As identified in Chapter 1, a proven method used to aid in requirements definition is Quality Function Deployment (QFD). QFD is a systems engineering tool that applies the IPPD approach to accomplish the requirements analysis objectives of Phase 0. QFD is a structured, team-oriented planning methodology for translating the top-level customer needs into appropriate requirements at each level of product and process design.

More information on QFD is contained in Chapter 7.

CAIV/Tradeoff Study/Cost Objective Examples

Joint Strike Fighter

CAIV was implemented on the JSF program by constructing in-depth requirements, cost, and performance tradeoff models (down to subsystems and major components) in order to set requirements and cost goals/targets at the same time. Only a few key performance parameters (KPPs) were defined and the customers were involved in the tradeoff studies. An aggressive unit cost target was defined as “less than the cost of a current low-cost fighter." These unit cost targets were included in the ORD and early RFPs. Production cost estimates will evolve based on commonality demos and manufacturing process demos to validate process maturity. The program funding was "front-loaded" to provide funding for the demos, other cost reduction tradeoff studies, and technology efforts.

For further information see http://www.jast.mil

Space Based Infrared Systems

A customer-led IPT for the Space Based Infrared System (SBIRS) identified the major cost drivers—considering and evaluating customer utility. A cost target was set in the ORD and Concept Validation RFP. The customer and industry were involved in requirements, cost, and

performance tradeoff studies to develop a set of affordable and achievable key requirements and set the KPPs. For Engineering and Manufacturing Development (EMD), aggressive cost targets were part of source selection. Contractor trades (with government access) will be conducted to minimize Total Ownership Cost (TOC). An innovative incentive fee splits cost savings per unit between the contractor and the government. Approval cycles were reduced, and the EMD RFP was streamlined from the expected 1,000+ pages to 60 pages. Contractors will participate in IPTs for management, cost, and contracts.

For further information see http://www.laafb.af.mil/SMC/MT/sbirs.htm

Joint Air-to-Surface Standoff Missile

Concept development phase studies, Air Force/Navy customer input, and acquisition inputs formed the basis for early cost targets in the Joint Air-to-Surface Standoff Missile program. A "Contractor Day" was held to request and obtain industry input. All of this was used to set both development cost and unit cost targets. The unit cost target, in the ORD and RFP, contained both objective and threshold unit cost values that were less than 50 percent of historical predictions. In addition, a "bumper-to-bumper" warranty is included in the unit cost target to cover TOC. A procurement cost commitment curve is being used for early units, with incentives for costs lower than the curve. The Government will have on-line access to the contractor system for cost tracking.

For more information go to http://www.safaq.hq.af.mil/acq_ref/stories/jassm.html

2.2.3 Define the Program

Both the system or product requirements and the process for acquiring the hardware and software to satisfy these requirements, i.e., the Program, need to be developed. The major tasks to be accomplished are identified along with a schedule by which to accomplish them. In an IPPD environment, providing an integrated plan and corresponding schedule helps the team members understand the work of their team within the context of the total program. The acquisition strategy for the program includes activities that focus on identifying risk and risk-handling options and the development of life-cycle cost (LCC), or total ownership cost (TOC) objectives. It also includes development of an integrated logistics support approach that enhances the overall value of the delivered product. Additionally, issues such as the type of contract, the method of competition, budget requirements, and industry capabilities should be considered at this stage. In an IPPD environment, each of these items or issues is interconnected with the others, and a balanced, optimal solution will require consideration of all factors. Such consideration can influence program success or failure—a significant reason for involving all the stakeholders, including business, contracts, and budgeting personnel, in the IPPD environment.

2.2.3.1 Planning

Tasks to be performed need to be organized in a way that enables the concurrent development of products and processes. The IPPD philosophy incorporates the planning of engineering activities as well as other key management and functional processes, such as manufacturing and support. In an IPPD environment, the process of defining the tasks should involve all stakeholders. For example, in the generation of a Test and Evaluation Master Plan (TEMP), contracting personnel

need to consider the procurement of test assets, the system designers need to design with testability in mind, budget personnel need to plan for the required government-furnished equipment (GFE) and government-furnished material (GFM) to support test, and the program office needs to ensure that the test strategy and key related events are reflected in the overall system acquisition strategy. Thus, these functions need to be included on the IPT developing the TEMP. Any proposed task plan can be evaluated as an indication of the commitment to an IPPD approach. For instance, key manufacturing and supportability planning tasks should show up early in the program.

One way of defining tasks and activities to reflect an IPPD approach is the use of an integrated master plan. Within an IPPD environment, the integrated master plan provides an overarching framework against which all the IPTs can work. It documents all the tasks required to deliver a high quality product and facilitate success throughout the product's life cycle. Cost, schedule (specific dates), and non-essential tasks are not included in this plan. During the initial stages of Concept Exploration, the integrated plan is preliminary and its purpose is to provide an understanding of the scope of work required and the likely structure of the program. It is constructed to depict a likely progression of work through the remaining phases, with the most emphasis on the current and/or upcoming phase (especially the period to be contracted for next). The integrated plan also serves to identify dependencies, which may be performed by different organizations such as various contractors, sources of Government Furnished Equipment (GFE), laboratories, test resources, etc., within different portions of the total effort. A preliminary integrated plan is developed principally by the government, but includes industry inputs obtained through open communications with potential sources during the pre-solicitation phase of the acquisition. When a solicitation is issued, the government does not normally issue its entire integrated master plan to contractors. It does, however, need to identify required delivery dates to support portions of the effort not required of the contractor, as well as when the future contractor can expect deliverables provided by the Government (including GFE from its other contractors). Under Secretary of Defense for Acquisition and Technology policy is to maximize efficiency of defense acquisitions by maximizing contractors' and subcontractors' utilization of their commercial product facilities, components, and processes (technical, management and business), whenever they meet DoD requirements, and minimize DoD-unique requirements. The Government issues a Statement of Objectives (SOO) or some other system requirements document that describes the functional/performance requirements for the desired product. The preparation of the integrated master plan (the "how to do it") for the portion of the work required under a contract is left to industry respondents for inclusion in their proposal, so that industry has the maximum flexibility to determine innovative, streamlined solutions to the government requirements. The program office and government integrating IPT should keep abreast of each major contractor's integrated master plan, but the integrated master plan should not be "placed on contract" as the delivery requirements of the contract should sufficiently define the contractors' obligations to deliver products.

As the program is defined, the integrated master plan is iterated several times, each time increasing the level of detail and confidence at which all essential work has been identified. The specific format for this plan is not critical; however, it usually reflects an Event/Accomplishment/Criteria hierarchical structure—a format that greatly facilitates the tracking and execution of the program.

In an IPPD approach, functional and life-cycle inputs are required to integrate the product and associated processes produced by the program. Without formal documentation, such as an integrated master plan, these inputs may be lost when personnel change. Such a plan also defines and establishes the correct expectations.

2.2.3.2 Scheduling

Event-driven schedules and the participation of all stakeholders are the IPPD principles involved in developing a program schedule. All stakeholders have to work against the schedule, and all tasks need to be accomplished in a rational and logical order allowing for continuous communication with customers. Necessary input conditions to complete each major task are identified and no major task is declared complete until all required input conditions and tasks have been satisfied. When documented in a formal plan and used to manage the program, this event-driven approach can help ensure that all tasks are integrated properly and that the management process is based on significant events in the acquisition life cycle and not on arbitrary calendar events. Deriving the program schedule presents an opportunity to identify critical risk areas. As IPT members estimate the times to complete specific tasks, events that may cause delays will become apparent. These events are potential areas of risk that the IPT should consider for further analysis.

One way to produce such a schedule is to develop an integrated master schedule based on an integrated master plan. With an integrated master plan, the integrated master schedule further helps the IPT members understand the links and interrelationships among the various teams. The integrated schedule begins as an integrated master plan with dates—the starting points are the events, accomplishments, and criteria that make up the plan. At a minimum, an integrated master schedule shows the expected start and stop dates for each criterion in the plan, but each criterion may be broken down into lower-level tasks that will be used to manage the program on a day-to-day basis. The schedule can be expanded downward to the level of detail appropriate for the scope and risk of the program. Programs with high risk show much lower levels of detail in the integrated master schedule in order to give the visibility to manage and control risk. The more detailed the integrated master schedule, however, the greater the cost to track and update the schedule. Under acquisition reform initiatives, the dates in the integrated master schedule usually are not made contractually binding in order to allow the flexibility to take full advantage of event-driven scheduling.

In an IPPD approach, an integrated master schedule performs the same job it always has—to track schedule variations. But with an IPPD approach and when the integrated master schedule is tied directly to the integrated master plan, the schedule also tracks the activities that provide functional and life-cycle inputs to product development. In this role it provides a crosscheck not only that the inputs were obtained, but that they were obtained at the right time.

Commercial standards EIA 632 and IEEE 1220-1994 can also be consulted for more information on developing master plans and schedules at
http://www.eia.org/eng/allstd/index.htm
http://standards.ieee.org

2.2.3.3 Managing Risk

All acquisition programs involve risk. The successful management of a program is defined by how that risk is managed. The key to managing risk is an ongoing, integrated risk assessment in which all aspects of a program (hardware, software, test, support, fielding, manufacturing, human resources, etc.) are examined for risk. Doing this requires the involvement of all stakeholders in an IPPD environment. This risk assessment becomes the basis for a risk management approach, which may be articulated in a formal plan or in informal briefings or other documentation. In either case, risk management planning is a continual effort. Program risks should be regularly assessed and the risk handling management approaches developed, executed, and monitored throughout the acquisition process.

DoD considers IPPD to be the focus of risk management. It facilitates consideration of risks across functional areas and detailed investigation of critical areas and processes over the life of the program. IPTs, composed of all stakeholders, continually review these critical areas to identify events that may adversely affect cost, schedule, or performance.

In support of a program's risk management approach, the IPTs should address critical cost, schedule, and performance risk areas and periodically reevaluate the program to identify new risk areas. The risk management process is a formal, up-front program planning process that assesses technical and programmatic complexity, identifies associated risk, and recognizes that risk drives the resources required to execute a program. The risk management approach addresses all phases of the acquisition program, from contracting and purchasing to technical issues covering the life cycle from development to disposal. The IPPD fundamentals—multidisciplinary teamwork, event-driven scheduling, and total life-cycle planning with an emphasis on the customer's needs—provide the necessary mindset and representation to accomplish an effective risk management program.

Detailed guidance concerning DoD risk management is contained in Paragraph 2.5.2 of the Defense Acquisition Deskbook, which is available at http://www.deskbook.osd.mil/ and in the newly published Risk Management Guide published by the Defense Systems Management College, Ft. Belvoir, Virginia, 22060-5566

Additional information about risk management in the IPPD environment is titled "ASC Handbook for Integrated Risk Management" and is available from Aeronautical Systems Center, ASC/FMC Building 11A 1970 Third Street, Suite 6, Wright-Patterson AFB, OH 45433-7213, or at http://www.wpafb.af.mil/az_public/abb.htm

2.2.4 Develop RFP for Phase I

Once the program is defined and a balanced approach is derived from appropriate cost/performance/schedule tradeoff studies, the next step is to develop an RFP. Both contract language and contract incentives need to be written to encourage an IPPD approach without contractually imposing a series of approved, recommended, or best practices for applying IPPD. Imposed practices become standards by implication, and contractors would be hesitant to deviate from them for fear of being found contractually nonresponsive. The desired contractor should already have established an IPPD culture and should not need steps for implementation.

RFPs consider all of the functional area requirements that have resulted from thorough value-added tradeoff study analyses and discuss risk management and cost objectives. The goal is to determine the minimum essential requirements that must be described in the RFP to enable the contractor to develop the best product. Each proposed requirement must be evaluated for its value, cost, associated risks, and alternative methods to achieve the same goal. An integrated requirements evaluation typically finds that fewer requirements are needed than have traditionally been requested. In the new environment of contracting, using performance specification requirements rather than product specifications, RFP requirements are stated in performance specification terms rather than in stipulated design parameters and "how-to" requirements embodied in detailed instructions or process specifications.

Care must be taken to build incentives into the RFP so that both the government and the contractor can benefit from implementing IPPD. Since the development contractor will soon become a part of the team, it is wise to allow prospective bidders to comment on the RFP while it is still in draft form. Such participation can further refine the government's goals and requirements by identifying contractor-known obstacles, cost drivers, and alternatives. The final RFP should also explicitly state that contractors are allowed and encouraged to propose alternatives to any RFP requirement and any improvements to the product specifications. When alternatives are proposed, cost/benefit analyses and associated risks should be conducted to determine their merits. These alternatives may be unique to a specific contractor's approach.

It is important for the government to inform potential offerors about the government's IPPD concept of operation. In the spirit of acquisition reform, the government should not mandate processes; however, the offeror should be aware of how the government conducts business. The government ascertains how the contractor's product and process approach reflects a balanced life-cycle focus. This information can be relayed by several methods including an executive summary attached to the RFP, Commerce Business Daily announcements, or a separate attachment to the solicitation.

A primary aspect to be evaluated in the offeror's proposal is the approach presented to accomplish IPPD. The government's method of evaluating the offeror's IPPD approach is part of the source selection process. Therefore, Section L, the Instructions to Offerors, should adequately identify the information that offerors are to provide in their proposals. This is necessary for the government to evaluate how the offeror intends to integrate each critical process into an overall integrated management approach. Offerors may include their integrated master plan and integrated master schedule to represent their approaches, but, to the extent required at all, solicitations should require these only at higher levels of detail sufficient for evaluation of the approach, rather than at greater detail levels, which will evolve after award. Along these lines, the criteria in Section M, the Evaluation Factors for Award, should reflect the relative importance of IPPD. Each program should tailor this language to fit the specific acquisition.

As a general approach, the RFP should ask the bidders to explain how they intend to implement the IPPD principles in their program. From this input the government can get a good idea of how well the contractor understands the principles of IPPD. It should be noted that the blanket endorsement of every tenet may indicate a contractor's lack of knowledge about IPPD. Nearly every IPPD tenet must be assessed and applied selectively to the particular situation presented.

Contractors who fail to indicate that they will use common sense to tailor the application of IPPD to their environment may have missed the point.

The following paragraphs offer samples of RFP language referencing one aspect of the IPPD approach—defect prevention—as an example. In this example, the government is concerned with how the contractor will address the balance between the manufacturing process, product design, cost, and risk during development.

Sample RFP Language: Defect Prevention Example

The following language is provided as guidance for the Statement of Work (SOW) or Statement of Objectives (SOO):

> "The government's objective is for the supplier to define and mitigate the manufacturing process risks associated with the design solution through the development of producible designs, capable fabrication and assembly processes, and associated controls. This includes activities such as the following:
> (1) Developing and implementing an approach for the identification of key product characteristics. Key product characteristics are the features of a material or part whose variation has a significant influence on product fit, performance, service life, or manufacturability.
> (2) Identifying manufacturing process risks (e.g., the risks related to developing stable and capable processes, to minimizing the need for engineering changes, to preventing defects) associated with the evolving design solution, and developing and implementing appropriate design alternatives and risk reduction efforts."

The following language is provided as guidance for Section L:

> "Propose and discuss any defect prevention practices to be employed for this acquisition. To facilitate government evaluation methods, provide rationale for each such method, indicating how it helps to meet the SOO paragraphs on defect prevention.
>
> Describe how key product characteristics will be identified and how existing manufacturing process capabilities are considered in the assessment of manufacturing process risks associated with the evolving product design. Define how manufacturing process risk assessments are fed back to product design efforts to ensure that producibility considerations are included in the evolving product design."

The following language is provided as guidance for Section M:

> "Proposed approaches will be evaluated based upon:
> (1) The extent to which they employ disciplined, structured processes (versus ad hoc or anecdotal) to identify and mitigate manufacturing process risks (e.g., the risks related to developing stable and capable processes, to minimizing the need for engineering changes, to preventing defects).
> (2) The extent to which the processes for identifying key product characteristics and identifying/mitigating of manufacturing process risks are integrated with the overall systems engineering process
> (3) The extent to which the proposed approaches reflect the integration of manufacturing process risk reduction efforts into the planning for this program. "

2.3 Phase I, Program Definition and Risk Reduction

During Phase I, Program Definition and Risk Reduction (PDRR), the most promising concepts investigated in Phase 0 are advanced, the risks associated with these concepts are analyzed, and the program requirements are refined sufficiently to enable the development of the most-favored design in Phase II, Engineering and Manufacturing Development. The following sections contain a discussion of the most important activities that take place and how IPPD tools and principles are applied during this phase's activities.

There are usually two ways to conduct PDRR: sole source or in a competitive environment. More and more the PDRR phase is used to give competing contractor teams the opportunity to refine their concepts and generate substantiating data for their approach to meeting the customer's requirements. The government then conducts a source selection to evaluate the different approaches and selects one to continue into Phase II, Engineering and Manufacturing Development.

2.3.1 Evaluating a Contractor's Proposal/Selecting a Contractor

Since IPPD is relatively new to some contractors, they may be tempted to propose a theoretical IPPD approach with which they have no first-hand experience. Or they may simply restate the IPPD evaluation criteria without making the internal cultural changes needed to operate using an IPPD approach. A true representation of the contractor's capabilities is of an even greater concern in an IPPD environment, because more authority will be granted to the contractor with less contractual oversight. The government's evaluation approach needs to ensure that the contractor truly understands and can apply the IPPD approach. It is important that the government evaluation team performs a thorough evaluation of each proposal, becomes familiar with IPPD techniques and methods and what can realistically be done, and looks closely at contractor past performance.

Things to look for in the proposal include—

- A convincing system to collect and distribute information about the program (reference Chapter 5)
- A tailored application of the IPPD tenets that makes sense for the particular situation (reference Chapter 1)
- A management approach that shows the operation of empowered IPTs, the effective delegation of authority and responsibility, and the realistic involvement of all stakeholders (reference Chapter 3),
- A rational program and IPT structure that reflects the products and processes being delivered, such as one based on the WBS (reference Section 2.1.3)
- A well-conceived program plan that shows the interaction of all required functional skills and life-cycle influences (reference Section 2.2.3.1)
- An event-based schedule that ties directly to the program plan (reference Section 2.2.3.2)

- A risk management process that is integrated into the program management system (reference Section 2.2.3.3)
- An integrated set of metrics and management tools that will be used to manage the program (reference Section 2.1.8 and Chapter 4)
- The effective and efficient use of modeling and simulation and virtual prototyping (reference Chapter 6)
- An integrated approach to cost modeling that can operate in near real time (reference Chapter 7)

A good understanding of IPPD by the contractor team that prepared the proposal is not necessarily a guarantee that the rest of its company will support IPPD. To assess the contractor's potential, it is good to review past performance records to see whether and how well the contractor has implemented IPPD on any similar programs.

2.3.2 Executing Phase I

The best leverage to encourage IPPD performance after the contract is awarded is an incentive or award fee that is based partially on the implementation of the IPPD tenets. Use of this approach should be part of an integrated contractual strategy that is designed to encourage and reward the elements of performance that are most important to the customer. In this environment, the role of IPPD performance is, therefore, a supporting one. The contract deliverables (e.g., a ship, a plane, a process) are what the customer really desires from the contract. IPPD is important because it can increase the chances of customers getting what they want, when they want it, and at the price agreed to. A program that chooses to reward IPPD performance must, however, structure the incentive in such a manner that the rewarded performance actually contributes to the delivery of the product or process required by the contract. Creating this incentive structure can be difficult and it is useful to discuss it with industry, either during the pre-solicitation phase or by having the bidders propose an incentive arrangement in their proposals.

Soon after the contract is awarded (or even earlier in a noncompetitive situation), the government and contractor need to discuss plans to execute the contract in terms of work scope, schedules and resources. This is referred to as a performance measurement baseline. Since the goal is mutual understanding, with identification of risk as a critical element, various IPTs provide input to the baseline. At the program manager's discretion, the appropriate-level IPT then participates in an Integrated Baseline Review. Once the integrated plan, including the performance measurement baseline, is in place, its execution is managed using the contractor's earned value management method.

More information on Earned Value Management and the Integrated Baseline Review can be found at http://www.acq.osd.mil/pm/

2.3.3 Transition to Next Phase

The transition of a program from one phase to the next is a good time to reassess the status of the program's IPPD implementation. Moving from Concept Exploration to PDRR, or from PDRR to EMD, will change the relative importance of the IPPD tenets. For example, in Concept

Exploration the program may have placed great weight on customer involvement, proactive risk management, and early life-cycle planning requirements. In PDRR, where the work is increasingly detailed, other tenets, such as robust design and event-driven scheduling, increase in importance, although IPTs will continue to identify and analyze risk areas. IPTs will spend considerable effort monitoring mitigation plans that are designed to reduce risk that was identified in the Concept Exploration phase. This change in program emphasis may require adjustments to program guidance or additional, refresher-type training for IPT leaders and members. Each case is different, but it is helpful to review the tenets and ensure that each is getting the attention warranted for the new phase of the program.

As the program transitions to later phases, the IPPD structure and composition of the IPTs also may need to be revisited for appropriateness. For each phase, the activities to be accomplished during the phase need to be defined and the stakeholders required to accomplish these activities need to be identified. The stakeholders should then form the IPTs that are built around the activities.

A redefinition of IPT objectives to correspond with the objectives of the new phase may trigger a change in the IPT organization. Moving from Concept Exploration to PDRR is the starting point for the first full-up IPT organization on the program. This is the point at which the initial IPT, which led the concept exploration, establishes and staffs IPTs for each of its major products and processes. This also coincides with the formal creation of a Program Office.

The change from PDRR to EMD may not be so dramatic, but IPT functional memberships still may have to be adjusted and IPT charters will still need to be reviewed for EMD application. One change usually seen in any program delivering hardware is the creation of an IPT charged with Producibility and Production Planning and/or Implementation.

The transition from EMD to Production, Fielding/Deployment and Operational Support will normally be the first time the Program Office will begin to shrink in size. IPTs that were heavily tasked during the development and test efforts will find that their responsibility transitions to a sustainment role. More logistics expertise and less engineering support will be needed. Some IPTs may even disappear completely, with their residual tasks being assumed by another existing team or a newly formed follow-on team. The IPPD tenets will again shuffle in importance as the development emphasis moves to a focus on efficient manufacturing and cost-effective support. This is where the early IPPD work can really pay off.

IPPD organizations are supposed to be flexible and responsive. If they all were in fact like that, changes driven by moving from one phase to the next would be anticipated and phased in as needed, and there would be no unique change caused by transitioning. Unfortunately, very few organizations are that proactive. Programs should force themselves, periodically and at every transition point, to reexamine their IPPD implementation and make the necessary adjustments to keep them current and active.

Before a program can proceed to the next phase, risks must be well understood and risk management approaches well developed. A variety of techniques exist to aid in the IPPD approach to managing risk. To ensure an equitable and sensible allocation of risk between government and industry, a contracting approach appropriate to the type of system being acquired

should be used for all phases of the system's life cycle. Objectives and thresholds for cost, schedule, and performance should be refined as the program matures, consistent with operational requirements.

2.4 Summary of the Application of IPPD in DOD Acquisition

IPPD is a methodology and a set of processes and tools that are continuously being developed and refined. This chapter has presented many ideas and examples for the application and development of IPPD within Phases 0 and 1 of the acquisition process. Most of the concepts and tools discussed carry over into the subsequent acquisition phases.

The following are the most important issues related to the successful implementation of IPPD:

- The early participation of all necessary disciplines and stakeholders, including the customers, to completely define the requirements and analyze the products and processes as they are developed
- A commitment at all levels to a multidisciplinary team organization that is appropriately structured, empowered, and held accountable
- Early investment in a seamless information infrastructure that is accessible to all parties involved, integrated across all development/acquisition functions and has adequate safeguards to ensure data security
- An emphasis, beginning early in development, on exploration of alternative design concepts
- A risk management program integrated into all activities of program planning and throughout all program phases
- A continuous focus on life-cycle requirements

Two closing points are worth noting before we move on to a discussion of teams. First, IPPD is not something that can be created and then left to function on its own. It takes continuous attention and constant reinforcement. Second, for a variety of reasons, a program may not be able to implement every IPPD practice as thoroughly as it would like. In this situation the program should implement as much as it can, then keep the pressure on to continuously improve the IPPD environment.

The remaining chapters of the handbook (Chapters 3 through 7) contain information on teams and tools useful throughout the life cycle.

Chapter 3 Team Best Practices for IPPD

This chapter focuses on building a cohesive product/process team, or Integrated Product Team (IPT), that functions efficiently and effectively. The important thing to remember is that each IPT in IPPD has a mission to develop and deliver a product and its associated processes. At the program level, IPT characteristics include—

- Responsibility for a defined product or process
- Authority over the resources and personnel
- An agreed schedule for delivery of the defined product
- An agreed level of risk to deliver the defined product
- An agreed upon set of measurable metrics

This chapter supplements two other documents on IPTs published by OSD. *Rules of the Road—A Guide for Leading Successful Integrated Product Teams* was published in November 1995. Intended for use within OSD, it addresses the two highest levels of IPTs (Overarching IPTs and Working-Level IPTs). The *DoD Guide to IPPD*, published on 5 February 1996, covers Program IPTs, which exist at the Program Management Office (PMO) level and below.

3.1 Definition of a Team

Jon R. Katzenbach and Douglas K. Smith have defined the characteristics they believe a group of people must meet to be considered a team:

> A team is a small number of people with complementary skills who are committed to a common purpose, set of goals, and approach for which they hold themselves mutually accountable. [1]

DoD Directive 5000.1 describes an IPT as follows:

> The Integrated Product Team (IPT) is composed of representatives from all appropriate functional disciplines working together with a Team Leader to build successful and balanced programs, identify and resolve issues, and make sound and timely recommendations to facilitate decision-making.

Katzenbach and Smith further characterize teams as *"…people with complementary skills who are committed to a common purpose, set of performance goals, and approach."* IPTs should contain members who represent all the stakeholders necessary to ensure that all customer requirements and functional concerns are represented and addressed up front in the developmental process.

Finally and most important for obtaining a quality product from an IPT, Katzenbach and Smith note that team members should *"hold themselves mutually accountable."* If team members feel a personal responsibility only for the portion of the product that they themselves produce, then the group consisting of those individuals is not a team. In contrast, a team that has been energized

1 Jon R. Katzenbach and Douglas K. Smith, *The Wisdom of Teams: Creating the High-Performance Organization*, Harvard Business School Press, 1993.

with a common purpose and fellowship tends to generate the atmosphere of trust and cooperation necessary to make the whole greater than the sum of its parts.

3.1.1 Team Size

Katzenbach and Smith define a team as *"a small number of people,"* ideally no more than 12. This school of thought is supported by an IPPD survey that DoD conducted in 1995 in which 50 percent of the respondents said the best team size was 10 or less—another 25 percent said 20 or less. Katzenback and Smith also state that when assembled groups of people become too large to function as a single team, they tend to break up into smaller, informal groups that then become separate teams from the rest of the group. Because they are informal groups, they may have a tendency to become disconnected from the main program unless the team leader carefully monitors them. One solution is to set up the IPT structure at the start so that team size stays within reasonable boundaries, thus avoiding the risk of informal teams being created. Another approach is to recognize when informal teams are forming and, if it makes sense, to formally incorporate them into the program structure with a charter, budget, assigned responsibilities, etc. Yet a third option is to allow them to operate separately but watch them closely to ensure that they do not become "Independent" Product Teams. This last option takes the most effort and is least desirable since it requires the Leader to manage this group slightly differently from the rest of the program.

The most important thing to remember, however, is that having the appropriate stakeholders on the team is the essential ingredient for an IPT. The team should not be limited by an arbitrarily set target number for members, but it should be limited to the minimum number of stakeholders needed to accomplish the work. In addition, the larger the team, the greater the leadership skills required to manage the team. For very large or joint programs, this could possibly involve a large number of people.

3.1.2 Team "Hierarchy"

Keeping the teams to a manageable size often requires a sort of "hierarchy" of teams. The term hierarchy is used here not in the sense of "power structure," but in the sense of creating a tree structure team of teams. The term hierarchy in this sense does not apply to the status of the teams or team members but rather to the relationships among the teams and how these relationships correspond to the product and process definition responsibility. Most programs have at least two levels of IPTs, a top level or system IPT and sub-tier IPTs for each of the major products or processes that make up the program. In a large program the breakout of responsibilities can lead to several layers of IPTs, each with its charter and clearly defined product or process. An example is an aircraft program where there may be four or five levels of IPTs in parallel with the product breakout—top level is the Weapon System, followed sequentially by the Air Vehicle, the Avionics, the fire control system, etc.—similar to the WBS. The final decision of IPT organization belongs to the Program Manager, who makes this judgement after consultation with the members of his or her team.

3.2 Team Leader

Each team must have a team leader, who is usually selected by the Program Manager/Director. In programs with two or more levels of teams, the team leader is the link to the next higher-level

team. The team leader should be the best-qualified person for the job, based on experience and interpersonal skills. Rank or position should not be considered a criterion for selecting a team leader; however, large differences in rank will most likely cause a team leader of junior rank to defer to senior ranking members. Team leaders must ensure that junior team members are not silenced or intimidated by more senior members.

The duration of an appointment as team leader will vary with the type of team being formed. Teams with a short or fixed life span are likely to have only one leader. On long-term teams, however, the role of the leader, and hence the person filling the position, may change as the product matures.

The following are some responsibilities of the team leader:

- Lead the team
- Negotiate staffing and participate in team member selection
- Ensure balanced participation within the IPT
- Ensure that decisions are made when required
- Resolve disputes
- Reinforce IPPD and IPT principles
- Support and reward IPT members
- Ensure integration with other teams
- Ensure compliance with the team charter
- Ensure that team members are trained

3.3 Team Member Selection and Negotiation

IPT members are selected based on a number of criteria, but, most important, they should be a stakeholder in the product or process being developed, i.e., they should be from a functional discipline that has a stake in the outcome. Selection of team members for IPTs often lies outside the direct control of the IPT leader—member selection usually occurs in a negotiating process between the team leader and the functional leaders. When a large program has many levels of teams or when it is competing with other programs for team members, limited availability of personnel and constraints on the personnel system can encumber the selection process. It is human nature to want the “best” people on your team—those all of their technical, problem-solving, and interpersonal skills finely honed. In reality, however, there are generally not enough “bests” to populate all the teams. Teams may have people assigned to them for whom the team leader and the functional leader have to have an understanding of the individual’s shortcomings. Together, the two leaders need to establish how they will each counterbalance these shortcomings with their own flexibility in time and resources until the individual does meet expectations required to be a fully functional member of the team.

In the mean time, if the team leader is well-trained and can create a positive, energetic environment, he or she can improve the performance of most team members. Furthermore, a

candidate team member's enthusiasm and willingness to participate can frequently overcome weaknesses in other areas.

The functional leader also needs to consider if a candidate team member is a good link to their functional equivalent in the next higher IPT. When issue resolution needs to progress to higher levels, it is important that the team member has communicated the issue to both his or her functional leader and the functional equivalents on the higher-level teams. Such team members understand their responsibility to their functional hierarchy as well as to the IPT.

It is obviously important to select people who have the time to meet and conduct the probable work of the team. Some of the people who are critical to system design or the process under study do not always have the time necessary. The team leader needs to negotiate with the functional leaders to help them allocate time to the team— all affected functional areas need to be represented on the team for it to function properly.

In reality, there probably will be instances when some functional leaders are unable to provide representation to an IPT. Different phases of a program need different expertise, and the team leader must compensate if the expertise is not immediately available in a team member. In any case, IPT assignments should be discussed and negotiated with functional leaders to get the best personnel mix on the team or ensure the expertise is available.

Additional selection criteria are discussed in the following sections.

3.3.1 Technical or Functional Expertise

When a system is being developed, a variety of stakeholders are required in order to incorporate all essential functions on the teams. It is important to include logisticians, customers, manufacturers, maintenance personnel, and others, as well as engineers, to ensure that all needs are met. Without proper representation of the necessary functions, a team can produce less than optimal products, or possibly even unsuitable results. Program managers or IPT leaders should determine in advance the technical qualifications needed in potential team members to accomplish the IPT's task assignment. One way to approach this is to assess the risk in the different areas of the program and seek more experienced personnel for assignments in the higher risk areas.

3.3.2 Problem-Solving and Decision-Making Skills

Problem-solving and decision-making skills are often difficult to assess without knowledge of the person's previous work performance. This is an area where the functional leader should be able to advise the team leader for the purpose of assigning a person to the team. However, in many cases the leader must simply take the time and opportunity to closely observe an individual team member at work and in interaction with other members. Unlike the technical or functional expertise described above, assessing a team member's ability to solve problems and make decisions is difficult and will probably become apparent only when there is a need to conduct tradeoff studies or make decisions on how to proceed with the program. To augment or reinforce these skills, training in problem-solving and decision-making skills can be provided.

3.3.3 Interpersonal Skills

Strong interpersonal skills of members assist the team in communicating effectively. Although interpersonal skills seem an inherent trait of a person, good communication skills can be taught at the time of team conception and applied throughout the life of the team. In addition, constructive conflict may be channeled into potential solutions to problems through the ability of members to relate to each other and draw on the expertise each member brings to the table.

3.3.4 Ability to Work Effectively in an IPPD Environment

In addition to being committed to an IPPD philosophy and its successful implementation in the program, IPT members should be able to operate in a somewhat free-form and flexible environment, often with more than one "boss." This is a really important characteristic to bear in mind, because some people need a great deal of structure, and, try as they may, do not flourish as effective IPT members. Again, this ability or lack thereof may not be apparent until some time into the program, but a team leader must be cognizant of the potential problem.

3.4 Team Dynamics

After the IPT organization is defined and membership assigned, the team dynamics need to be developed by taking the following steps:

- *Define team goals for each specific IPT and common goals for all of a program's IPTs*. Team goals should reflect program objectives and be geared toward the product the team is responsible for delivering. Remember that the product may actually be a process (see Process discussion in Sections 1.1 and 2.1.3).

  By specifying performance objectives for the team in terms that are clearly understood by all, a venue is created that allows for clear communication and constructive criticism. These objectives should lead to common goals that are defined in unambiguous terms. Once objectives and goals are defined, the IPT members should begin to focus their thoughts as a team.

- *Define the reporting structure of and working relationship among all IPTs*. In addition to reporting within and among the IPTs, team members also have a responsibility to report back to their functional organization's leadership and management.

- *Define the level of empowerment of all IPTs*. The IPTs need to have authority in line with their goals and objectives in order to make decisions for the product that they are responsible for delivering. The team as a whole needs to be empowered to make decisions within the authority defined in the team charter (see below). IPT empowerment, however, is not a blank check to do whatever the team desires. Every team must operate within some constraints, and these limits on authority must be identified and defined up front. For example, all IPTs in a program have certain cost and schedule constraints. Additionally an IPT may be constrained by the need for its product to interface with other parts of the program product, or to adapt to an existing system that is already fielded. These constraints are simply reflections of the real world of acquisition, but if they are not identified for all to see, IPT members may not understand their level of authority to accomplish their goals and objectives.

In addition to team empowerment, individual team members must be empowered by their respective functional leadership/managers to make decisions. When authorities outside of the team membership have the power to make decisions that affect the team-chartered responsibilities, the IPT concept is severely compromised. This does not mean that team members must abandon their organizations' interests and goals; rather, they must be thoroughly cognizant of their organizations' objectives and empowered to speak for their organization—even to commit the organization during team decision making. This authority also requires that team members keep their functional organizations apprised of team actions. It also means that a team member will often have to consult with their functional leadership/management before committing to a major team decision. Team members who have the authority to make decisions must be willing and able to do so when required and accept the responsibility for reporting those decisions back to their functional leadership/management.

A perceived lack of empowerment is not uncommon, according to more than one DoD survey. Team leaders should address concerns with the functional leader(s) of the members involved or with the next higher IPT to solve the problem. If this does not work, and team members have to operate without empowerment, then the team is not an IPT but just a traditional working group operating outside the IPPD concept.

- *Define the relationship between government and contractor personnel*. Along with defining the relationship of an IPT to the other IPTs on the program, there is a need to address the relationship between government and contractor personnel on the same team. In order to understand this relationship, it may be necessary to have some open, honest discussions between the two groups. Prior to this discussion, the upper level management of the two teams will most likely need to have an agreement that can then be factored into the discussion of the two groups. Each must understand what the other's critical objectives are. For example, a legitimate critical objective for contractors is to return a profit to its company. Government team members must recognize this as a prime motivator for their contractor counterparts on the team. A critical objective for the government is, almost always, to deliver the defined product at the price and schedule agreed to. By combining these two motivators, the IPT objective becomes on-time delivery of the specified product, at cost, and in an efficient manner that provides a fair profit for the contractor. The addition of the "fair profit" motive to the government objective can help ensure a very critical, team-wide sensitivity to any unplanned or unnecessary work on the contract.

  There may be other differences between contractor and government needs—some objectives may be coincident, while others may be exclusive. The way to address these differences is to focus on common, rather than separate, interests. These interests need not interfere with the goals of the team. The challenge is to adapt them so they reinforce the team goals. The success of an IPPD organization is attained when all parties involved benefit from the organization's output. Further information guiding government personnel participating on contractor-led IPTs is contained in Section 2.1.2.

3.4.1 Team Charter

The best way to minimize team misunderstandings is to document the team dynamics in a team charter for each IPT. An IPT charter should include the following items:

- The mission and objectives of the team (including top-level schedule if applicable)
- The metrics by which the team's progress will be evaluated
- The scope of the team's responsibilities
- The relationship of the team with other teams (reporting structure, interfaces)
- The authority and accountability of the team (empowerment)
- The resources available for the team
- A team membership list (by function/organization)

All affected stakeholders and their management should help develop the charter, and the Program Manager/Director approves it. This participation, or buy-in to establish the IPT and document the roles and responsibilities of the IPT, helps cultivate a cooperative and collaborative working environment and eliminates or at least mitigates many of the problems that could be encountered when operating in an IPPD environment. Examples of such problems are as follows:

- Lack of direction or vision that causes an IPT to constantly try to define its objectives
- Power struggles between the IPTs and management or organizations outside the IPT
- Infighting among IPTs because of ill-defined roles and responsibilities

The team goals should be written to minimize conflicts resulting from misunderstandings or hidden agendas. Conflicts of interest and goals among the team members should be resolved early in the development of team charters. Examples of conflicts include the natural conflicts between customers and contractors or among multiple contractors with conflicting business interests. Once established, IPT charters need to be frequently reviewed as an acquisition program progresses to ensure that they remain in line with changing program goals.

Figure 3-1 is an example of an IPT charter.

3.4.2 Team Unity and Issue Resolution

The key to good teamwork is the successful realization of team unity. The team acts as one, understanding the strengths of each of its members and using this knowledge to pursue the team's mission and the success of the program. Because of the many different, traditionally competing functions involved in IPPD teams, team unity could prove a challenge. In some cases, members may attempt to maximize their functional area at the expense of the system under development. In other cases, functional representatives may feel they have personal experience that outweighs group consensus. In these instances, the IPT leader will be faced with a situation that needs to be resolved early in order to avoid dysfunction in the IPT.

IPT Name:	Level of IPT:

IPT Mission/Objectives

Provide an overall description of the mission.

Describe specific objectives required to accomplish the mission.

Metrics

Describe specific metrics that measure objectives described above.

Scope of Team's Responsibilities

Provide a description of the work to be accomplished (can be SOW). Include key requirements, schedule, output(s) required (such as communications requirements like periodic informal reports, etc.), and budget/cost authority.

Scope of Team Members' Individual Responsibilities

Leader's Responsibilities (please list)

Member's responsibilities (please list)

Team Membership by Discipline/Function

Name	Function	Competency	Workyears

Customers/Interfaces

Identify all agencies and names of key people.

Authority/Accountability

Identify key authority and accountability required to accomplish successful IPT activity. This includes cost, schedule, and technical performance.

Review and Approval Process

Date of Approval:_____(Will be reviewed annually)

Submitted by_____

Approved by Team Leadership [signature]

[signature] [signature]

Figure 3-1. Sample Charter (F/A-18 Program Team)

The power of team unity pulls together the knowledge, skills, and attitudes of each individual. At the same time, the discord that so often impedes group meetings is suppressed to ensure positive momentum toward group consensus and the selection of win-win solutions to problems. Though it is an ideal and often difficult to fully achieve, team unity does contribute to the optimization of a team's capabilities when the following principles are followed:

- All team members must be stakeholders in the mission of the group
- All members must be empowered and capable in their functional discipline
- All members must feel free to make suggestions
- Members must trust one another, especially when sensitive issues surface
- The team must desire consensus and remain focused on team goals
- All members must actively seek win-win solutions to problems

True consensus occurs when all the team members can live with the solutions, although they may not be everyone's first choice. To facilitate this process of consensus building, team members must try not to be locked in by old paradigms. They should strive for innovation—to "think outside the box"—and should not be afraid to voice concerns. Thus, an operating rule that many IPTs find useful is "Don't shoot the messenger." To gain the most from the IPT environment, a team must find out about "bad news" immediately. That way, the team has the maximum potential to correct the situation while it is still manageable. IPTs must seek out any negative data concerning their product and should encourage members who discover a problem to bring it to the IPT as soon as possible, whether or not the member believes it can be controlled. Therefore, a team member who brings negative news to the team cannot be attacked; rather, the team member should be praised. This is not the traditional organization's approach to bad news. A strong commitment from the team leader and each team member is required to ensure that the IPT has good open communication.

While team unity is strongly encouraged, an IPT should not become so focused on its own product that the members forget to coordinate and integrate with the other elements of the system. This is when an "Integrated" Product Team becomes an "Independent" Product Team. Team members must recognize that their responsibility is to deliver a product that contributes to the optimum total system and that building the world's greatest widget is useless if it doesn't support the rest of the system.

Therefore, when an issue does arise for which the team cannot reach consensus, that issue should be taken to the next higher level in the hierarchy of teams—the next tier up. In general, this would be to the team that is the customer for the sub-tier team's product. Unresolved issues can go up the chain for resolution, however, every effort should be made to arrive at consensus decisions at the lowest team level possible.

3.4.3 Compensation

A quick way to undermine the success of the team is to reward individuals in a way that discourages them from helping other team members. Traditional systems, such as suggestion

programs, ranking employees for pay raises, and individual performance appraisals, can subtly discourage teamwork and encourage individuals to watch out for themselves. Compensation and pay raises must be linked to team performance. In addition, the team leader can ensure that the personnel who contribute most to successful teamwork get the recognition and rewards due to them.

While compensation for civilian personnel is usually monetary, methods for compensating military personnel need to be consistent with the military system (such as awards and decorations or training opportunities for individual professional development).

Compensation Example: F/A-18

The F/A-18 Program Team rewards its members based on competency and the accomplishment of team-related objectives. Indeed, team-related work objectives carry the most weight. Generic factors for team performance workplan objectives are as follows.

For Team Member	For Team Leader
• Meets team deadlines with quality product	• Meets/under budget
• Keeps team informed	• Logical, clear, concise task delegation
• Committed to the team and team goals	• Encourages innovation
• Respects programmatic issues	• Uses team effectively in decision making
• Provides competency expertise	• Meets team deadlines
	• Timely annual performance inputs

Extracted from the *F/A-18 Program Team (PMA265) Program Operating Guide*, 15 November 1996.

3.5 Team Meetings

Team meetings need to be structured for efficient and effective decision making. Individual roles and responsibilities, agendas, ground rules, and the frequency of meetings need to be determined upfront in team planning. Suggestions for these are given in the following sections.

3.5.1 Roles and Responsibilities

Team meetings need to have a team leader. Meetings also function best with a recorder and a facilitator, if possible.

Team Leader

The team leader runs the meetings and has the following responsibilities:

- Calls the meetings and develops the agenda
- Focuses on the content of the session

- Uses team effectively in decision making
- Resolves disputes to make sure decisions are made
- Encourages balanced participation
- Provides logical, clear, and concise task delegation
- Assigns and tracks action items
- Maintains all of the official meeting records
- Arranges for administrative support (i.e., reserve the meeting room, distribute the agenda, record the minutes of the meeting, and set up the video teleconference (VTC), if necessary)
- Ensures attendance of IPT members critical to the discussion points on the agenda

Recorder

The recorder chronicles the highlights of the meeting, any action items that develop during the meeting, and other important discussion points. It is usually not necessary to keep verbatim minutes, but if it is deemed necessary, a professional recorder should be added. Normally, however, the recorder will simply keep track of major items and document the highlights and key decisions.

Facilitator

Early in the life of an IPT, it is useful to designate a facilitator to monitor team meetings, to ensure that the team operates in an IPPD manner, and to observe the rules established by the team. The facilitator focuses on the conduct of the meeting rather than the content and ensures that the focus is maintained and the appropriate team-building techniques are employed. It is helpful, however, if the facilitator has some technical understanding. This helps a facilitator to determine what is important and to formulate directions to guide the team. The facilitator also serves as quality advisor to the team and can help with administrative tasks. Having people available to act as a facilitator is sometimes difficult; however, one person can facilitate many teams and contractors often have human resource-type people who can function in this role. It is also a role that can be contracted for. However, if an outside facilitator is used, part of their job should be to put themselves out of work by enabling the team to do its own required facilitation through internal process monitoring.

3.5.2 Agendas

An agenda should be prepared prior to every meeting and distributed in advance of the session. It is particularly important to distribute the agenda well in advance of the meeting if advanced preparation is required of the membership. The IPT leader sets the agenda; however, administrative personnel can aid in its preparation and distribution.

3.5.3 Ground Rules

Establishing ground rules, by which all meetings will be conducted, should be one of the first items on the team's agenda for the first meeting. The team must view these rules as inviolable,

and everyone must understand and agree to all of the ground rules. The most critical rules pertain to the following:

- Attendance
- Discussions ("no sacred cows")
- Confidentiality (no retribution or "poisoning the well" with those outside of the team)
- An analytical approach (use facts to support decisions)
- End-product orientation (everyone gets assignments and does them)
- Constructive confrontation (no finger pointing)
- Participation of all members

Some basic rules for team members to follow during meetings include—

- Listen to others' ideas without judging
- Question ideas, rather than questioning people
- Ask for expansion or clarification of ideas
- Contribute to, but do not dominate, the conversation
- Look for answers without losers (win-win solutions)
- Avoid disagreements—look for something good or something to build on in every idea
- Avoid debating or fighting for an idea that appears to be inappropriate
- Review frequently and summarize ideas, as you see them
- Stay focused--do not jump ahead
- Get on board and work to implement it, when you've had your say and the decision has been made

Additional ground rules can be found in Rules of the Road at
http://www.acq.osd.mil/ar/doc/taba.pdf

3.5.4 Meeting Frequency

How often a team meets depends upon the team's mission. Essentially, there is no set frequency for IPT meetings. Meeting frequency will be determined by the team and team leader. To avoid unproductive time spent in meetings, all team members must arrive at meetings fully prepared to take action and make decisions according to the set and pre-distributed agenda.

3.6 Team Training

Team training is a very important aspect of IPTs. The appropriate training at the appropriate time can increase the effectiveness and efficiency of a team. Training comes with the added cost of the member's time, but it can pay significant dividends at a later date when the team accomplishes tasks more quickly. Listed below are some common types of training that might be offered to

teams. All of the courses listed, except for product-specific training, are offered by the individual Services, many universities and colleges, and a variety of commercial offerors who specialize in these types of training.

3.6.1 Team-Building Training

Team-building training is oriented toward the quick formation of a group of individuals into a team. It focuses on exercises designed to engender trust, cooperation, team goal attainment, and communication among team members. Participants learn teamwork by taking part in challenging exercises and role playing. By practicing the principles taught in a group environment, team members become familiar with each other. They learn the strengths and weakness of the other members in order to learn how to function more efficiently as a team.

Informal training programs can be conducted locally and then reinforced during regular team meetings by using team-building exercises given by trained facilitators. This may be a quicker, less expensive method of conducting team training if time is considered a critical factor for team members.

3.6.2 IPPD Training

IPPD training is an important part of each team's training program. At a top level, IPPD training covers the application of DoD's IPPD tenets and provides examples and suggestions on how to implement the approach. It provides a good general background for someone who has not been exposed to IPPD and acts as an effective refresher for a team member who has been away from IPPD for a while. Additional training educates team members in tools and processes. Tool training focuses on key tools and how and when they are used. Process training is centered on process development, process improvement, and the development and use of metrics to monitor or improve processes. Team members learn how to make analysis charts and conduct process analysis. IPPD training often includes lessons in Total Quality Management (TQM) and the principles for creating quality products. Course content is likely to vary depending on who is offering the training. Team leaders should be the first ones trained in IPPD principles and should also be capable of determining the level of training required for their team.

For more information on IPPD training, visit the Defense Acquisition University (DAU) homepage at http://www.acq.osd.mil/dau/
See also the DoN-sponsored IPT Learning Campus CD resource guide http://www.acq-ref.navy.mil/q-tools.html

3.6.3 Information Technology Training

Despite the fact that computers are everywhere, not everyone is knowledgeable or proficient in their use. Team leaders can assume that team members' collective computer skills will range from non-existent to exceptional. But even proficient members may find that the selected software is foreign to them. For these reasons, teams should be given an appropriate level of training to ensure that electronic information transfer is used to the maximum extent possible. This will also aid in ensuring that the data transferred between team members is usable by the other members.

3.6.4 Product-Specific Training

Product-specific training is usually conducted as needed. Not all teams will require in-depth knowledge of a product to effectively accomplish their charter. Those that do will usually have this training provided by the contractor developing the product or by a member of the Program Office who is sufficiently knowledgeable to conduct the training. This particular type of training is generally of a technical nature. It may be a lesson in the capabilities of a new technology, the special handling requirements for a particular component, or disposal requirements for anticipated byproducts from the use or disposal of the system. Whatever the nature of the system, it is important that all members of the team have the same information if it impacts the mission of the team.

3.6.5 Systems Engineering and Analysis Training

Team leaders may find it advantageous to conduct some team training in the area of systems engineering or systems analysis. Some team members may be very familiar with methods for conducting analyses, tradeoff studies, and assessments, while others will be unfamiliar with the methods. Therefore, this training should be conducted as needed to familiarize team members with such areas as risk management, risk assessment, tradeoff studies, and cost/performance analysis. Since cost/performance analyses and tradeoff studies are crucial to effective IPT decision making, training in these areas can be very valuable. Each member needs to understand the procedures used to conduct analyses, including the relative importance of all of the variables used in a particular method and how they affect the outcome of that methodology. Tools and methods are most effective when all members understand their value and use.

3.6.6 Facilitator Training

If a professional facilitator is not available, facilitator training for one or more team members is important, because it enables the team leader to focus on the content of the meeting, while the facilitator focuses on context. A facilitator can assist the team by helping the team leader to plan and run meetings, use team-building techniques to develop trust and cooperation, enhance team communications, focus team discussions, and deal with problematic team members. Facilitators are also trained in building and interpreting various types of analysis charts, such as Pareto charts, flowcharts, and cause and effect diagrams.

3.7 Team Membership and the Government Role

With IPPD, the government needs to be actively involved as a customer and a team member from the start of an acquisition program. The government can function as a leader or as a participant but should not assume the traditional role of oversight. The government role in IPPD is to structure a program that gives the contractor the highest possible probability for successfully delivering what the customer wants and then helping the contractor to achieve that success. In this way, all parties should achieve their goals—customers get what they need and contractors' companies make a profit.

The contractor often leads the development of products and processes with government personnel as members of the IPTs. Government personnel functioning on contractor-led IPTs need to be

familiar with the contractor's processes and business practices and avoid trying to change the contractor's methods to reflect government methods. Such familiarity increases the likelihood that government IPT members will be treated as positive additions to the team. Moreover, because the success of the program depends on the success of the contractor, all team members need to work to make the contractor a success. This requires a major change in the mindset of government personnel whose former role was usually one of regulation and enforcement. The new environment becomes one of incentivized performance, where both the government and the contractors work together and share the benefits. The following is an example of the "Program First - Contractor First" mindset.

Government/Contractor Role Example: Advanced Deployable System (ADS) Program

The following is the Navy's ADS Program Manager's vision as stated in his Program Management Plan:

> The Contractor is the key to our success. We intend to work cooperatively to develop an affordable shallow water surveillance capability. The Government team will strive to ensure that the Contractor understands the requirements. The Government team will provide added value to the Contractor's efforts.

The following excerpt from the LPD 17 homepage illustrates both the oversight function being replaced with active government participation in the program and the importance LPD-17 places on including all stakeholders right from the beginning of an acquisition or development program.

Government/Contractor Teams Example: LPD 17

Earlier ship acquisitions have employed systems engineering principles to include the operator, but often these efforts would gear up precisely when the design, integration, and construction phases were entering a period of minimal flexibility—4 to 7 years after contract award. In contrast, Team 17's process relies on mission teams to define the overall operational context for a new surface combatant. The mission teams include representation all the way across the shipbuilding-customer base: the Office of the Chief of Naval Operations, the Marine Corps, the fleet commanders, other services, and the organizations that regularly study questions of warfighting. More specialized development and support teams, composed of representatives from the systems commands and design agencies, contribute by translating operational context into specific shipbuilding technology. Coordination is facilitated by a "virtual team" approach that uses computer technology to link geographically dispersed work centers for continuous interaction.

For further information see http://lpd17.nswc.navy.mil/exwar.html

Government personnel participating on a contractor-led IPT need to recognize that, while they are assisting in developing solutions, the contractor is responsible for contract performance. Should the contract requirements (performance requirements, schedule, deliverables, testing, etc.) require modification, such modification must be effected only through formal modification of the contract by the government contracting officer. Direction provided to the contractor by government personnel, which constructively changes the terms of the contract, is prohibited.

3.8 Final Thoughts on Team Best Practices for IPPD

An IPT structure is not something that can be set up and then allowed to function on its own. It is not self-sustaining. Personnel will move into and out of the group, the status of the program will change over time, and the personalities of the team may evolve as well. For these reasons it is imperative that the IPT spirit be constantly nurtured and reinforced. When the IPT ground rules are permitted to slide, the team members will instinctively revert to what they know best, which in most cases is the traditional stovepipe structure. An IPT will at least to some degree be constantly subjected to these traditional pressures to some degree and must be diligent in its efforts to overcome the hurdles. An inability to implement all the concepts described in this handbook or learned through other training material does not mean that the benefits of IPPD cannot be achieved; it just means that the benefits will be a little bit harder to reach. Remember that the purpose of the IPT structure is to make it easier to implement IPPD. Once set up and operating, each IPT must remain focused on improving the team's effectiveness and taking every opportunity to make the changes that move the team closer to the ideal IPPD environment.

Chapter 4 Metrics

This chapter defines what metrics are, describes their essential properties and types, and outlines a nine-step process for developing metrics.

4.1 Metric Attributes

A metric differs from a measurement in that a metric is a composite of meaningful, quantifiable product or process attributes taken over time that communicate important information about quality, processes, technology, products, and/or resources. Measurements are simply the raw data from which metrics are calculated. A good metric is capable of reliably measuring a specific process repeatedly over time. The purpose of a metric is to measure change, regardless of whether that change is positive or negative. For example, when measuring the technical performance of a test article, the goal is usually to increase the performance of the article. If the present test of the article reflects a decrease in performance from the previous test, the data, process, and any changes made must be examined to determine the cause. Metrics help define problems by fostering process understanding and indicating when corrective action is required. The goal of metrics is to show a trend that results in action to improve the process.

For a metric to be meaningful, it must represent one or more cause-and-effect relationships that control the process being measured. Sometimes data may be difficult to measure or collect, but it is very valuable. Other times, data that is easily collected is meaningless. Ensuring that data value is worth the collection effort is essential to a good metric. Metrics should be reconsidered if the data do not represent cause-and-effect relationships, do not show a trend, or are not timely. In addition, output metrics are preferred over input metrics.

Many metrics, such as those relating to cost, schedule, and performance, can be used throughout the program's life cycle, while others may be tied to only one portion of the program. Choosing quality over quantity of metrics is a continuing challenge. To assist teams in assessing metrics, the following is a list of attributes generally associated with a good metric:

- Has value to the team members or is an attribute essential to customer satisfaction with the product
- Tells how well organizational goals and objectives are being met through processes and tasks
- Is simple, understandable, logical and can be used repeatedly
- Shows a trend
- Is unambiguously defined
- Uses data that is cost-effective to collect
- Allows for timely collection, analysis, and reporting of information
- Provides insight that drives appropriate action

4.2 Types of Metrics

Metrics are used at all levels of a program's structure to represent key measures mainly in the areas of cost, schedule, and performance. Metrics monitored by program IPTs should be supported by other metrics monitored by sub-tier teams. Sub-tier teams should ensure that their metrics are aligned with the Program IPT's metrics in intent, language, and format. Sub-tier team metrics, however, should not be limited to those handed down from the program team. At the sub-tier level, additional metrics are often needed to accurately monitor the performance of the sub-tier team's product.

Although this chapter focuses primarily on hardware metrics, many programs have a software component. Efforts in measurement for software development include Practical Software Measurement (PSM) by the Joint Logistics Commanders Joint Group on Systems Engineering. Their website has links to other software measurement sites.

The PSM website is at http://www.psmsc.com

Three major categories of metrics are progress, product, and process. These categories are intended to assist teams in identifying the types of metrics they should be using.

4.2.1 Progress

Progress metrics are used to monitor the health and status of the program. They serve as alarms for adverse trends. These metrics must allow for the detection of adverse trends in sufficient time to permit corrective actions (see Figure 4-1 for an example of a progress metric). Metrics that indicate a trend after the outcome has become a *fait accompli* are useless as control metrics. The following are metrics examples that fall into the progress category:

- Cost performance index and variance
- Schedule performance index and variance
- Earned value
- Risk assessment tracking
- Manpower (planned versus actual)
- Deliveries

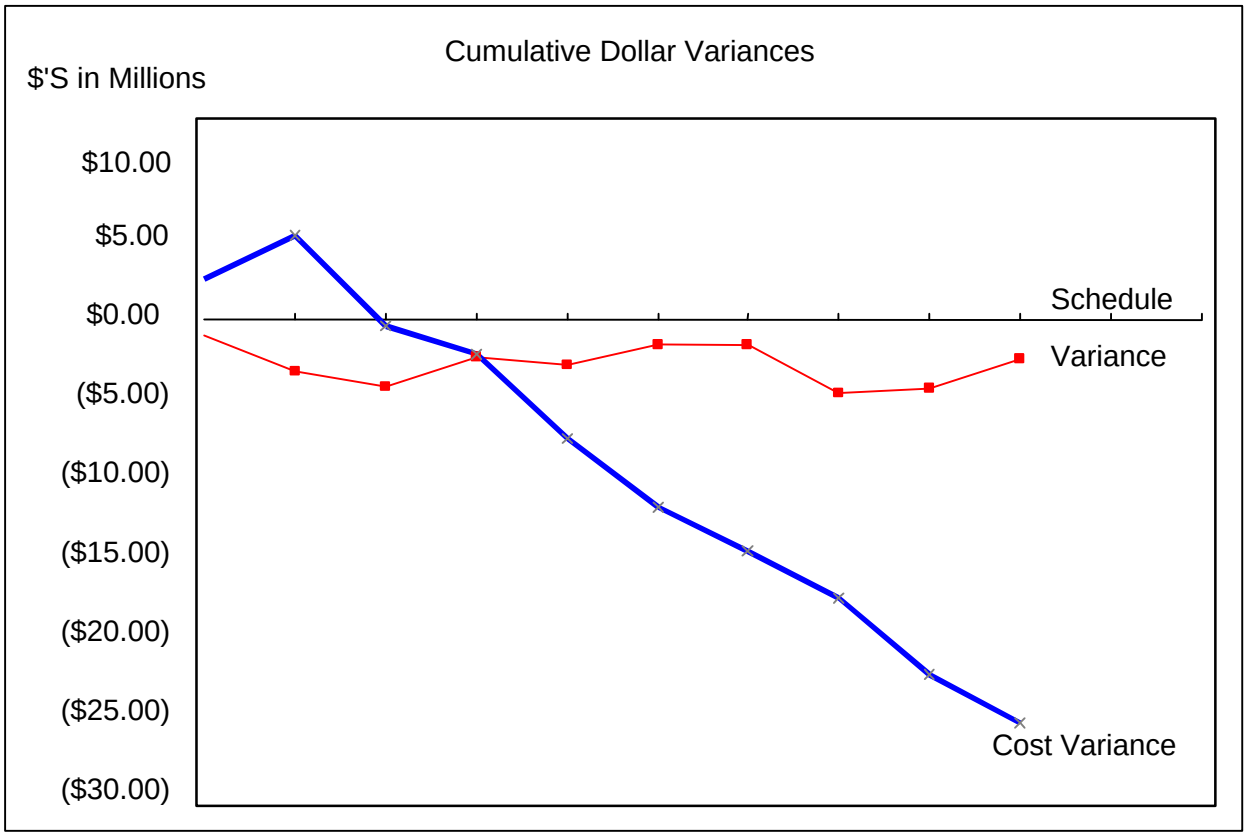


Figure 4-1. Sample Progress Metric

4.2.2 Product

Product metrics are measures of a program's technical maturity and are tied to the key performance parameters of a product. For developmental programs, these measures are found in the operational requirements document (ORD) as objectives and thresholds and in the test and evaluation master plan (TEMP) as critical technical parameters (see Figure 4-2 for an example of a product metric). Each performance parameter has an associated cost, schedule, and risk impact. Metrics of this type indicate to teams whether or not the desired technical performance is achievable given the constraints of the program. To ensure a degree of commonality in reporting metric data to higher-level teams, the program team should determine the objectives that each sub-tier team is to accomplish, the frequency and level of detail of their reporting, and the allowed variation for each product metric. Examples of product metrics include—

- Operational availability
- Weight budget
- Mean time between failures (MTBF)
- Speed
- Range
- Payload

- Product unit cost
- Power consumption

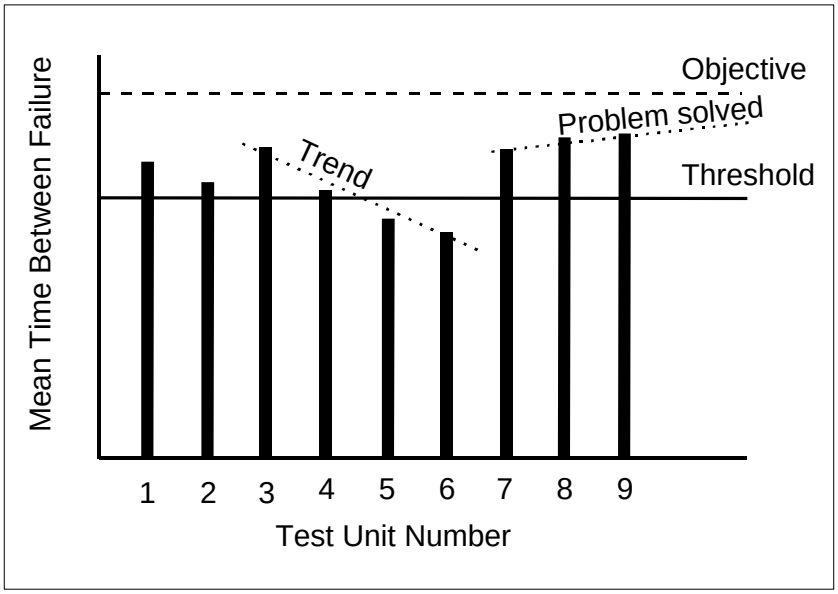


Figure 4-2. Sample Product Metric

4.2.3 Process

Process metrics assess the quality and productivity of a program's processes. In order to improve a process, it must be understood and measured. Data is collected at specific checkpoints in the process flow and then analyzed. The analysis of the data should be able to predict quality at later stages in the process (see Figure 4-3 for an example of a process metric).

Process metrics are a concern not only of the IPPD stakeholders or IPTs measuring them, but also of the functional organizations (such as budgeting, contracting, or testing) that own the processes being measured. Cooperation is essential to ensure that the best metrics are used or developed.

Process metrics usually compare current/predicted performance versus performance objectives. A standard of performance is set using historical data or expected levels of performance. The process is then measured to see whether the objective is being met. If the objective is not met, analysis should determine why. If the objective is missed, it might suggest that the objective was not properly set. In either case, the process should be examined for ways to improve process performance and thereby establish a new objective. Statistical process control (SPC) is a good method to use for monitoring, controlling, and improving processes (see Section 7.3.6).

Examples of process metrics are—

- Number and cost of requirements changes
- Number and cost of engineering change proposals

- Number and cost of test failures
- Cycle Time
- Defect rates

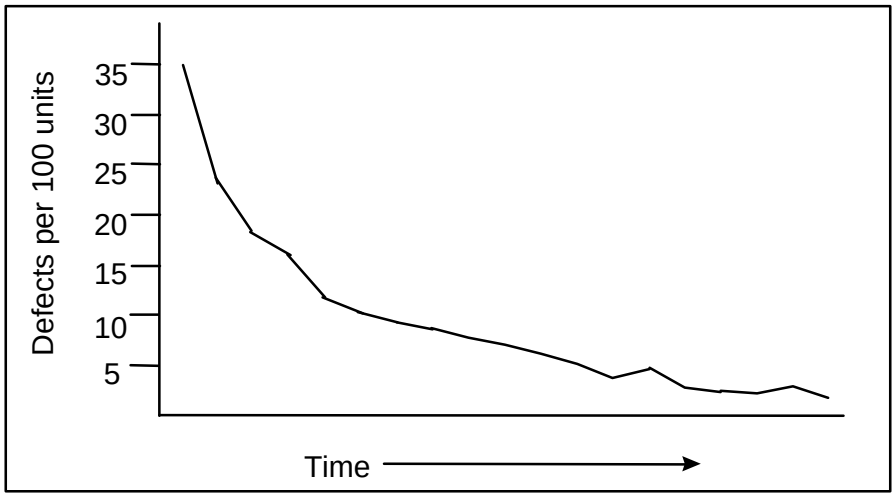


Figure 4.3. Sample Process Metric

4.3 Metric Development Process

Choosing or creating metrics is not a random process. Developing a measurement system requires an in-depth understanding of customer and project requirements. Program processes and process outputs must be identified. From there, process output thresholds must be determined and the appropriate measures or performance indicators developed. The following nine-step process is not the definitive methodology for metric development, but it does provide guidance in what to consider when creating or choosing a metric, specifically for process metrics.

1. *Identify the purpose of the metric*. Is this metric intended to provide data only to the team creating it or will it be reported to higher level teams? What type of metric is needed—programmatic/management control, technical performance measure, or process?
2. *Define what is to be measured*. Identify what it is that needs to be measured to satisfy the purpose (see step 1). If the process that is to be measured is not clearly understood in terms of cause-and-effect relationships, then the measurement will consist of a trial-and-error determination of seemingly related factors that may or may not have a bearing on the outcome.
3. *Identify and examine existing metrics*. Once the cause-and-effect relationships have been identified, existing metrics from this or other programs should be examined to determine if any of them satisfies the requirement. It makes good sense to use a proven metric when the process previously measured matches or parallels the process under consideration.
4. *Generate new metrics if existing metrics are inadequate*. When generating a new metric, pay attention to what is needed as an output of the process to be measured and how that output contributes to the end product. With metrics, the focus is on a process'

contribution to these final outputs. Teams should be interested in those measures that drive the final outcome and are key to making process improvements.

5. *Rate the metric against the attributes of a good metric*. Refer to the attributes listed in section 4.1. The metric should satisfy all of the criteria listed. If it does not, return to step 2 and correct the deficiencies.

6. *Select the appropriate measurement tools*. Keep in mind that the metric data should be economical to gather. This includes the hours spent gathering the data, processing it and the time required to display it. Automated data gathering is preferred, but many collection processes do not lend themselves to automation. Once the data is gathered, it often requires analysis or processing to be useful. There are many means of analyzing and displaying the data, such as process variance charts and control charts for process data. In some cases, a specialist may be needed to analyze and present the data.

7. *Baseline the metric*. This will serve as a reference point to begin acquiring data and measuring any changes.

8. *Collect and analyze metric data over time*. Aggregate metric data over time and examine trends. Special and/or common causes of effects on the data should be investigated. Compare the data with the baseline to ascertain improvement, decline, or no change. Utilize SPC when and as appropriate.

9. *Initiate process improvement activitie*s. Initiate iterative process improvement activities with key process owner involvement. Once the process has been changed, the data must be closely watched for trend improvement. If degradation is noticed, the reason for it must be identified and corrected. The process should not be changed until data trends have been clearly established, unless a change is required to correct a previous change that resulted in a decline in performance.

4.4 General Guidelines for Team Metrics

Metrics for IPT performance generally follow the guidelines below.

1. Metrics should measure only what is important**, and o**utput/outcome metrics are preferable to input/activity metrics.
   Metrics should measure the goals of the IPT as stated in the charter for the following reasons:

- All activities of the IPT should be centered on meeting the chartered goals. Measurements of any other items are distractions. When the metrics apply directly to these goals, products of these goals—which the program manager might be tempted to track independently—will be tracked indirectly with the primary metrics.
- Reporting and documentation of extraneous metrics consume too much valuable time that should be devoted to accomplishing the chartered goals.
- Metrics should roll up through the IPT hierarchy. Metrics not directly related to primary goals cannot easily track upwards.

2. Metrics should be measurable in real time.
   The purpose of metrics is to indicate the current performance of the IPT. Metrics of a

historical nature are just that—a measure of what has happened, a summary, and not necessarily an indicator of future performance. Ideal measurements should also be easy to make. Difficult measurements take time and, thus, may not be done "in real time."

3. Metrics should be "on display."
   Metrics should be visible to those whose work is being tracked. This can give individual team members a better understanding of the goals of the team and what actions are needed to better meet those goals.

4. Metrics should be updated.
   Because acquisition programs change as time progresses and, thus, the goals of the IPTs change over time, metrics also need to be frequently reevaluated for current applicability.

Chapter 5 Integrated Information Environments

An integrated information environment is a key element of an IPPD environment; thus, its importance is stressed throughout this document. This chapter shows how computing assets in a program can be integrated to enhance IPPD implementation.

In an IPPD environment, different functions are linked through integrated computer assets to give all stakeholders real-time access to technical and business (financial, contracting, etc.) information. Hand delivered mail or isolated computer systems that produce hard copies are replaced by local area networks (LANs) and the Internet, the dominant vehicle in this paperless environment. With this reliance on electronic communications, software compatibility and computer security are related issues of importance to the successful implementation of IPPD.

5.1 Internet

Until recently, electronic communications have been transmitted via fax machines, dedicated data lines, or internal networks. Today, the Internet is an ideal host vehicle for electronic data exchange. E-mail over Local Area Networks (LANs) and the Internet is rapidly becoming the dominant medium of communication between collocated and noncollocated personnel. See Figure 5-1 for a generic Internet-based network.

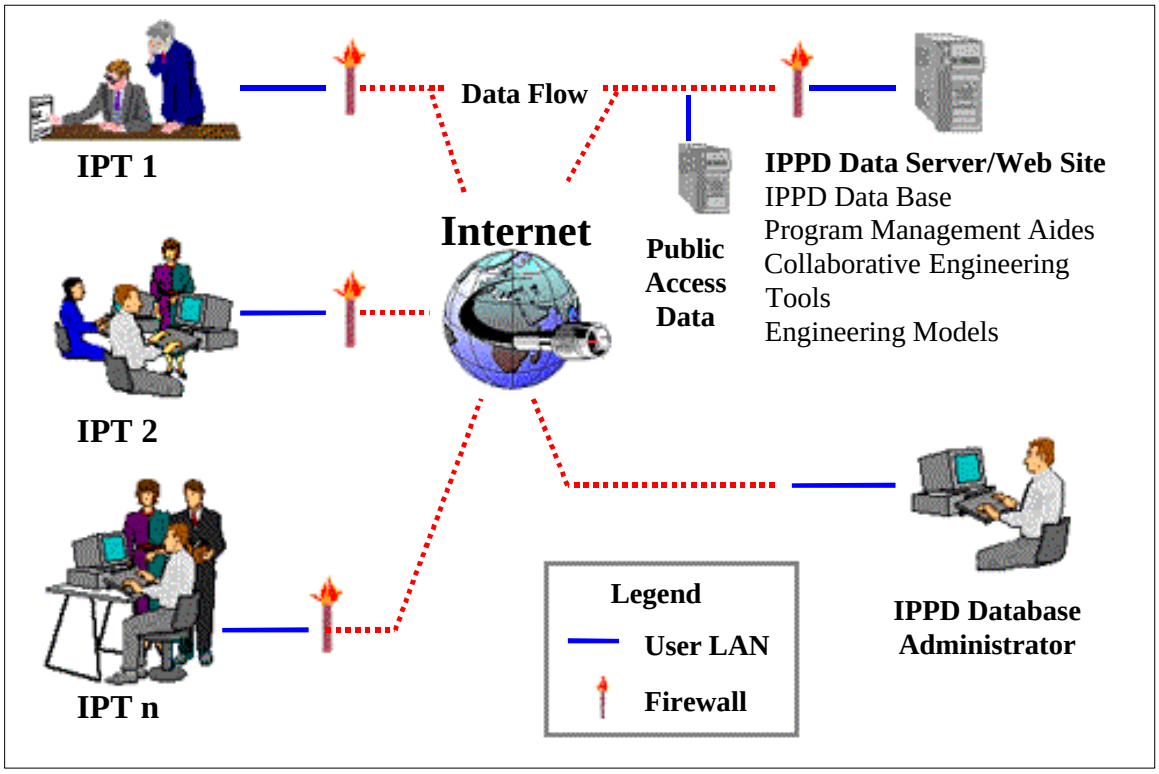


Figure 5-1. Internet-Based Network

The Internet can be used to make both business and technical data bases available to IPPD stakeholders at widely separated locations. This capability permits the near-real-time sharing of program and engineering data and enhances workflow management, action item coordination, electronic document sharing, and scheduling and milestone planning. Internet software tools are continually being developed to integrate these data bases.

IPPD Internet Tools Example: Army Missile Command

The Army Missile IPPD team at Redstone Arsenal is organizing a set of applications for performing IPPD via the Internet. The following are some of the applications currently available:

- A rolling calendar that provides team-wide coordination with hypertext links
- An action item data base that provides a clear picture of responsibilities and task interrelationships, real-time task status, a multiple parameter search engine, and automatic e-mail message generation to the responsible individual when a task is assigned
- A discussion group area (similar to an Internet bulletin board) that functions as a virtual meeting area where people can be remotely located and not simultaneously present at different times
- A meeting minutes data base that provides everyone with access to meeting minutes and contains a search engine for locating specific topics
- An IPT organizational/hierarchical data base that

  —Displays the current IPT hierarchy

  —Provides access to team charters, missions, schedules, meeting minutes, key deliverables, etc.

  —Provides a built-in e-mail capability

  —Provides team member information such as skills, resumes, and photos
- A computer-aided design (CAD) drawing data base capable of reading drawing data sets from the majority of available CAD programs with a “red-line” review comments feature
- A technical document library that allows documents to be stored in text or graphic form, retrieved across platforms, and researched using an advanced search engine
- A workflow management tool for timely and intelligent routing and distribution of documents with attachments

For further information contact the Manufacturing Technology Division, System Engineering and Production Directorate, Research, Development and Engineering Center at http://ippd.redstone.army.mil/mippd/

For programs in which facilities and personnel are not very dispersed (i.e., that have a limited number of locations needing access to information) or that have security requirements exceeding the capabilities of the Internet, more traditional network solutions (dedicated networks using secure communication lines) can be used in place of or in conjunction with the Internet. In setting up such a network, attention needs to be paid to the network capacity: Bandwidth can be a major

consideration when organizations are widely distributed—the efficient exchange of very large files, such as CAD and engineering analysis files, can be hampered by limited network capacity.

5.2 Compatibility

One roadblock to an effective integrated product development environment is the inability of different design tools, data bases, and other business software tools to talk to each other. This deficiency not only makes communication between team members from different functional groups difficult, but also significantly diminishes the productivity of the individuals that need to use multiple tools.

Because the interoperability of different design/development/business tools is currently being investigated, any specifics listed here might well be out of date as soon as this document is published. Thus, for up-to-date developments, the reader is encouraged to consult the Department of Commerce National Institute of Standards and Technology (NIST). Current NIST efforts include work to develop a set of integrated design and manufacturing tools as well as a national information infrastructure that would make it possible to perform electronically the many business tasks that have traditionally been done manually—all in an environment where different applications can interact with each other.

For more information on NIST's activities see http://www.nist.gov/

Two standardized options for interoperability are NIST's Common Interface Standard and DoD's Continuous Acquisition and Life-Cycle Support (CALS) standards.

5.2.1 Common Interface Standard

NIST is promoting a common interface standard to eliminate or significantly reduce the interoperability problem between manufacturing and design tools that can be experienced in IPPD. One project is the Computer Aided Manufacturing Environment (CAME), in which architectures, interfaces, and data bases for integrating engineering tool environments are being developed (from commercial products where possible).

5.2.2 Continuous-Acquisition and Life-Cycle Support

The Computer-Aided Life-Cycle Support (CALS) initiative is an industry and government strategy to enable more effective generation, exchange, management, and use of digital data supporting the life cycle of a product. CALS centers on use of international standards, business process changes, and advanced technology application. This initiative was started in September 1985 by the DoD with the goal of enabling the integration of enterprises on a worldwide basis through the development, implementation, and integration of digital information standards for product design, manufacture, and support.

The National Technical Information Service (NTIS) CALS Information Center, the largest single source for current information on CALS, is accessible at http://www.fedworld.gov/edicals/calsinfo.html

5.3 Security

Neither government nor industry can accept integrated information environments unless electronic network transactions, including e-mail, are secure. During IPPD, for example, there are clear requirements for authenticating the source of data; verifying the integrity of the data; preventing disclosure, alteration, or destruction of the data by unauthorized users; and verifying receipt of the data.

A secure network includes firewalls, comprehensive security policies, data encryption measures, educated users, and electronic signature safeguarding programs.

- *Firewalls.* The most popular firewall technology today is Trusted Information Systems (TIS) Internet Firewall Kit, which was developed under a Defense Advanced Research Projects Agency (DARPA) program. Because firewall technology is constantly changing, program network security personnel should remain up to date on the state of the technology (and upgrade program software as necessary).
- *Comprehensive security policies*. Each organization participating in an IPPD project, even if it is unclassified, should have established and enforced security policies covering personnel, physical plants, and automated information systems (AISs) to protect competition-sensitive information and proprietary data. Sources for security policies are: the DoD *Industrial Security Program Operating Manual*, DoD 5220.22-M; *Security Requirements for AIS*, DoDD 5200.28: and *Information Security Program*, DoD 5200.1-R.
- *Data encryption*. Because the Internet operates on commercial (unsecure) communication lines between network servers (locations of the firewalls), data encryption is a vital part of the overall secure network. Data encryption packages include Acrobat Encryption, Pretty Good Protection (PGP), Netscape Secure Server, and others. Data encryption is used to ensure that the data sent over the Internet is useless to anyone who intercepts it along the way. This includes all data, even e-mail messages.
- *Educated users*. The probability of security compromises is high unless users are indoctrinated and regularly refreshed on security issues. While IPT members are encouraged to freely share data among themselves and with other IPTs, all programs involve some sensitive information that should be appropriately safeguarded.
- *Electronic signature safeguarding programs*. Many transactions, especially those involving financial data or engineering data that is under configuration control, require a way to electronically indicate approval by one or more authorized individuals. Traditionally this was accomplished by pen on paper signature blocks. While signatures can be easily scanned into digital form, security software is required to deter forgery. Electronic signature safeguarding programs include the Department of Commerce's Advanced Authentication Technology Program

  More information on this NIST program is at http://csrc.nist.gov/authentication/overview.htm).

  Whenever an engineering drawing or business form is modified, the approval cycle needs to be repeated. Thus version control software should automatically rescind approvals and route changed drawings or forms back to approval authorities again for digital signature.

For further information on security, contact the Manufacturing Technology Division, System Engineering and Production Directorate, Research, Development and Engineering Center, U.S. Army Missile Command, RSA, AL
http://ippd.redstone.army.mil/mippd/

Security Example: USAF Data Base Compromised

In 1996, a computer programmer working for a major defense contractor gained complete access to an USAF data base on the readiness of USAF aircraft and other weapon systems. The computer system, part of a network of data bases that the USAF uses to monitor how ready its combat units are for war, was left unprotected because a program designed to secure it was never installed. With the right passwords, which were found in a file housekeeping program, the system was even accessible from the Internet. Upon discovering the breach in security, a program named "Safeguard" was loaded.

Extracted from "The Washington Post" 15 June 1997 edition.

5.4 Electronic Business Applications

IPPD is greatly facilitated by communication networks and related tools available today in the world of electronic business. This mode of business has been legislated by the Federal Government (for government business) and is being developed by both government and commercial entities.

5.4.1 Federal Acquisition Streamlining Act of 1994

The Federal Acquisition Streamlining Act (FASA) of 1994 (Public Law 103-355), signed by President Clinton on 13 October 1994, was designed to simplify and streamline the federal procurement process. It has significantly changed how the government does business. The Act repeals or substantially modifies more than 225 provisions of law to reduce paperwork burdens, transform the acquisition process to electronic commerce (EC), and improve the efficiency of the laws governing the procurement of goods and services. Most significantly, the new law—

- Emphasizes the acquisition of commercial items
- Streamlines acquisition procedures under an elevated small purchase threshold
- Establishes uniformity in the procurement system
- Improves protest and oversight processes and authorized specific pilot programs.
- Implements a system for electronic data exchange, the Federal Acquisition Computer Network (FACNET)

The FACNET requires the government acquisition process to evolve from the traditional paper-based mode to an expedited data-based mode. The electronic system is intended to provide a "single face" to industry. The Act establishes parameters for FACNET along functional lines, both for government and private users. These functions are to be implemented by agencies within 5 years of FASA's enactment. The government wide FACNET will be designed to—

- Inform the public about federal contracting opportunities
- Outline the details of government solicitations
- Permit electronic submission of bids and proposals
- Facilitate responses to questions about solicitations
- Enhance the quality of data available about the acquisition process
- Be accessible to anyone with access to a personal computer (PC) and a modem

More information on FACNET can be found at http://www.acq.sd.mil/ec/facnet.htm

5.4.2 Electronic Commerce and Electronic Data Interchange

Electronic commerce (EC) is the paperless exchange of business information using electronic data interchange (EDI) and related technologies. In its traditional role, EC consists of e-mail, computer bulletin boards, fax machines, Electronic funds transfer (EFT), and other paperless data transfers. All EC systems replace all or key parts of paper-based workflows with faster, cheaper, more efficient, and more reliable communications between machines.

EDI is a collection of public standard message formats and a data element dictionary that allows trading partners to exchange data in a simple way using any electronic messaging service. These standard message formats provide an application neutral format for the direct computer to computer exchange of information. In EDI, the electronic equivalents of common business documents, such as purchase orders and invoices, are transmitted electronically between the computers of trading partners. These electronic documents are formatted in accordance with American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12, the U.S. national standard for EDI. The international standard is the United Nations Electronic Data Interchange for Administration, Commerce, and Transport (UN/EDIFACT). The government has mandated the use of either the ANSI or UN standards when data are exchanged electronically with vendors, suppliers and contractors. Translation software is used by each trading partner to translate the business data from ASCII or another applications software format to an ANSI ASC X12 format and vice versa.

EDI standards often are confused with the method of data transport. They are two separate entities. The standard formats can be exchanged over any electronic messaging service. In the past, the ANSI ASC X12 standards were married to a formal method of data transport involving translation software and a value added network or proprietary direct connection. This approach can be costly and difficult. Today, EDI data move over many types of messaging services, including the Internet. The Internet open system based standards make it very easy to implement EDI at minimal cost. It is cost effective for a program office to implement EDI because of the variety of commercial off the shelf tools that are available to exchange EDI messages between application systems.

In the government context, a Request for Quote (RFQ) may be transmitted to all registered trading partners. Trading partners respond with an electronic response to an RFQ document. The government buyer reviews all received responses using bid evaluation software, chooses a contractor to buy from based upon bid price or another preestablished criterion, and transmits an electronic purchase order document to the selected contractor. The contractor responds by

transmitting a purchase order acknowledgment document, shipping the product, and transmitting an invoice document to the government buyer. The buyer, upon receiving the goods, transmits a payment order document to the contractor and pays the contractor using EFT.

The Joint Electronic Commerce Program Office (JECPO) is responsible for accelerating the application of electronic business practices and associated information technologies to improve DoD acquisition processes and supporting sustainment life-cycle practices. The National Electronic Commerce Resource Center (ECRC) program also was established to help small businesses with EC and EDI through regional centers located across the United States.

Contact the DoD Joint EC Program Office at http://www.acq.osd.mil/ec/
Contact the ECRC program at http://www.ecrc.ctc.com/
Contact EDI for Program Management Reporting at http://www.acq.osd.mil/pm/edi/edi.htm
Contact the DoD Integrated Data Environment at http://www.acq.osd.mil/api/tpm/ppmo.htm/

5.4.3 Business Tool Examples

Traditional manual methods across all functions are being replaced with newly-developed computer tools. In the business arena, EC and EDI are opening up many opportunities for such tools. For example, the JSF program has developed two software tools to aid in a paperless contracting process: the Bids Evaluation Support Tool (BEST) and the Contracting Officer Support Tool (COST).

More information on BEST and COST can be found at http://www.jast.mil/html/contracts.html

A Standard Procurement System (SPS) is being developed within DoD as a fully-functional automated information system (AIS) that will standardize the procurement business practices and data elements by promoting the use of the same automated contracting procedures. It will perform standard, automated procurement functions for acquiring systems, supplies, and services and is supposed to subsume individual program legacy systems, like the ones mentioned above, unless those systems perform functions not inherent within the SPS. The system is due to be completed in 1999.

Additional information on the SPS can be found at http://www.sps.hq.dla.mil

5.5 Product Development Applications

In the recent past, major weapon systems were designed, produced and fielded with each functional group using manual pencil-and-paper techniques and tools. Then, one by one, many of these techniques and tools were automated using computerized applications. Today, it is common to find many function-unique computer tools and applications employed on a single development effort. As previously discussed in Sections 2.1.6 and 2.1.7, there is a need to integrate these tools to work together.

A middle-of-the-line approach is to integrate all data-base-type data (manufacturing, logistical, reliability, maintainability, purchasing, etc.) into one system and have that system interact on a limited basis with a drawing program (parts lists, configuration management). This approach is most useful when developing improvements to an already established product line. Lockheed Martin is incorporating this approach on the F-16 program to cut the costs and cycle times of product support efforts and product upgrades.

Computer-Integrated Manufacturing (CIM) takes the interoperability issue one step further and creates a computer environment in which all the applications not only talk to each other but also use a common data base. Implementing CIM—

- Makes up-to-date data available to all parties
- Eliminates translation errors resulting from reformatting data from one application to another
- Simplifies computer resource support and data base administration
- Simplifies configuration management of data
- Guarantees that downstream functions will be notified of changes that impact interfaces or overall system performance
- Enhances the ability to conduct concurrent engineering and manufacturing development.

Many tools are widely used in industry to accomplish many of the CIM functions—for example, CATIA (IBM, Dassault Systemes), Unigraphics, and. Pro/ENGINEER… .These tools provide capabilities such as—

Computer-Aided Design (CAD)

- 2-D and 3-D drafting tool
- Assembly modeling tool that allows a designer to assemble separate engineering models in a 3-D environment
- Wire bundle installation tool that automates the design and routing of wire bundles
- Solid and wireframe modeling

Computer-Aided Engineering (CAE)

- Finite element modeling tools
- Mechanical, thermal, acoustic, dynamic, and other analysis tools
- Stress analysis tools
- Fitting simulation tool that enables users to define the trajectory of parts to be assembled or disassembled

Computer-Aided Manufacturing (CAM)

- Wire bundle formboard generation (formboards are used for wire harness manufacture)
- Cell design and robot programming tool for verifying the robot’s suitability for a given task and then generating the programs
- Fixed and multiple axis milling tools that enable numerical control programmers to generate, verify, implement, and maintain tool paths for simple to complex milling and drilling machines

- Manufacturing infrastructure tool that provides a way to visually replay and verify a machine tool path on an electronic mockup and to examine and modify cutter tool paths

Manufacturing Resource Planning (MRP)

- Integration of parts lists, bill of material, product documentation needed by MRP programs

Chapter 6 Modeling and Simulation

Modeling and simulation (M&S) supports the IPPD approach, the integration of complex systems, and is a key tool used by IPTs. The members of an IPT share test and simulation data and identify needed information from the tests and simulations. Furthermore, technical and operational challenges, which can be identified early in system development through simulation, can be targeted for further testing. Virtual prototypes embedded in realistic synthetic environments can aid in developing a shared vision of the proposed system and provide a means for understanding the complex interactions among the configuration items in the system design. Design, manufacturing, and test engineers can work together in IPTs to build a prototype that can be more efficiently manufactured and tested.

Simulation is being used more in the acquisition process due to increased availability of M&S tools and processes, declining resources, and the recent emphasis on IPPD. DoDD 5000.1 and DoD 5000.2-R, Part 3.4.4 state that—

> Models and simulations shall be used to reduce the time, resources, and risks of the acquisition process and to increase the quality of the systems being acquired. Representations of proposed systems (virtual prototypes) shall be embedded in realistic, synthetic environments to support the various phases of the acquisition process, from requirements determination and initial concept exploration to the manufacturing and testing of new systems, and related training.
>
> Accredited modeling and simulation shall be applied, as appropriate, throughout the system life-cycle in support of the various acquisition activities: requirements definition; program management; design and engineering; efficient test planning; result prediction; and to supplement actual test and evaluation; manufacturing; and logistics support. PMs shall integrate the use of modeling and simulation within program planning activities, plan for life-cycle application, support, and reuse models and simulations, and integrate modeling and simulation across the functional disciplines

In addition to increasing the effectiveness of the design, test, and manufacturing functional specialists, modeling and simulation will benefit the product support members of the team (e.g., the logisticians and maintainers), as well as the training and warfighting communities.

Program offices need to support and use modeling and simulation more than ever before and must plan for the funding of program and legacy M&S. Modeling and simulation capability has matured to the point where it can facilitate several activities: (1) development; (2) communication between government and contractor; (3) requirements exploration in the context of CAIV; (4) demonstrating the significance of features found in component and subcomponent tests; (5) test planning and analysis; (6) communication between engineering, manufacturer, tester and user; (7) logistics management; and (8) training and human factors evaluation during the life-cycle of a system. M&S used well in the IPTs can be a key contributor to the implementation and success of IPPD.

M&S is increasingly being employed by the DoD to provide better insight into weapon system performance, reduce testing and training costs, and develop force mixes of weapon quantities and

types. These uses ultimately support the twin goals of reducing DoD weapon acquisition costs and dramatically shortening the time to weapon system fielding. Accomplishment of these goals requires—

- An integrated simulation/T&E process that provides continuous insight—to ensure that quality is built into programs from the start
- An emphasis on prevention over cures—where simulation, test, and evaluation are used to identify and resolve problems early

The innovative use of M&S to produce systems better, faster, and cheaper is demonstrated by the following examples:

- The AIM-7P Sea Sparrow was developed and tested using only 10 of the planned 50 launches. The Navy was able to eliminate the remaining 40 flight tests using an end-game effectiveness model to predict the lethality of the missile.
- The GBU-28 was developed in less than 6 weeks during Desert Storm by relying almost exclusively on lethality and vulnerability modeling to design and predict the performance of the system.
- Army testing of bridge durability—a process that traditionally requires 12 weeks to do 3,000 crossings—was reduced to 9 weeks with a mix of actual crossings and simulation.
- At the Air Force's Arnold Engineering Development Center, M&S has been used to lower the cost of testing to the customer. The average time in the PWT-16T wind tunnel has decreased from 6 weeks to 3 to 4 days.
- At Eglin AFB, the use of the Preflight Integration of Munitions and Electronics Systems (PRIMES) ground simulation led to a 35 percent reduction in cost and a 300 percent increase in data capture during a recent flight test program of the APG-63 radar.

6.1 Simulation-Based Acquisition

The DoD is seeking to streamline ways in which it acquires weapons systems. Evolving modeling and simulation tools have the potential to reduce the time, resources, and risk associated with the process, while improving the quality of the systems produced through a strategy called Simulation Based Acquisition (SBA).

The Department’s vision is to have an acquisition process that is enabled by the robust, collaborative use of simulation technology that is integrated across acquisition phases and programs. The goals of SBA are to—

- Substantially reduce the time, resources, and risk associated with the acquisition process
- Increase the quality, military utility, and supportability of fielded systems while reducing total ownership costs
- Enable IPPD across the full acquisition life cycle

SBA is an integrator of simulation tools and technology across acquisition functions and program phases and across programs. It is a concept in which M&S as a resource is more efficiently

managed in the acquisition process. In a defense environment of decreased funding, SBA addresses both the decreasing availability of resources for system development and the increasing power of M&S tools.

Through reliance on the collaborative use of simulation technology in an IPPD environment, models and simulations are integrated between program phases to reduce the time, processes, and risks associated with the acquisition process.

6.2 The Simulation, Test and Evaluation Process

The Simulation, Test and Evaluation Process (STEP) is a major DoD initiative designed to improve the acquisition process by integrating M&S with T&E. STEP is consistent with the regulations that govern systems acquisition and does not require their modification.

STEP moves beyond the "test, fix, test" approach to a "model-simulate-fix-test-iterate" approach. Problems are fixed as they are discovered. This approach (model first; simulate; test; fix after each step and then iterate the test results back into the model) is reiterated throughout system development. Iterative loops can occur in this process. For example, one can model, simulate, fix, simulate, fix, simulate, fix, test, and then feed the results into the model. When a need to fix is discovered, the time for each fix can be much shorter when the fix can be verified in the model in hours or days as opposed to a field test which can take weeks or months to verify a fix.

The latest information on STEP can be found at http://www.acq.osd.mil/te/programs/tfr/step.htm

6.3 Defense Modeling and Simulation Office

Extensive M&S capabilities exist in the DoD. The Defense Modeling and Simulation Office (DMSO) was established to provide a focal point for information concerning DoD M&S activities. Currently, the DMSO promulgates M&S policy, initiatives, and guidance to promote cooperation among DoD components to maximize efficiency and effectiveness. DMSO is a staff activity reporting to the Director, Defense Research and Engineering (DDR&E), Office of the Under Secretary of Defense (Acquisition and Technology), (OUSD(A&T)).

Current DoD policy and capabilities concerning M&S are contained in the DoD M&S Master Plan, DoD 5000.59-P. This plan is the DoD's vehicle to direct, organize, and concentrate its M&S capabilities and efforts on resolving commonly shared problems.

DoD 5000.59-P is available with additional information on DMSO activities at http://www.dmso.mil

Modeling and Simulation Examples

M&S Environment Example: Joint Strike Fighter

The JSF program has adopted an M&S environment that has shortened the timeline for task identification and requirements generation. The program office has pursued a product and process team approach that includes industry and has developed the modeling tools necessary to replicate the threat environment, operations concept, and JSF weapon system performance. This open product and process approach has enabled the government and industry team to gain early operational insight and make the pertinent trades up front to ensure that performance and affordability objectives are met. Customers and DoD officials alike are convinced that JSF M&S efforts will result in a better product for the warfighter.

For further information on the Joint Strike Fighter program see http://www.jast.mil

M&S as a Tool Example: Simulation Based Design

The Defense Advanced Research Project Agency (DARPA) originally sponsored the Simulation-Based Design (SBD) program to develop technology that would enable IPPD in a computer-based environment for the design and evaluation of complex mechanical systems. Elements of the SBD program include the following.

Virtual Prototype. An engineering representation of a product and process model. It is geometrically and dimensionally correct and behaves in accordance with the laws of physics. Virtual prototypes may contain many different subsystems and components, all of which interact with each other.

Synthetic Environment. A system of computer-based models generating a comprehensive workspace for conceiving, optimizing, and evaluating virtual prototypes.

Product and Process Model. An information structure that shows how the system operates and how it is made. SBD expands beyond the traditional basic geometric description of a system to include the system configurations, behavioral attributes, and performance descriptions needed to simulate functionality. As a system evolves from concept to fielding, the virtual prototype's product and process model grows in complexity and detail in the areas of design, cost, predicted performance, reliability, and other factors.

Virtual Environment. This is a system that provides a medium for design team members to collaborate and access the resources of a design in real time. Systems simulated in a virtual environment can use virtual prototypes to simulate the actual product and its operation, as well as the processes necessary to manufacture and assemble that product.

Using virtual prototypes in synthetic environments allows complex systems to be rapidly prototyped. The virtual prototype, when placed in the synthetic environment, behaves as the real product would. Immersed in a virtual environment, designers can manufacture the product, test the product under realistic conditions, provide customer walk-throughs, have operators test the human factors and usability, and test out repair procedures—all without actually building the physical product.

SBD is intended to permit manufacturing, cost, performance, and life-cycle considerations to be coordinated and integrated through the entire process, from concept development to manufacture and operation. Use of these tools will—

- Permit detailed evaluation of product and process designs early in the life cycle, therefore reducing the number of expensive surprises during manufacturing and operational service
- Eliminate costly prototypes for both product and process designs
- Provide realistic operator interaction with the product during the requirement and design process
- Permit development of tactics and training in realistic operational scenarios with existing operational assets.

Information about these M&S tools can be found at http://sbdhost.parl.com/

6.4 Prototyping

The heart of the M&S topic is prototyping. The purpose of a prototype is to provide a vehicle for:

- Learning—generating information concerning the design
- Communication—giving a visual and tactile description of the design (i.e., seeing and feeling how it works)
- Integration—assembling and fitting components within a design
- Reducing design iterations—improving the certainty of information, thus reducing the need for rework
- Milestones—achieving a desirable level of functionality

Prototypes can be physical or virtual, depending on the maturity of the design and the intended use of the prototype. For example, virtual prototypes are usually more flexible than physical ones because design iterations are much faster with computer models. Physical prototypes are usually necessary to identify and analyze multiple, interacting phenomena, and they are also better for detecting unanticipated phenomena. Most programs incorporate both types of prototypes in their development.

6.4.1 Virtual Prototyping

A virtual prototype can be defined as a computer-based simulation of a system or subsystem with a degree of functional realism comparable to a physical prototype. Computer-generated prototyping has advanced to become an exceptionally powerful tool used in all aspects of the systems engineering and development processes. From an IPPD standpoint, virtual prototyping (VP) benefits the requirements analysis process, functional analysis, and allocation and synthesis of an emerging product, as well as the product verification (testing). VP also dramatically

improves the ability to conceptualize with a 3-D picture. In addition, VP is useful much earlier in the design process than physical prototyping and can be used to prototype large systems, such as ships, submarines, and buildings.

Advanced planning is critical for a valid application of VP. Proper investment in VP for the short term can yield tremendous time and budget savings and a superior product in the long term. The degree of fidelity and the basis for verifying, validating, and accrediting (VV&A) the prototype are important up-front decisions. The customer and T&E communities should be involved early, and all should agree on the modeling and simulation program and its application. VV&A is the keystone for the successful use of all VP technology and involves extensive up-front planning and investment.

VP tools exist today that enable the simulation of nearly any aspect of the design and operation of a system. Because of the high initial cost of these tools in hardware, software, and training, computer simulation efforts should be directed to those areas where the payoff is greatest, such as:

- Fit and assembly assessments
- Performance simulations and assessments
- Operating processes
- Manufacturing process simulations
- Maintenance analyses
- Operational assessments

Virtual Prototyping Examples

Fit and Assembly Assessments Example: Boeing 777

For the first time in the company's history, Boeing Aircraft designed the entire 777 aircraft on a computer and successfully built it without a complete physical mock-up. Using an extensive VP process, Boeing effectively brought together 33 subcontractors spread across 13 countries, all operating in a digital electronic format. The VP resulted in a 93 percent reduction in design changes compared with those in its previous aircraft, and the greatest first-time form and fit ever achieved by the company. Furthermore, VP has improved the accuracy of tool design by a factor of 10. Boeing found that their product and process teams benefited from VP, because it stimulated the employees' creativity.

Performance Simulations and Assessments Example: Predator

M&S has been employed extensively in the Predator Advanced Concept Technology Demonstration (ACTD). It has been used in the broadest context to address global issues such as force mix assessments; in a lesser context, to simulate capabilities in exercises; and, in an even more narrow context, to address specific performance issues, such as the

identification of design tradeoff study parameters.

Force Mix Assessments. At the highest levels, M&S is being used to develop assessments of alternative force mixes of manned and unmanned reconnaissance systems, including Predator. Several classified studies, such as the Intelligence, Surveillance, and Reconnaissance (ISR) Joint Warfighting Capability Assessment (JWCA) and the Command, Control, Communications, and Computers ISR Mission Assessment (CMA), are using M&S to identify reconnaissance architecture options for consideration. Additionally, the Defense Airborne Reconnaissance Office's (DARO) architecture development includes, within its force mix, considerations of all unmanned air vehicles (UAVs), including Predator. Predator has been integrated into each of the exercises, and its performance characteristics (platform and sensors) are incorporated in the full range of studies, which include campaign- and mission-level analyses. The results of these efforts are helping to determine, for example, the number of Predator UAV systems that will be needed to support the objective of "dominant battlespace awareness" at an affordable cost.

*Capabilities Simulation in Exercises***.** At the next level, M&S is being used to support Predator participation in operational exercises. In these exercises, virtual Predators are flown by operational users because the limited quantities of real hardware assets are unavailable, and because M&S yields substantive insights at considerably lower cost than operating the real assets. These exercises have contributed significantly to the development of the concepts of operation (CONOPS) for Predator and to an increase in the user knowledge base about the employment of UAVs in general. For instance in FY96, Predator was modeled in a simulation called the Multiple Unmanned Aerial Vehicle Simulation Environment (MUSE). The MUSE was combined with an improved Joint Surveillance and Target Attack Radar System (JSTARS) simulation to provide a representation of real-time capabilities at selected theater, corps, and division-level command and control headquarters.

*Performance Issues***.** At a third level, M&S has been used in the Predator program to assess operational performance, analyze performance parameters, conduct tradeoff studies, and evaluate potential system changes and improvements, as in the following examples.

After initial radar cross section (RCS) measurements were conducted, computer modeling was used to determine the Predator RCS.

In accomplishing the initial operational assessment of Predator, limited data from the 1995 European deployment was used as the basis for several engineering models and numerous simulations to complete the analysis of Predator's effectiveness. On many occasions sufficient field data simply could not be collected to validate critical assessment objectives, and M&S was the only practical alternative for evaluation.

Much of the engineering design of the Predator de-icing system was done through M&S. The determination of ethylene glycol flow requirements, hole emplacement on the front leading edge of the wings, and the flow rates necessary to operate successfully were modeled and then tested in a wind tunnel prior to actual vehicle flight tests.

A recently completed M&S study for the DoD's Director of Operational Test and Evaluation (DOT&E) has been used to predict the Predator's coverage capabilities of the target area. This work was done to gain insight into Predator's ability to meet its Key Performance Parameter (KPP) of a continuous 24-hour target area presence. Because a demonstration of this capability had never been attempted, an event-driven simulation was developed to help identify the factors that might affect Predator's ability to meet this requirement. The model included missions of various ranges, system failures, projected system reliability, and maintenance actions (scheduled and nonscheduled). The study's key finding was that the Predator's ability to continuously monitor a target area (i.e., the target-area presence or time-on-station) is most sensitive to the transit time to the target area and less sensitive to system reliability and maintenance capabilities.

The judicious use of creative M&S has directly contributed to the management of costs on the Predator program by predicting operational effectiveness in conjunction with abbreviated operational assessments, effectively assessing air vehicle survivability cost, determining optimum system configuration, and assessing alternative force structure options.

Further information on the Predator UAV program can be found at
http://www.acq.osd.mil/daro/homepage/predms.htm

Performance Simulations and Assessments Example: USAF In-Flight Simulators

The following three USAF aircraft can be programmed to test the flight performance of other aircraft—real or conceptual:

NF-16D. This aircraft, commonly known as VISTA (Variable Stability In-flight Simulator Aircraft), is a special modification of a high-performance airframe in current production that can be configured to emulate the performance of other modern fighter aircraft. The model of the aircraft to be simulated is programmed on the in-flight simulator's computers. When the evaluation pilot flies from the cockpit, the in-flight simulator responds like the model. The NF-16D has been used to support the development of the F-22 and the Light Combat Aircraft (India).

NT-33A. This predecessor of the NF-16D, which is still available for supporting in-flight simulation needs, has such features as independent control of pitch, roll, and yaw and a programmable heads-up display (HUD), center stick, and side stick. The NT-33A was used in the development of the X-15, A-10, F-15, F-16, F-18, F-22, Lavi (Israel), Gripen (Sweden), and the Light Combat Aircraft (India).

NC-131H. This Total In-Flight Simulator (TIFS) is the world's only large 6-degree-of-freedom in-flight simulator. Its features include: a separate evaluation cockpit that is easily reconfigured and accessible in flight; a programmable display system; and a rugged, dependable, proven airframe. The NC-131H was used to develop the Space Shuttle, Supersonic Transport, B-1, and B-2. This aircraft also has an alternate mission to perform avionics system testing.

Operating Process Simulation Example: Electric Boat Electronic Visualization System

The Electronic Visualization System (EVS) is a computer environment for the design and evaluation of submarines. This system's capabilities include:

- Simulation of the performance of the submarine
- Simulation of operations in the control and engine rooms
- Practice manufacturing and interface resolution

The EVS is displayed in a room where the IPPD team can view, display, and communicate with one another to resolve problems. Each person can wear virtual reality devices to be immersed in a virtual environment. Using the EVS, IPT members can perform detailed assembly animations, kinematic studies, analysis animations, and anthropomorphic studies.

The EVS can be accessed at various locations via a secure network; thus, it is available to IPT members at different locations.

Manufacturing Process Simulation Example: VM FastTrack

A primary objective of virtual manufacturing (VM) tools is to reduce the cost of the first product in production by iterating design options and manufacturing approaches in a virtual factory environment where the design and manufacturing approach can be solidified at minimal expense. In other words, learning is done on the computer, rather than on the factory floor.

McDonnell Douglas demonstrated this in a program called VM FastTrack in which an F-15E production design change was accomplished by simultaneously using both the current paper design approach and commercially available VM techniques. The following benefits were attributed to the VM approach:

- A 33 percent reduction in design release time
- A 27 percent reduction in design cost
- A 19 percent reduction in manufacturing cycle time
- A 20 percent reduction in factory floor space utilization

Manufacturing Process Simulation Example: Simulation Assessment Validation Environment

The JSF program has contracted the development of a VM program called Simulation Assessment Validation Environment (SAVE) to support low-risk transition of weapon system technology from concept to EMD. The objective of the Lockheed SAVE program is to integrate, implement, and validate low-risk VM technology. The SAVE system can be adapted to any engineering/manufacturing effort and is designed to be employed during all phases of a product's life cycle, from concept design through production. However, the focus of this project is on virtual manufacturing for aircraft structural assemblies as part of the total weapon system development. This program, when developed, will provide significant cost

savings to the JSF program.

The primary users of the SAVE system are the JSF program's IPT members. SAVE is a comprehensive VM modeling and simulation environment using multiple engineering and manufacturing variables. SAVE's iterative modeling capabilities facilitate the development of the optimum production fabrication/assembly plan. Lastly, through electronic links, the integrated simulation technology and its associated data base permit worldwide electronic processing of the same VM environment using a common data base.

SAVE's full suite of VM software tools, operating in a single environment, allows cost, schedule, and risk assessment to be continually evaluated as the program advances. The integrated tool suite permits verification and refinement of the design and manufacturing process prior to the production of the physical hardware. The SAVE system—

- Integrates the software tools used today in a standalone environment
- Collects and controls the data developed by the IPT in a single logical data base
- Provides ready access for all members of the IPT organization to a single data base
- Allows transparent communication between IPT members through telecommunications networking, online messaging, and workflow management
- Permits the IPT to conduct EMD simulations to optimize design, producibility, and manufacturing processes while simultaneously reducing cost, schedule, and risk

The SAVE tool suite supports the IPT in a cooperating evaluation of component design, tool design, tolerance analysis, assembly planning, ergonomics, factory floor simulation, schedule simulation, risk assessment, and cost analysis through the SAVE data base.

Maintenance Analysis Example: Design Evaluation for Personnel, Training, and Human Factors

The Air Force Materiel Command's Logistics Research Division-Acquisition Logistics Branch has developed software for simulating maintenance activity. Design Evaluation for Personnel, Training, and Human Factors (DEPTH) is primarily used to detect human factors problems during the design process. The software also has applications in training, process efficiency analysis, and logistics data generation. By using DEPTH, acquisition costs can be dramatically reduced by accelerating development time with virtual prototyping and helping to eliminate the need for physical mockups.

DEPTH allows maintenance activity to be analyzed using articulated, 3-D human figure models (HFMs). The HFMs, provided by the Jack software, are accurate representations of humans with respect to both anthropometry (body size and shape) and motion. The HFMs can be proportioned to represent different percentiles within Air Force, Army, or civilian populations. They can be dressed for arctic, chemical defense, or normal environments; and they can work with any of the 200-plus tools in the data base. Movement of the HFMs can be controlled with a standard mouse, body tracking equipment, or the automatic simulation capability. The automatic simulation capability (referred to as motion modeling) allows complex simulations to be rapidly created. As simulations run, DEPTH reports such

information as accessibility, visibility, and strength. The information can also be directed to logistics data bases.

The DEPTH software runs on most current Silicon Graphics workstations and is available at no charge to most U.S. organizations requiring a maintenance simulation. However, a licensed copy of Jack—an interactive graphic system for the manipulation and display of articulated figures developed at the University of Pennsylvania—must be purchased to run DEPTH.

Operational Assessments Example: Synthetic Theater of War

Various battlefield simulators located around the country enable the system developers to assess how their concept will perform in different scenarios. Synthetic Theater of War (STOW) is an ACTD jointly sponsored by DARPA and the United States Atlantic Command (USACOM). The STOW program seeks to create a seamless simulated environment that will be usable across the spectrum of service and joint training, crisis rehearsal, doctrine development, battle planning, resource readiness assessment, material development, and system acquisition.

STOW 97 will demonstrate enhanced simulation fidelity based on combat resolution at the weapons system level of detail, realistic simulation of command and control behavior, networking and information flow technology, and the capability to provide knowledge-based autonomous forces in simulation with human-in-the-loop (HITL) participation wherever desired. STOW 97 will be fully distributed so that forces may participate in exercises or rehearsals from command posts and simulators at widely separated bases or on a live range if desired. Significant additional goals of STOW 97 are to integrate simulation with operational C4I and management information systems and to improve the technology and processes of After Action Reconstruction and Analysis (AARA).

Further information on STOW 97 can be found at http://www.acq.osd.mil/at/stow.htm

6.4.2 Physical Prototyping

Both virtual and physical prototypes have their place in today's acquisition environment. The F-22 development relied heavily on virtual M&S to meet the cost and schedule objectives of the program. But virtual prototypes could not satisfy all of the M&S needs, as the following example illustrates.

Physical Prototype Example: F-22

The F-22 program demonstrates the continued usefulness and need of physical prototypes. The following major physical prototypes have been or will be used in the F-22 program:

Avionics Prototypes. The F-22 avionics concept was demonstrated first in the Boeing Avionics Ground Prototype Laboratory. This was followed by airborne tests in Boeing's 757

Airborne Flying Laboratory (AFL).

RCS Prototype. The low observability features of the F-22 design were confirmed using a full-scale pole model of the F-22.

Wind Tunnel Prototypes. More than 36,000 hours of wind tunnel testing have been completed in the F-22 development program so far. A total of 19,195 test hours were accumulated in the demonstration/validation phase of the program for the F-22 prototype, and a total of 16,930 wind tunnel test hours were completed on the refined F-22 configuration during the current EMD phase. Wind tunnel testing was used not only to test the flight characteristics of the airframe, but also to test weapon separation characteristics for various munitions.

Other Prototypes. The F-22 EMD contract includes two airframes, one for static testing and one for fatigue testing, in addition to 9 flyable aircraft.

A major drawback of traditional physical prototypes was the time and expense involved in producing them. New technologies that are available today enable the quick and inexpensive fabrication of small prototypes using automated processes. These technologies are commonly grouped under the title “rapid prototyping.”

6.4.2.1 Rapid Prototyping

If a picture speaks a thousand words, a 3-D model speaks volumes. Rapid prototyping (RP) makes generating affordable physical 3-D models possible, with little lead-time. The ability to quickly generate numerous models (compared with earlier labor and time intensive methods) is of great value in the IPPD environment for communicating ideas, creating T&E articles, and even creating relatively low-cost tooling.

RP, also known as desktop manufacturing, solid free-form manufacturing, or solid free-form fabrication, consists of various manufacturing processes by which a solid physical model of a part is made directly from a 3-D CAD model. Unlike milling, in which machines remove material to form a shape, RP systems build a part layer by layer from liquid, powder, or sheet material. Materials used include plastics, ceramics, metals, and paper.

To begin the RP process, the 3-D data is sliced into thin (~0.005 inch) cross-sectional planes by a computer. The cross sections are sent from the computer to the RP machine, which builds the part layer by layer. The shape of the first cross-sectional plane generated by the computer defines the first layer’s geometry. It is bonded to a platform or starting base and additional layers are bonded on top of the first, shaped according to their respective cross-sectional planes. This process is repeated until the prototype part is complete. The resulting prototype provides a "conceptual model" for design visualization and review by the entire design team. Engineers may use it to check form and fit and to perform limited function tests. It can also be utilized for soft tooling for prototypes and as a pattern for hard tooling.

RP processes include—

- Printing
- Ballistic particle manufacturing
- Design-controlled automated fabrication
- Direct shell production casting
- Fused-deposition modeling
- Multijet modeling
- Selective laser sintering
- Solid-ground curing
- Stereolithography
- Topographic shell fabrication
- Laminated object manufacturing

Time and again, companies have documented how RP has helped them save an almost unbelievable amount of prototyping time, avoid costly design errors, and enhance the production of tooling. The cost of a model produced by one of these systems can range from under $50 to $1,000. The less expensive models are generally too delicate to be used for any purpose other than concept modeling and early design review and approval. The main restriction of RP is the limited size of the models. The average build volume of an RP system is about a 250-milimeter (10-inch) cube, but there are systems that produce larger part prototypes. Many companies have successfully built parts in sections and then fastened (e.g., glued or screwed) them together. While this works, it is an approach that RP users tend to avoid.

Chapter 7 Additional IPPD Tools

Many additional tools that are available are described in the literature for use in an IPPD environment. Some selected examples are included in this chapter for convenience, with further references given for additional information.

7.1 Requirements Definition

7.1.1 Quality Function Deployment

Quality Function Deployment (QFD) is a tool often cited as an enabler for IPPD because it is an efficient and effective method for meeting customer requirements. The QFD methodology consists of a structured procedure that starts with the qualities desired by the customer (the objective), identifies the functions required to provide these products or services, and identifies the means for deploying the available resources to best provide these products and/or services. This Objective-Function-Means process is documented and mapped in a matrix that allows all team members to see how their inputs contribute to satisfying customer requirements. This has the added benefit of helping to break down the walls between the functional areas in the product development process. QFD provides a systematic approach to building a team perspective of what needs to be done, the best ways to do it, the best order in which to accomplish it, and the staffing and resources required. It also provides a good format for capturing and documenting decision making.

Additional QFD information can be found at the QFD Institute website at http://www.qfdi.org/. Links to other sites are provided at this site as well.

Quality Function Deployment Example: Joint Strike Fighter

The JSF program office has found QFD to be a very effective tool in the implementation of IPPD. QFD has helped enable the program office to build a consensus across a large group of individuals and organizations representing different experiences, operational needs, and priorities.

7.1.2 Requirements Analysis Process in Design for Weapon Systems

One software application that aids in requirements definition is the Requirements Analysis Process in Design for Weapon Systems (RAPID-WS). The RAPID-WS software enables the capture and iterative use of operational and technological data before committing to a system-specific solution. The data is used by the weapon system operators (or IPTs) who are responsible for defining the operational requirements. RAPID-WS offers the potential to reduce both manpower costs and contractual analysis costs through the standardization and reuse of critical acquisition data. With RAPID-WS, operational users, designers, and the acquisition corps have iterative and effective use of requirements-oriented data to support the earliest phases of acquisition.

For additional information, contact the Air Force Research Laboratory, Logistics Research Division, (AFRL/HESS), Wright-Patterson AFB or go to http://www.alhrq.wpafb.af.mil/

7.2 System Decomposition

Many engineering systems are large and multidisciplinary. The design of new complex systems, such as large aerospace systems, cannot begin until the possible interactions among subsystems and their parts are determined. Once that task is completed, the proposed system can be decomposed to identify its hierarchical structure. The Design Manager's Aid for Intelligent Decomposition (DeMAID) is a knowledge-based system developed by NASA for ordering the sequence of modules and identifying a possible multilevel structure for the design problem. DeMAID displays the modules in an N x N matrix format (called a design structure matrix) where a module is any process that requires input and generates an output. (Modules that generate an output, but do not require input, such as an initialization process, are also acceptable.) Although DeMAID requires an investment of time to generate and refine the list of modules for input, it can save a considerable amount of money and time in the total design process, particularly in new design problems where the ordering of the modules has not been defined.

The decomposition of a complex design system into subsystems requires the judgment of the IPPD participants. DeMAID reorders and groups the modules based on the links (interactions) among the modules, helping the team members make decomposition decisions early in the design cycle. The modules are grouped into circuits (the subsystems) and displayed in an N x N matrix format. Feedback links, which indicate an iterative process, are minimized to occur only within a subsystem. Since there are no feedback links among the circuits, the circuits can be displayed in a multilevel format. Thus, a large amount of information is reduced to one or two displays, which are stored for later retrieval and modification. The IPPD teams then have a visual display of the design problem and the intricate interactions among the different modules.

The design manager can save a substantial amount of time if circuits on the same level of the multilevel structure are executed in parallel. DeMAID estimates the time savings based on the number of available processors. In addition to decomposing the system into subsystems, DeMAID examines the dependencies of a problem with independent variables and dependent functions. A dependency matrix is created to show the relationship.

DeMAID is based on knowledge-base techniques to provide flexibility and ease in adding new capabilities. Although DeMAID was originally written for design problems, it has proven to be capable of solving any problem that contains modules (processes), which take input and generate an output. For example, one group is applying DeMAID to gain an understanding of the data flow of a very large computer program. In this example, the modules are the subroutines of the program. Several companies, including General Motors (GM) and Boeing, are using this tool.

Further information on DeMAID can be obtained at http://www.cosmic.uga.edu/abstracts/lar-14793.html

7.3 Defect Prevention

Traditional engineering focuses on solving problems, analyzing failure, using a repetitive process of design-build-test, testing one factor at a time, firefighting, and studying in detail the problems associated with interactions among the factors involved. This approach is costly and time-consuming and is not always successful. The IPPD environment, with its integrated teams and a centralized information system that allow real-time access and timely iterative analysis, makes prevention of defects and problems more likely. One means of problem prevention is Variability

Reduction (VR). VR enables the reduction of variations that can lead to product defects in the design and manufacturing processes.

Variability reduction is accomplished using many tools, some of which are discussed in the following sections. First, the following example from Northrop Grumman Corporation (NGC) illustrates the use and benefits of some of these tools.

Design For Manufacturing/Assembly (DFMA) And Variability Reduction (VR) Tools Example: Northrop Grumman Corporation

Integrated Product Development (IPD) Data Sheets are controlled drawings at the assembly level that depict the interrelations of detailed parts, tooling and assembly sequences for each cost center. They include the datums of detail parts and the tolerance requirements of part features and tooling part locators. They also include key characteristics at the assembly level, which are then flowed down to the detailed part level.

Geometric Dimensioning & Tolerancing (GD&T) is an internationally recognized engineering drawing language that specifies tolerance/dimensional requirements with respect to actual function and the inter-relationship of part features. NGC has provided extensive GD&T training to IPD team members and suppliers.

Key Characteristics (KC) are designated to identify those part or assembly features/interfaces where variation from nominal results in the greatest loss. Statistical Process Control (SPC) measurements are then focused on key characteristics to minimize variation, ensure capable processes, and reduce unnecessary inspection requirements.

Statistical Process Control (SPC) provides data to measure the capability of critical processes and/or key characteristics to produce quality parts within specified tolerance bands and to control process shifts and spreads. Successful SPC applications on close tolerance holes and countersinking have resulted in significant defect reduction.

Variation Simulation Analysis (VSA) is an assembly simulation model in which detail part and tool tolerances are compiled to predict conformance to geometric requirements to include out of specification conditions. VSA is proprietary software requiring seat licenses. VSA operates in a 3-D environment, and is being used on selected aircraft programs.

NGC's experience has shown that the combination of these DFMA/VR tools with 3-D design and IPD implementation have resulted in—

- Improved parts fit
- Net trimming before assembly
- Reduced shimming
- Reduced assembly hours/cost
- Reduced cycle time

7.3.1 Design for Manufacturing Process Capability

Design for Manufacturing Process Capability is a design policy that requires new designs to be optimized with respect to manufacturing processes. This method requires an intimate knowledge of process capabilities and the impact that tolerance stacking in successive operations has on key characteristics. Key characteristics are features of a design for which variation has the greatest impact on the fit, performance, or service life of the finished product.

7.3.2 Design for Manufacturing/Assembly

Design for Manufacturing/Assembly (DFMA) techniques are designed to reduce product cost through design simplification. DFMA achieves such simplification by reducing the number of parts and ensuring that the required parts are easy to manufacture and assemble. DFMA usually results in enhanced product quality, because many noncompliances are attributable to product complexity.

7.3.3 Process Variability Reduction

Variation in the process used to manufacture a product can result in variation in the key characteristics of the product. By reducing the variability of the processes, the variability of the key characteristics can be reduced and, hence, the quality of the product increased.

7.3.4 Root Cause, Closed Loop Corrective Action

Traditionally, process quality control involved inspection to identify nonconforming items and disposition of defective items as scrap or rework. Much time, effort, and cost was spent determining rework procedures and performing the rework, while little effort went to addressing the basic cause of the problem. By investigating the root cause of the problem with a multidisciplinary team empowered by high-level management and then applying corrective action to the process or design, recurrence of most problems can be prevented. This process was used in the late 1980s to address the high rate of nonconformance found on the General Dynamics F-16 fighter production line, and within a short time that production line returned to world-class standards.

7.3.5 Robust Design

Robust design is the systematic approach to finding optimum values of design factors that result in economical designs with low variability to provide consistent customer satisfaction. A robust design results in a product that is insensitive to, or tolerant of, sources of variation and change that are difficult, costly, or impossible to control whether on the shop floor or in use over time. Robust design is accomplished using a variety of tools and methodologies, including Taguchi Methods, Design of Experiments, Six Sigma and others. The Taguchi Methods describe a strategy to optimize a design to withstand variation in its manufacture and use. Design of Experiments (DOE) is a tool for collecting and managing information for design optimization. Six Sigma defines a specific quality goal and a strategy to meet it.

7.3.5.1 Taguchi Methods

Taguchi Methods is a system of cost-driven quality engineering that emphasizes the effective application of engineering strategies rather than the use of statistical techniques. It includes both upstream and shop-floor quality engineering in a process of product parameter design, tolerance design, process parameter design, and on-line quality control. Upstream methods efficiently use small-scale experiments and orthogonal arrays to reduce variability (called “noise”) and find cost-effective, robust designs for large-scale production and the marketplace. Shop-floor techniques provide cost-based, real-time methods for monitoring and maintaining quality in production. Taguchi Methods allow a company to rapidly and accurately acquire technical information to design and produce low-cost, highly reliable products and processes.

While the following example applies to production quality of an existing design and not new development, it is still a good example of the benefits of applying Taguchi Methods.

Taguchi Methods Example: Aerojet Ordnance

Poor production quality and nonconforming products were a problem for the Government-Owned/Contractor-Operated (GOCO) plants making the Area Denial Artillery Munition (ADAM) mine for the Army. Nineteen out of 25 lots were rejected (40,000 rounds per lot). A joint team of government and industry tried—without success—to find the cause of the problem. Although Aerojet Ordnance had not developed this product, it was called in to apply Taguchi experiments to the testing. Aerojet took three months to prepare for and conduct experiments in order to identify the critical parameters. It identified 13 controllable factors and set three different levels for each factor (all except one were within tolerance). Aerojet fired six rounds for each experiment. It identified four factors of greatest improvement and determined how building the round with those factors at optimum levels would provide rounds virtually 100 percent in conformance.

Results: These predictions were validated in field testing. Using the parameters identified in the experiments, 54 rounds were produced and tested without a failure. This was the first time in the history of the product that a 100 percent yield had been observed over a reasonable time period. Another 54 rounds were produced using a parameter setting where the experiments predicted a yield of 50 percent. Twenty-seven of the rounds failed the test. Production lines are now working to capacity, building good products. There have been no reported problems in eight months.

7.3.5.2 Design of Experiments

Design of Experiments (DOE) is a tool used to collect and manage information for design optimization. DOE is used to optimize process parameters for increased yields. DOE is a statistical tool that maximizes the amount of information obtained from a limited number of controlled experiments. The experiments are derived by varying parameters and conducting an "experiment" or operating a process to determine the result. By continually adjusting controllable process variables and analyzing the results, the design process can be tweaked toward maximum

output. This continuous controlled adjustment process is referred to as "Evolutionary Operations." Software tools to assist in the application of DOE are available. For example, applications to date of *Gosset*, developed by Bell Labs, include optimizing the production of wafers for integrated circuits, placing laser beams for the treatment of tumors in the brain, growing protein crystals, designing a cellular substrate used in catalytic converters, and designing coated photographic paper.

7.3.5.3 Six Sigma

The term “six sigma” relates to the statistical function used to measure the amount of variance in a process. Six Sigma as an industry program is an effort to achieve high quality, low cost, and minimum cycle time, resulting in a highly satisfied customer. Six Sigma is a way to measure the chance that any unit of product can be manufactured with zero defects—no more than 3.4 defects per one million items. To achieve a Six Sigma design, the characteristics of the design that most affect performance and reliability need to be identified. Then, by increasing the allowable range of variation of those characteristics, many more units will be usable. This is a six-step process depending on customer requirements and process capability.

Two good journal articles on company (Motorola, Texas Instruments, General Electric) successes with Six Sigma can be found at http://www.qualitydigest.com/dec97/html/sixsigma.html and http://www.ge.com/investor/article/

7.3.6 Statistical Process Control

Another tool used to ensure high manufacturing yields through variability reduction is Statistical Process Control (SPC). SPC is most applicable to Phase II, Engineering and Manufacturing Development and the Production part of Phase III. It allows for the continuous monitoring of the output of critical stages of a process and identifies special-cause variation that, once isolated, can be removed from the process to control product output within known or knowable process capabilities. Automated tools are available to collect the required measurements, perform the required mathematical analysis, and alert the operator of process change or unexpected variation.

Statistical Process Control (SPC) Example: Hewlett Packard

SPC is usually only part of an overall quality program. Hewlett Packard (HP), however, developed their quality program using SPC. Results of its implementation include the following:

- The composite field failure rate of all HP products decreased 83 percent over the past eight years.
- Scrap and rework costs have been drastically reduced in many divisions. One wave soldering process reduced its defect rate from 4000 parts per million (ppm) to 3000 ppm. Other areas have experienced reductions of 80 to 95 percent.
- Manufacturing costs have been reduced as much as 42 percent.
- Parts inventories have been reduced as much as 70 percent.
- Manufacturing cycle times have been reduced as much as 95 percent.

- Product development times have been cut up to 35 percent.
- Productivity has increased as much as 300 percent.
- Physical plant requirements, including floor space, have been reduced significantly in many cases. One division reported that it has increased shipments 400 percent over the last several years without having to add any floor space.
- One field repair station reported reducing its repair turn-around-time by 80 percent.
- The finance department at one division trimmed its financial close cycle by 33 percent.
- Total Quality Control (TQC) applications in field sales operations have improved sales effectiveness.

7.4 Cost Modeling

DoDD 5000.1 directs that cost must be viewed as an independent variable. To use the Cost as an Independent Variable (CAIV) methodology, accurate and current cost models are needed. Without up-to-date (real-time) cost data, the CAIV process cannot be used in a timely and repetitive fashion to guide design decisions.

7.4.1 Real-Time Costing

In the past, cost models were a consequence of the way the engineering process worked. Customer requirements led to a design, and the technical output of the design process was used as an input to the cost models. The cost models reflected a point cost estimate of the design concept; this estimate, along with its supporting cost data, was forwarded to the customer, who used it as a model for his or her own cost analysis. The cost estimates produced by both industry and the customer were mainly based on parametric cost models (e.g., weight as a size parameter, engineering or manufacturing complexity factors). While this method yielded a cost estimate based on easily measured or estimated factors, it was accomplished after design decisions had been made and reflected cost estimates based on historical processes and approaches.

In an IPPD approach, cost estimating needs to be performed up front in order to provide timely feedback to the design process. To be effective, concurrent cost estimating requires integrated cost and engineering models. Without such integration, the process becomes as tedious and time consuming as traditional methods.

Another way to eliminate the redundant cost modeling effort, which becomes necessary when evaluating proposals from different vendors using different cost models, is to do what the JSF program office did—make a single cost model available for the contractors to use.

7.4.2 Activity-Based Costing

One of the best methods available today to produce an accurate cost model is activity-based costing (ABC). ABC has received its name because of its focus on the activities performed in the realization of a product. Costs are traced from activities to products, based on each product's

consumption of such activities. ABC differs from conventional costing systems in two distinct ways.

1. In conventional costing systems, the assumption is that each unit of a given product consumes a certain amount of resources (e.g., material, labor, and energy). ABC is based on the assumption that products directly consume activities not resources. Therefore, the cost of a product is the sum of all the costs of the activities performed to produce that product.
2. Conventional cost systems are based on unit-level cost drivers (or allocation bases) of the product that are directly proportional to the number of units produced. Direct labor hours, machine hours, and pounds of material are examples of such *unit-level allocation bases*. The ABC system uses cost drivers that can be at the unit level, batch level, and/or product level. Examples of batch-level cost drivers are setup hours and the number of setups. Examples of product-level cost drivers are the number of parts, the number of times parts are processed, and the number of engineering change orders.

One of the prime advantages of ABC over traditional methods is its ability to distinguish between direct costs from indirect costs by separating batch-level costs from product-level costs. For example, economies of scale cannot be accurately modeled in the traditional cost model. It is also well known that using common components yields cost reductions; but again, only ABC can model the cost savings associated with this practice. The inability of traditional cost models to trace overhead costs correctly by only using unit-level cost drivers result in their systematically under-costing small, low-volume products and over-costing large, high-volume products.

For further information on Activity-Based Costing, visit the NASA web site at http://mijuno.larc.nasa.gov/ or query the Defense Technical Information Center (DTIC) at http://www.dtic.mil

7.5 Lean Enterprise

"Lean enterprise" refers to a company's ability to increase flexibility to react to changing requirements and to eliminate waste in the design and manufacturing processes. Lean enterprise originally began as a concept called *lean manufacturing* in the Japanese automobile industry and has since been credited with turning around the U.S. automaking industry. Within DoD, the principles of lean enterprise are being tailored to the aerospace industry, through a program called the Lean Aircraft Initiative (LAI), jointly led by the USAF and Massachusetts Institute for Technology (MIT) with the full participation of the leading companies in aerospace. The principles of lean enterprise are captured in a series of overarching practices that include the implementation of IPPD. The objective of lean enterprise is to improve the total company—the objective of IPPD is to improve program performance within that company. Consequently, the lean enterprise's overarching practices complement and reinforce an IPPD approach.

During source selection, one indicator to look for is the degree to which the contractor has implemented the lean enterprise practices detailed in the Lean Enterprise Model (LEM). These practices create a corporate environment in which an IPPD program can thrive. Another valid indicator, as mentioned earlier, is the company's implementation of lean enterprise practices, with strong corporate support for Lean initiatives generally equating to lower risk for achieving IPPD success.

Information on the Lean Aircraft Initiative may found at http://web.mit.edu/lean/
The Lean Enterprise Model may be found at http://imvp.mit.edu/LAI/lem/lem.html

Appendix 1

Acronyms

3-D	Three-dimensional
AARA	After Action Reconstruction and Analysis
ABC	Activity-Based Costing
ACTD	Advanced Concept Technology Demonstration
ADS	Advanced Deployable System
AFB	Air Force Base
AFL	Airborne Flying Laboratory
AIS	Automated Information System
ANSI	American National Standards Institute
APB	Acquisition Program Baseline
ASC	Accredited Standards Committee
BEST	Bids Evaluation Support Tool
C4I	Command, Control, Communications and Computers and Intelligence
CAD	Computer Aided Design
CAE	Computer Aided Engineering
CAIV	Cost as an Independent Variable
CALS	Continuous Acquisition and Life-Cycle Support
CAM	Computer Aided Manufacturing
CAME	Computer Aided Manufacturing Environment
CDRL	Contract Data Requirements List
CIM	Computer Integrated Manufacturing
CLIPS	C Language Integrated Production System
CMA	Command, Control, Communications, and Computers ISR Mission Assessment
CONOPS	Concepts of Operation
COST	Contracting Officer Support Tool
CPIPT	Cost Performance Integrated Product Team
DAB	Defense Acquisition Board
DARO	Defense Airborne Reconnaissance Office
DARPA	Defense Advanced Research Projects Agency
DAU	Defense Acquisition University
DDR&E	Director of Defense Research and Engineering
DeMAID	Design Manager's Aid for Intelligent Decomposition
DEPTH	Design Evaluation for Personnel, Training, and Human Factors
DFMA	Design for Manufacturing/Assembly
DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
DOE	Design of Experiments

DOT&E	Director of Operational Test and Evaluation
DTIC	Defense Technical Information Center
e-mail	Electronic Mail
EC	Electronic Commerce
ECP	Engineering Change Proposal
EDI	Electronic Data Interchange
EFT	Electronic Funds Transfer
EMD	Engineering and Manufacturing Development
EVM	Earned Value Management
EVS	Electronic Visualization System
FACNET	Federal Acquisition Computer Network
FASA	Federal Acquisition Streamlining Act
GOCO	Government Owned/Contractor Operated
HFM	Human Figure Models
HITL	Human-in-the-Loop
HP	Hewlett Packard
HUD	Heads Up Display
IBR	Integrated Baseline Review
IPPD	Integrated Product and Process Development
IPT	Integrated Product Team
ISR	Intelligence, Surveillance, and Reconnaissance
IT	Information Technology
JECPO	Joint Electronic Commerce Program Office
J-MASS	Joint Modeling and Simulation System
JROC	Joint Requirements Oversight Council
JSF	Joint Strike Fighter
JSTARS	Joint Surveillance and Target Attack Radar System
JWCA	Joint Warfighting Capability Assessment
KPP	Key Performance Parameter
LAN	Local Area Network
LCC	Life-Cycle Cost
M&S	Modeling and Simulation
MAIS	Major Automated Information System
MDA	Milestone Decision Authority
MDAP	Major Defense Acquisition Program
MNS	Mission Needs Statement
MRP	Material Resource Planning

MTBF	Mean Time Between Failure
MUSE	Multiple Unmanned Aerial Vehicle Simulation Environment
NAVAIR	Naval Air Systems Command
NDI	Nondevelopmental Item
NIST	National Institute of Standards and Technology
NSSN	New Attack Submarine
NTIS	National Technical Information Service
OIPT	Overarching IPT
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
PC	Personal Computer
PDRR	Program Definition and Risk Reduction
PGP	Pretty Good Protection
PMO	Program Management Office
PRIMES	Preflight Integration of Munitions and Electronics Systems
QFD	Quality Function Deployment
RAPID-WS	Requirements Analysis Process in Design for Weapon Systems
RCS	Radar Cross Section
RDT&E	Research, Development, Test and Evaluation
RFP	Requests for Proposal
RFQ	Requests for Quotation
RP	Rapid Prototyping
SAVE	Simulation Assessment Validation Environments
SBA	Simulation-Based Acquisition
SBD	Simulation-Based Design
SFRC	Short Form Research Contract
SM-3	Standard Missile
SOO	Statement of Objectives
SOW	Statement of Work
SPC	Statistical Process Control
STEP	Simulation, Test and Evaluation Process
STOW	Synthetic Theater of War
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
THAAD	Theater High Altitude Area Defense

TIFS	Total In-Flight Simulator
TIS	Trusted Information Systems
TOC	Total Ownership Cost
TQC	Total Quality Control
TQM	Total Quality Management
UAV	Unmanned Aerial Vehicle
UN/EDIFACT	United Nations Electronic Data Interchange for Administration, Commerce, and Transport
USACOM	United States Atlantic Command
USAF	United States Air Force
USD(A&T)	Undersecretary of Defense (Acquisition and Technology)
VAN	Value Added Network
VISTA	Variable Stability In-flight Simulator Aircraft
VM	Virtual Manufacturing
VP	Virtual Prototyping
VR	Variability Reduction
VTC	Video Teleconference
VV&A	Verification, Validation, and Accreditation
WBS	Work Breakdown Structure

Appendix 2

Sources of Additional Information

Air Force Research Laboratory, Logistics Research Division, (AFRL/HESS), Wright-Patterson AFB: http://www.alhrg.wpafb.af.mil/

CAIV: http://www.acq.osd.mil/

CALS: http://www.fedworld.gov/edicals/calsinfo.html

CATIA: http://www1.ibmlink.ibm.com/HTML/SPEC/g2214399.html

DeMaid: http://www.cosmic.uga.edu/abstracts/lar-14793.html

DMSO: http://www.dmso.mil

DoD Guide to IPPD: http://www.acq.osd.mil/te/survey/table_of_contents.html

DoD EC/EDI Information Center
Phone: 1-800-EDI-3414
World Wide Web: http://www.acq.osd.mil/ec/

DoD risk management
Defense Acquisition Deskbook: http://www.deskbook.osd.mil/
ASC Handbook for Integrated Risk Management:
Aeronautical Systems Center, ASC/FMC Building 11A
1970 Third Street
Suite 6
Wright-Patterson AFB, OH 45433-7213,
or http://www.wpafb.af.mil/az_public/abb.htm
DoD Risk Management Guide:
http://www.dsmc.dsm.mil/pubs/gdbks/risk_managementhtm.htm

Security Requirements for AIS, DoDD 5200.28:
http://tecnet0.jcte.jcs.mil:9000/htdocs/teinfo/directives/soft/ds.html

Information Security Program, DoD 5200.1-R.: http://www.dtic.mil:80/c3i/52001.html

Information Systems Security:
Manufacturing Technology Division,
System Engineering and Production Directorate
Research, Development and Engineering Center
U.S. Army Missile Command, RSA, AL
http://ippd.redstone.army.mil/mippd/

IPT Learning Campus CD resource guide: http://www.acq-ref.navy.mil/ipthome.html

IPPD Multimedia Training Tool: http://www.acq-ref.navy.mil/g-tools.html

J-MASS: http://www.jmass.wpafb.af.mil/

JSF program: http://www.jast.mil

LPD 17 program: http://lpd17_wr.nswc.navy.mil/

Missile IPPD Tools:
Manufacturing Technology Division,
System Engineering and Production Directorate
Research, Development and Engineering Center
U.S. Army Missile Command, RSA, AL
http://ippd.redstone.army.mil/mippd/

National Institute of Standards and Technology: http://www.nist.gov/

NSSN program: http://www.acq-ref.navy.mil/

Open Systems Joint Task Force: http://www.acq.osd.mil/osjtf/

Predator UAV program: http://www.acq.osd.mil/daro/homepage/predms.htm

Quality Function Deployment: http://www.qfdi.org

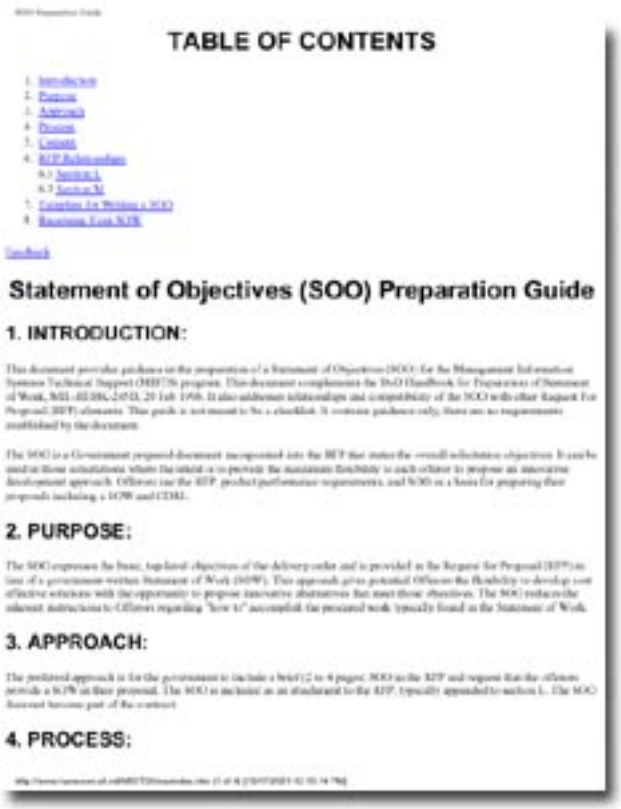
Rules of the Road: A Guide for Leading Successful Integrated Product Teams:
http://www.acq.osd.mil/ar/ipt.htm

Simulation Based Design: http://sbdhost.parl.com/

STEP: http://www.acq.osd.mil/te/programs/tfr/step.htm

STOW 97: http://www.acq.osd.mil/at/stow.htm
m
Tools of Total Quality: http://www.acq-ref.navy.mil/g-tools.html

[22] Statement of Objectives (SOO) Preparation Guide



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Statement of Objectives (SOO) Preparation Guide

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3. APPROACH:

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Feedback

Statement of Objectives (SOO) Preparation Guide

1. INTRODUCTION:

This document provides guidance in the preparation of a Statement of Objectives (SOO) for the Management Information Systems Technical Support (MISTS) program. This document complements the DoD Handbook for Preparation of Statement of Work, MIL-HDBK-245D, 20 Feb 1996. It also addresses relationships and compatibility of the SOO with other Request For Proposal (RFP) elements. This guide is not meant to be a checklist. It contains guidance only, there are no requirements established by the document.

The SOO is a Government prepared document incorporated into the RFP that states the overall solicitation objectives. It can be used in those solicitations where the intent is to provide the maximum flexibility to each offeror to propose an innovative development approach. Offerors use the RFP, product performance requirements, and SOO as a basis for preparing their proposals including a SOW and CDRL.

2. PURPOSE:

The SOO expresses the basic, top-level objectives of the delivery order and is provided in the Request for Proposal (RFP) in lieu of a government-written Statement of Work (SOW). This approach gives potential Offerors the flexibility to develop cost effective solutions with the opportunity to propose innovative alternatives that meet those objectives. The SOO reduces the inherent instructions to Offerors regarding "how to" accomplish the procured work typically found in the Statement of Work.

3. APPROACH:

The preferred approach is for the government to include a brief (2 to 4 pages) SOO in the RFP and request that the offerors provide a SOW in their proposal. The SOO is included as an attachment to the RFP, typically appended to section L. The SOO does not become part of the contract.

4. PROCESS:

The following steps provide the conceptual process for developing the SOO.

Step I. The site RFP team develops a set of objectives compatible with the overall program direction including the following:

- the user (s) basic requirements for service
- draft technical requirements (system spec), and
- a draft WBS and dictionary.

Step II. Once the program objectives are defined, they will need to be distilled or focused to arrive at the SOO addresses product oriented goals, rather than performance oriented requirements. As a goal, the SOO should not exceed 4 pages, longer documents may be providing too much detail.

5. CONTENT:

SOO content depends both on the type of services and on the program phase. It is possible that a "mature" program, such as a software product which is the maintenance phase, could require slightly more detail in the SOO to properly integrate with other software program under development or operation. In any case, the key is to keep the document short and concise.

The SOO should not address each WBS element, but each WBS element should be traceable to do something in the SOO. For example, a SOO may instruct the bidder to address his engineering approach. That is not a particular WBS element, but several WBS elements might be created to breakout the engineering tasks. Try not to group all WBS elements in the same objective. MISTS users will get the best service and competition will be maintained if dissimilar objectives are submitted on separate SOOs for bidding by the contractors.

6. RFP RELATIONSHIPS:

6.1 SECTION L:

Section L of the RFP must include instructions to the offeror that require using the SOO to construct and submit a SOO. Suggested Section L wording follows:

The Statement of Objectives (SOO), included as (site location in the RFP), provides the Government’s overall objectives, and the Offeror’s required support to achieve those objectives. The offeror shall use the SOO, together with other applicable portions of the RFP as a basis for preparing a proposed statement of work (SOW). The specific efforts defined in the SOW shall be structured according to the Contract Work Breakdown Structure (CWBS) and traceable to the SOO. The SOW shall be submitted as part of the proposal and will become an attachment to the contract at award.

The offeror’s SOW shall include appropriate compliance and reference documents. The documents that are included shall be listed in a fashion sufficient to properly identify the revision that will be used, and shall include appropriate tailoring. The offeror shall comply with all requirements contained in compliance documents, as tailored. The offeror shall obtain information from reference documents as tailored, but is not required to comply with any requirement contained in a reference document. As a minimum, the SOW shall include the compliance documents listed in the RFP, including tailoring. The offeror may propose additional compliance documents, provided such documents are existing, or propose Government or industry specifications or standards.

The offeror’s SOW shall also include data requirements in the form of a Contract Data Requirement List (CDRL), including appropriately tailored data item description (DID) references. As a minimum, the SOW shall include the CDRL and DID requirements specified in the RFP. The offeror may include additional data requirements. All data requirements shall be

traceable to specific tasks defined in the SOW. Each specific data requirement shall be specified using the DD Form 1423-1. Contract Data Requirements List. The successful offeror shall submit data in accordance with the information specified in the DD Form 1423-1.

6.2 SECTION M:

When writing Section M evaluation criteria, the program office should include sufficient criteria for evaluating the offeror's ability to reflect the objectives of the SOO in the resulting proposal (i.e., SOW, Integrated Master Plan (IMP), CWBS, etc.). Since the concept of asking the contractor to propose a SOW without strict guidance is new, the government's intention to evaluate the proposed SOW should be stressed in Sections L and M.

7. TEMPLATE FOR WRITING A SOO:

Program Objectives
Define Objectives of Program on a global scope
· multi phased program
· one program, multi-contractor
· one phase contract
Data Source: Minutes from Roundtable(s) and ASP

Sample 1
The objective of the Evolved Expendable Launch Vehicle (EELV) program is to design and develop a spacelift system, evolved from current launch vehicle systems or major subsystems thereof, in accordance with the EELV System Performance Document (SPD) requirements. This spacelift system will reserve or improve reliability, maintainability, and operability and reduce cost over current systems.

Sample 2
The objective of the Space Based Infra-red System (SBIRS) is to procure an integrated, cost-effective, flexible system that will meet United States infrared space surveillance needs through the next two to three decades.

Management Objectives
Describe the management objectives for the overall program or for each of the contract phases as appropriate

Data Sources: Policy Directives on integrated Product Development (IPD), Minutes from Roundtable(s) and ASP

Samples:
The primary management objective is twofold: (a) allow the contractor maximum flexibility to innovatively manage program cost, schedule, performance, risks, warranties, contracts and subcontracts, vendors, and data required to deliver an effective and affordable SLRS and (b) maintain clear government visibility into program cost, schedule, technical performance, and risk.

8. RECEIVING YOUR SOW:

When reviewing your SOW, ensure the contractor avoids words such as will, etc., as required, as necessary, periodically. Make the contractor define exactly what is to be performed and when it shall be delivered. This is similar to nailing Jell-O to the wall but is essential to have this verbiage in your SOW in order to clearly define what services you will be receiving. If the contractor specifies providing technical support, analysis, planning, assistance, control, interface, monitoring, developing, operation, training, implementation, management, testing, be sure the SOW states specifically what these terms mean and what will be delivered. If the contractor specifies efficient and reliable exchange, maximum uptime, make sure the contractor

quantifies these terms and the metrics and reporting process they will use.

Please take a look at MIL-HDBK-245D. It has an area where it goes into a little more detail on SOO preparations. Pay particular attention to Appendix C; Phrases Having Multiple Meanings. The list is even more phrases to be aware of when reviewing your SOW.

Feedback form for the SOO Preparation Guide

Date:

Name(anonymous):

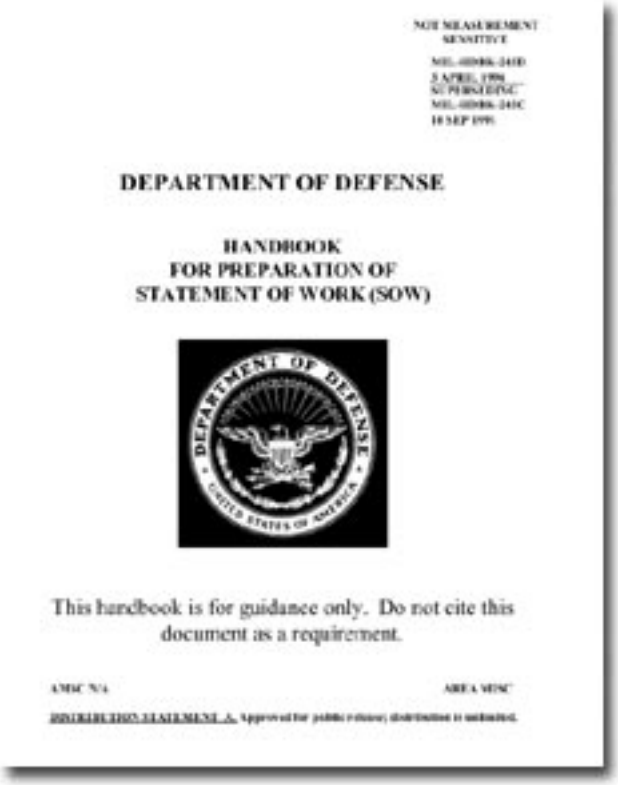
1. What would you do to improve the effectiveness of the SOO Preparation Guide?

2. What would you remove from the SOO Preparation Guide?

3. What would you add from the SOO Preparation Guide?

Please send feedback by E-Mail to Capt Stephen Rauch, ESC/CO, rauchs@hanscom.af.mil

[23] DoD Handbook for Preparation of Statement of Work (SOW)



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MIL-HDBK-245D
3 APRIL 1998
SUPERSEDING
MIL-HDBK-245C
10 SEP 1991

DEPARTMENT OF DEFENSE

HANDBOOK
FOR PREPARATION OF
STATEMENT OF WORK (SOW)

This handbook is for guidance only. Do not cite this document as a requirement.

AMSC N/A

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3 APRIL 1996
SUPERSEDING
MIL-HDBK-245C
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FOREWORD

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense.

2. This handbook is for guidance only and cannot be cited as a requirement in any DoD contract. Contractors may, at their option, utilize this document for guidance in preparing responses to Government requests for proposals.

3. This handbook provides guidance to enable personnel to create a completed contract Statement Of Work (SOW) applicable to any material acquisition life-cycle phase. It also covers the SOW preparation for non-personal services contracts.

4. Modern weapon systems have traditionally contained many more specifications and greater detailed SOWs than those of the past. Contrast the Army Signal Corps SOW for the Wright Brothers' heavier-than-air flying machine in 1908 to the Air Force SOW for the Advanced Tactical Fighter in 1986. Requirements in the 1908 SOW (e.g., be easily taken apart for transport in Army wagons and be capable of being reassembled for operation in an hour, carry 350 pounds for 125 miles, and maintain 40 miles per hours in still air) and other contract conditions were specified on one page. The requirements section in the 1986 SOW for the Air Force Advanced Tactical Fighter is 85 pages long with 300 paragraphs of requirements. Today's SOWs are much more complex requiring greater attention to detail.

5. The handbook is organized so that the SOW writer after reviewing Section 3, General Description, can proceed to that portion of Section 4, Detailed Requirements, that pertains to the type of SOW required. Each portion of Section 4 has detailed instructions on the specific requirements for each type of SOW tailored to specific needs. The specific instructions provide techniques for defining task elements, and a method for organizing these elements into a comprehensive SOW. Sample outlines and significant DO's and DONT's are provided.

6. The tendency of SOW writers is to include requirements which belong in other parts of a government contract. Contract requirements should be specified in Sections A - M and should not be restated in other parts of the contract. Quantitative technical requirements should be specified in the specification and not be restated in other parts of the contract. Work requirements should be specified in the SOW, and all data requirements for delivery, format, and content should be in the Contract Data Requirements List (CDRL) in conjunction with the appropriate Data Item Description (DID) respectively, with none of the requirements restated in other parts of the contract. Redundancy invites conflict.

7. This handbook provides guidance, following DoD direction, that will enable SOW writers to rely on commercial contracting practices. The new SOW will specify what tasks need to be accomplished but leave “how to” accomplish those tasks up to the contractor.

8. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Space and Naval Warfare Systems Command, Attn.: SPAWAR 05L1, 2451 Crystal Drive, Arlington, VA 22245-5200 by using the Standardization Document Improvement Proposal (DoD Form 1426) appearing at the end of this Handbook.

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1 SCOPE

1.1 Background. This handbook applies to the preparation of Statements of Work (SOWs) for projects and programs that have deliverables and/or services performed. It is written to implement the acquisition policies established in DoDD 5000.1. It covers the preparation of SOWs which correlate to the acquisition life cycle phases identified in Department of Defense (DoD) Acquisition Instructions such as DoDI 5000.2. This handbook is for SOWs in DoD solicitations and contracts and covers work requirements, in conjunction with applicable performance/design requirements contained in specifications, but also data deliverables contained in Contract Data Requirements Lists (CDRLs). The Federal Acquisition Regulations (FAR) and Defense Federal Acquisition Regulation Supplements (DFARS) discuss the essentiality of the SOW for sound contracting. An offeror submits a proposal based on his perception of the Government's needs as defined in the RFP. Precisely stated requirements will enable the offeror and the Government to negotiate a fair price for the deliverables and/or services to be provided. This handbook has been developed as a framework to assist the responsible manager in providing a consistent, orderly, and complete description of work required.

1.2 Importance of SOW. The majority of government contracts include a SOW which forms the basis for successful performance by the contractor and effective administration of the contract by the government. A well-written SOW enhances the opportunity for all potential offerors to compete equally for Government contracts and serves as the standard for determining if the contractor meets the stated performance requirements.

1.3 Introduction of Statement of Objectives (SOO). This document introduces a new concept called the SOO which shifts the responsibility for preparing the SOW from the government to the solicitation respondents. Following recent DoD direction to lower Government costs by encouraging innovative contract options and flexible design solutions, the SOO captures the top level objectives of a solicitation and allows the offerors complete freedom in the structure and definition of SOW tasks as they apply to the proposed approach. However, the requirement, content and purpose of the SOW in the contract remain unchanged. The SOO concept is explained in detail in Section 5.

2 APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are the ones that are needed in order to fully understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the latest issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-881	Work Breakdown Structures for Defense Material Items
MIL-STD-961	Department of Defense Standard Practice for Defense Specifications

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-248	Acquisition Streamlining

2.3 Other Government Documents, Drawings and Publications. The following Government documents, drawings, and publications form a part of this handbook to the extent specified herein:

REGULATION

FEDERAL ACQUISITION REGULATION

FAR 52.215-33	Order of Precedence

DEFENSE FEDERAL ACQUISITION REGULATION SUPPLEMENTS

DFARS 211	Describing Agency Needs
DFARS 212	Acquisition of Commercial Items - General
DFARS 227.71	Rights in Technical Data

DFARS 237.104	Personal Services Contracts
DFARS 252.211-7000	Acquisition Streamlining

MANUALS

DEPARTMENT OF DEFENSE

DoD 5010.12-L	Acquisition Management System and Data Requirements Control List (AMSDL)
DoD 5010.12-M	Procedures for the Acquisition and Management of Technical Data

DIRECTIVES

DEPARTMENT OF DEFENSE

DoDD 5000.1	Defense Acquisition
DoDI 5000.2	Defense Acquisition Management Policies and Procedures

FORMS

DEPARTMENT OF DEFENSE

DD Form 1423	Contract Data Requirements List (CDRL)
DD Form 1664	Data Item Description (DID)

(Unless otherwise indicated, copies of the above specifications, standards, handbooks, or publications are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Any documents required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

3 GENERAL DESCRIPTION

3.1 Purpose. The SOW should specify in clear, understandable terms the work to be done in developing or producing the goods to be delivered or services to be performed by a contractor. Preparation of an effective SOW requires both an understanding of the goods or services that are needed to satisfy a particular requirement and an ability to define what is required in specific, performance-based, quantitative terms. A SOW prepared in explicit terms will enable offerors to clearly understand the government's needs. This facilitates the preparation of responsive proposals and delivery of the required goods or services. A well-written SOW also aids the Government in conduct of the source selection and contract administration after award. A Data Requirements Review Board (DRRB) may review each SOW to ensure compliance with the policy, guidance and procedures contained in this handbook (see DoD 5010.12-M for requirements for conducting the DRRB). The SOW is aligned with the acquisition milestones and phases discussed in detail in Section 4.

3.2 Relationship between Statement Of Work and Specification. The SOW defines (either directly or by reference to other documents) all work (non-specification) performance requirements for contractor effort. Qualitative and quantitative design and performance requirements are contained in specifications developed according to MIL-STD-961. Such specifications are typically referenced in the SOW, but the specific qualitative or quantitative technical requirements should not be spelled out in the SOW. For example, the referenced specification may cite reliability and maintainability requirements in terms of quantifiable mean-time-between failures (MTBF) and mean-time-to-repair (MTTR); the SOW should task the contractor to establish, implement and control a reliability and maintainability program.

3.3 Relationship Between the SOW and Contract. The SOW should be compatible with these provisions:

Requirements that are mandated by law, established DoD policy or necessary for effective management of its acquisition, operation, or support.

At the outset of development, system-level requirements should be specified in terms of mission-performance, operational effectiveness, and operational suitability.

During all acquisition phases, solicitations and contracts, the SOW should state management requirements in terms of results needed rather than "how to manage" procedures for achieving those results.

DFAR 252.211-7000, Acquisition Streamlining, is required in all solicitations and contracts for systems acquisition programs. This enables a contractor to effectively evaluate and recommend the tailored application of management systems and specifications and standards for use in the appropriate phase of the program life cycle.

3.4 SOW and Contractor Performance. After contractor selection and contract award, the contract SOW becomes a standard for measuring contractor performance. Consequently, the SOW writer must consider the contractual and legal implications of the SOW during its preparation. As the contracted effort progresses, the government and the contractor will refer to the SOW to determine their respective rights and obligations. In this respect, the SOW defines the contract and is subject to the interpretations of contract law. The SOW must clearly define the work to be performed, since the language detailing the contractor's effort may be pertinent to legal questions concerning the scope of work. In a dispute concerning performance, rights, or obligations, clearly defined requirements will enhance the legal enforceability of a SOW, which has a high level of precedence in the solicitation document and contract as stated in FAR 52.215-33.

3.5 Relationship of Contract Sections. The government Request for Proposal (RFP) or solicitation defines the government's requirements and constitutes the cornerstone of the program, as it ultimately shapes the resultant contract. Therefore, the SOW must be consistent with all sections of the RFP. The SOW preparer should work closely with the overall RFP drafter and all contract section authors to achieve consistency. If acceptance and inspection of supplies or services is required to satisfy the contract, RFP Section E should address the acceptance criteria. Data deliverables are identified in Contract Data Requirements List (CDRL) exhibits to the contract. Section F (Deliveries or Performance) requires delivery of data listed in these exhibits. Clauses required by law, regulation, or any other clauses that may apply to a resulting contract are cited in Section I (Contract Clauses). Section J is a listing of all exhibits and attachments to the contract. Sections K, L, and M apply only to RFP's. They are contained at the end so that when the contract is awarded, they can be removed. Section K includes provisions that require representations, certifications, or the submission of other information by offerors. Section L includes provisions and other information or instructions to guide bidders/offerors in preparing their offers or bids in a manner that is responsive to the government’s RFP. Section M identifies the factors that will be considered in awarding the contract. It contains the evaluation criteria listed in order of importance and other factors for award. The SOW and Work Breakdown Structure (WBS) are utilized in preparing the corresponding CDRL, Section L, Section M, and other parts of the RFP/contract. The relationship of RFP/contract sections to the SOW is illustrated on Figure 1. Figure 1 is provided for general guidance and shows that the SOW and SOO may, at the preference of the procuring activity, be placed in one of several different locations in the solicitation. Because of the complex interrelationships among RFP/contract documents, use of a cross-reference matrix may be helpful (see Figure 2).

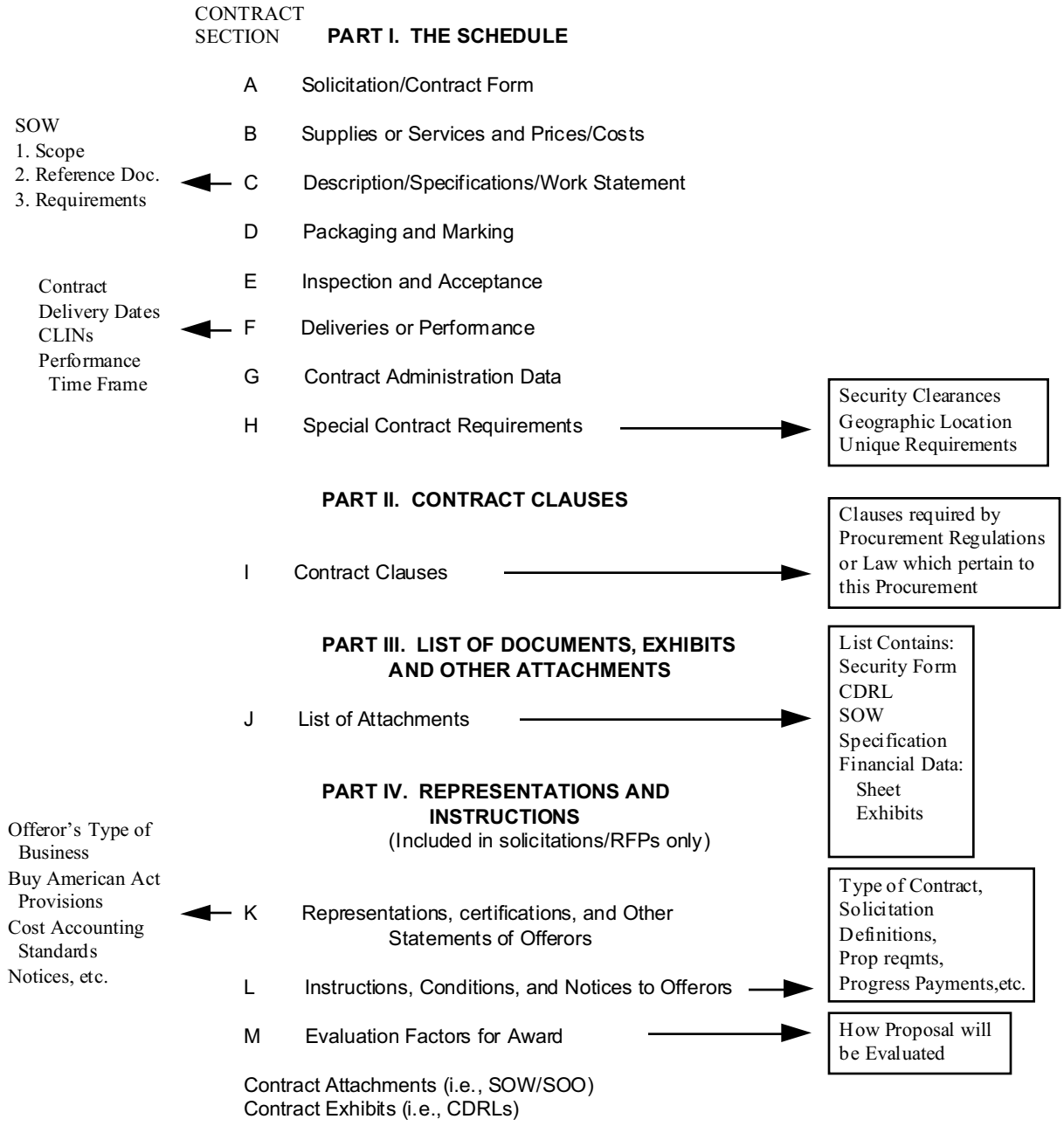

FIGURE 1. Relationship of Government solicitation/contract sections to SOW/SOO.

The following matrix is intended to reduce internal RFP inconsistencies and aid in proposal preparation. It is provided as a reference tool for information only. In the event of conflict between this matrix and any other section of the RFP, the other section shall take precedence.

WORK DESCR	WBS ELEM	SOW PARA	CLIN	CDRL	INSTR TO OFFERORS (SEC L)	EVAL FACTORS (SEC M)	PROP LOC
Design B	2.2	3.2.2	0001	N/A	3.B.1	Tech 1.A	V1-p.64
Build A	2.3	3.2.3	0002	A001	3.B.2	Tech 1.B	V1-p.75

FIGURE 2. Cross reference matrix.

3.6 Standard Format. The standard format for the SOW is as follows (subject to variations specified in Section 4 for specific types of SOWs):

SOW Section	Title
1	SCOPE
2	APPLICABLE DOCUMENTS
3	REQUIREMENTS

Deviations from the standard format may be made by the writer when necessary to accommodate overriding program needs.

3.6.1 SOW Section 1 - Scope. This Section includes a brief statement of what the SOW should cover. The scope paragraph defines the breadth and limitations of the work to be done. In some cases, the use of an introduction, background, or both, is preferred. Separate indentures under this Section are used in SOWs to accommodate complex acquisitions requiring lengthy background information. Background information should be limited to only that information needed to acquaint the proposer with the basic acquisition requirement. The items listed below should not be included in the "Scope" Section.

a. Directions to the contractor to perform work tasks.
b. Specification of data requirements.
c. Description of deliverable products.

3.6.2 SOW Section 2 - Applicable Documents. Military handbooks, government instructions, service regulations, technical orders, and policy letters, as a type, are not written in language suitable for contract application. In the event requirements of these documents must be included in a SOW, excerpts only should be used and should be made into either a clear task statement or a clear reference statement for guidance only, and not for contract compliance. Any documents called out in Section 2 of the SOW should have the specific version referenced, i.e. by date or by revision letter.

The SOW writer should refer to DFARS 252.211-7000 with respect to referenced documents and begin with a zero base situation. The requirement for any specification and standard should be justified before being placed in Section 2 of the SOW. Therefore, Section 2 should not be prepared until the draft of the requirements Section, Section 3, is complete. Sections 2 and 3 are reciprocal. Documents invoked by specific reference in Section 3 of the SOW must be identified and listed in Section 2. When invoked in Section 3 of the SOW, the application should be tailored to invoke only those minimum requirements from the document which are absolutely necessary for program success as described in MIL-HDBK-248. The applicability of each document listed in Section 2 of the SOW should be specified in Section 3 and identify only that portion needed to perform the work. Improper document referencing (e.g., blanket imposition) was often a major cost driver since total compliance with a document listed in Section 2 of the SOW was implied unless Section 3 specified otherwise.

3.6.3 SOW Section 3 - Requirements. Specific work tasks are called for in SOW Section 3 (see Appendix D). These tasks, developed to satisfy program needs, are essentially the contractor work requirements. Although the Source Selection Evaluation Board (SSEB) is responsible for the examination of SOW requirements in order to eliminate nonessential requirements, such examinations may be accomplished by the functional technical groups during development of the SOW. A well-written SOW has the following attributes:

a. Specifies requirements clearly to permit the government and offerors to estimate the probable cost and the offeror to determine the levels of expertise, manpower, and other resources needed to accomplish the task.

b. States the specific duties of the contractor in such a way that the contractor knows what is required and can complete all tasks to the satisfaction of the contract administration office.

c. Written so specifically that there is no question of whether the contractor is obligated to perform specific tasks.

d. References only the absolute minimum applicable specifications and standards needed. Selectively invokes documents only to the extent required to satisfy the existing requirements.

(The tailoring of reference document requirements should result in a reduction to the overall costs otherwise incurred if all requirements stated in a document are invoked).

e. Separates general information from direction so that background information and suggested procedures are clearly distinguishable from contractor responsibilities.

f. Avoids directing how tasks are to be performed and states only what results are required.

3.6.4 SOW Do's and Don'ts.

a. Do's:

· Select a competent team with an experienced team leader.

· Exclude “how to” requirements since the offeror should be tasked to provide the deliverables under the contract in the most cost effective manner.

· Use the program Work Breakdown Structure (WBS), as discussed in paragraph 3.8.1 in this handbook to outline the required work effort.

· Set SOW objectives in support of the Acquisition Plan (AP), if applicable.

· Explicitly define the tailored limitations of all standards and specifications cited.

· Exclude design control or hardware performance parameters because these requirements should be covered in a specification.

· Educate personnel with respect to acquisition streamlining. (DFARS 211.002-70 Contract Clause).

· Give priority to commercial items over specification items when the former satisfies military requirements.

· Give priority to commercial practices as a means of acquisition (DFARS 212 Acquisition of Commercial Items - General).

b. Don'ts:

· Order, describe, or discuss Contract Data Requirements List (CDRL) data.

· Invoke, cite, or discuss a Data Item Description (DID). Although the text of the SOW should not include the data format and content preparation instructions

and/or data delivery requirements, a data item description number listed on the CDRL may be cross-referenced in the SOW.

· Specify technical proposal criteria or evaluation factors.

· Establish a delivery schedule. (May include significant milestones for clarity.)

· Specify design control parameters or the performance of hardware because these items should be covered in a specification.

· Impose on the contractor a Government format when a contractor format is acceptable.

· Overspecify. Specify only what is required and let the contractor establish the best method to fulfill the requirement.

· Invoke in-house management instructions.

· Use the SOW to establish or amend a specification.

· Invoke handbooks, service regulations, technical orders, or any other document not specifically written according to DoD standards. (Non-government documents excluded.)

3.6.5 Title Page and Table of Contents. All SOWs should have a title page or cover that shows the SOW title, preparation date, procurement request number or contract number, revision number, date, and identity of the preparing organization (see Figure 3). A table of contents should be used when the SOW exceeds five pages (see Figure 4).

3.6.6 Paragraph Numbering and Identification. Each paragraph and subparagraph should be numbered consecutively within each SOW Section using a period to separate the number representing each sublevel. Paragraph numbering should be limited to the third sublevel, if possible, as shown in the following example for SOW Section 3:

Requirement	3
1st Sublevel	3.1
2nd Sublevel	3.1.1
3rd Sublevel	3.1.1.1

Paragraph breakdowns should be kept to that level necessary to clearly define required contractor tasks. Only one task should be provided in a numbered paragraph or sub paragraph to facilitate costing, referencing and tailoring of tasks. Each paragraph and sub-paragraph should be titled.

13 NOV 1995

STATEMENT OF WORK

FOR

RAPID DEPLOYABLE COMMUNICATIONS SYSTEM

Prepared by

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

FIGURE 3. Sample Title Page.

CONTENTS

Section/Para		Page
1	Scope	
2	Applicable documents	
2.1	Department of Defense specifications	
2.2	Department of Defense standards	
2.3	Other publications	
3	Requirements	
3.1	General Requirements	
3.2	Technical Objectives and Goals	
3.3	Specific Requirements	
3.3.1	Contractor Services	
3.3.2	Integrated Logistics Support	
3.3.3	Management Systems Requirements	
3.3.4	Production Planning for Phase II	
3.3.5	Reliability Program	
3.3.6	Maintainability Program	

FIGURE 4. Sample Table of Contents.

3.6.7 Language Style. SOW requirements should be written in language understandable to all potential program participants. Requirements should be stated explicitly in a topical, logical, chronological, or similarly structured order, avoiding words which allow for multiple interpretations. Use technical language sparingly with simple wording predominating in concise sentences. Use "shall" whenever a provision is mandatory. “Will” expresses a declaration of purpose or intent; for example, "The Government will review all recommendations and provide direction within thirty calendar days". Use active rather than passive voice; for example, "The contractor shall establish a program", not "A program shall be established by the contractor.”

Spell out acronyms and abbreviations the first time and put the abbreviated version in parentheses after the spelled-out phrases. This will define them for each subsequent use. Acronyms and abbreviations may be defined in a glossary. Many of the common acronyms used are found in Appendix A.

Use verbs that identify work and performance task requirements (See Appendix B) and answer the explicit question: "What are the work requirements?" When selecting the appropriate work word which properly expresses the degree of contractor involvement, the SOW writer must explicitly define the total nature of the work requirement.

Avoid using “Any,” “Either,” “And/Or,” as these words imply that the contractor can make a choice which may not support the intent of the SOW. Do not use pronouns. Repeat the noun to avoid any misinterpretation. Terminology should be consistent throughout the SOW. When referring to a specific item, use the same phrase or word, particularly when referring to technical terms and items. Where words can be spelled in several different ways, employ the most common spelling. Make every effort to avoid ambiguity. A list of ambiguous phrases is provided in Appendix C.

3.7 Data Management. As the contractor performs and completes the SOW tasks, data may be developed. Submissions of this data are generally expensive. Proper tailoring and scheduling of data submission items requires particular attention by the SOW preparers. Data costs can be minimized by selectively eliminating unnecessary reports and requiring appropriately phased submissions. A review of anticipated data requirements should therefore include definition of a time line defined for data submission. The contractor's format may be the acceptable form for submission of data products. The SOW preparer should make every effort to ensure that the CDRLs and DIDs reflect the anticipated need for data and to ascertain whether the specific data required will in fact be generated and available prior to the proposed delivery date stated on the proposed CDRL.

3.7.1 Use of Contract Data Requirements List (CDRL) Data. The ordering and delivery of data which the Government requires are specified and scheduled through the use of the Contract Data Requirements List (CDRL), DD Form 1423, in conjunction with the appropriate Data Item Description (DID), DD Form 1664. The CDRL is used to order the data required and tailor the DID. The DID's use is to describe the data's format and content requirements. The SOW task(s) that will produce data requirements should be referenced in Block 5 of the CDRL. The SOW author should exercise considerable care and attention to the data delivery implications of the SOW. While data may be inherently generated by a work task, recording and delivering the data in a specific format are cost drivers that must be considered when preparing the SOW and CDRLs. The CDRL should specify that the contractor's format is acceptable, wherever possible.

3.7.2 Data Item Description (DID). After the need for recording and delivery of data resulting from a work task has been determined, appropriate DIDs should be selected from DoD 5010.12-L, Acquisition Management System and Data Requirements Control List (AMSDL). If certain elements of data are not needed, the DID should be tailored downward noting deletions in CDRL Block 16. When the contractor format for a data product will meet the Government's needs, it should be specified in block 16 of the CDRL if the DID does not already state contractor format is acceptable. The CDRL should only require data specifically generated in a SOW work task. The SOW, and not the DID, must task the contractor to perform work. At the end of each SOW task paragraph, the DIDs that are associated with the effort described in the task may be identified in parentheses.

To understand the relationship of a SOW to the CDRL and DID (see Figure 5), consider the example where the SOW establishes a requirement that, "the contractor shall establish, implement and control a Configuration Management (CM) program". The associated CDRL would order a CM data item and identify due date, distribution and other such parameters while the DID would provide the format and content requirements for that particular CM item, with non-essential references tailored out of the DID.

3.8 SOW Development. Section 4 of this handbook describes how the SOW content may change depending on which acquisition phase it supports. The following paragraphs will describe a general planning and development approach that is applicable to all SOWs regardless of which acquisition phase is to be supported.

3.8.1 Work Breakdown Structure (WBS). A WBS should be used in developing the SOW. MIL-STD-881 may be used for guidance. A WBS provides the framework for a disciplined approach of structuring and defining the total project or program. It is a product-oriented family tree composed of equipment, services, and other items which make up the project or program, and provides the basis for progress reporting, performance and engineering evaluations, and financial data reporting. When preparing the SOW a complete application of a WBS may not be necessary in all programs, however, the underlying philosophy and structured approach can and should be applied. The Contract Line Item Number (CLIN) and the SOW should be constructed to

correlate with the WBS. Use of a WBS during SOW development facilitates a logical arrangement of the SOW elements and provides a convenient check-list to trace all necessary elements of the program and ensure that they are addressed in the SOW. The WBS will evolve into greater detail as the system definition and acquisition phases advance. For each phase, the WBS must be in sufficient detail to cover all the required work in that phase, as well as to produce the technical information needed for the next phase. The WBS may be tailored to the minimum level required to manage program risk.

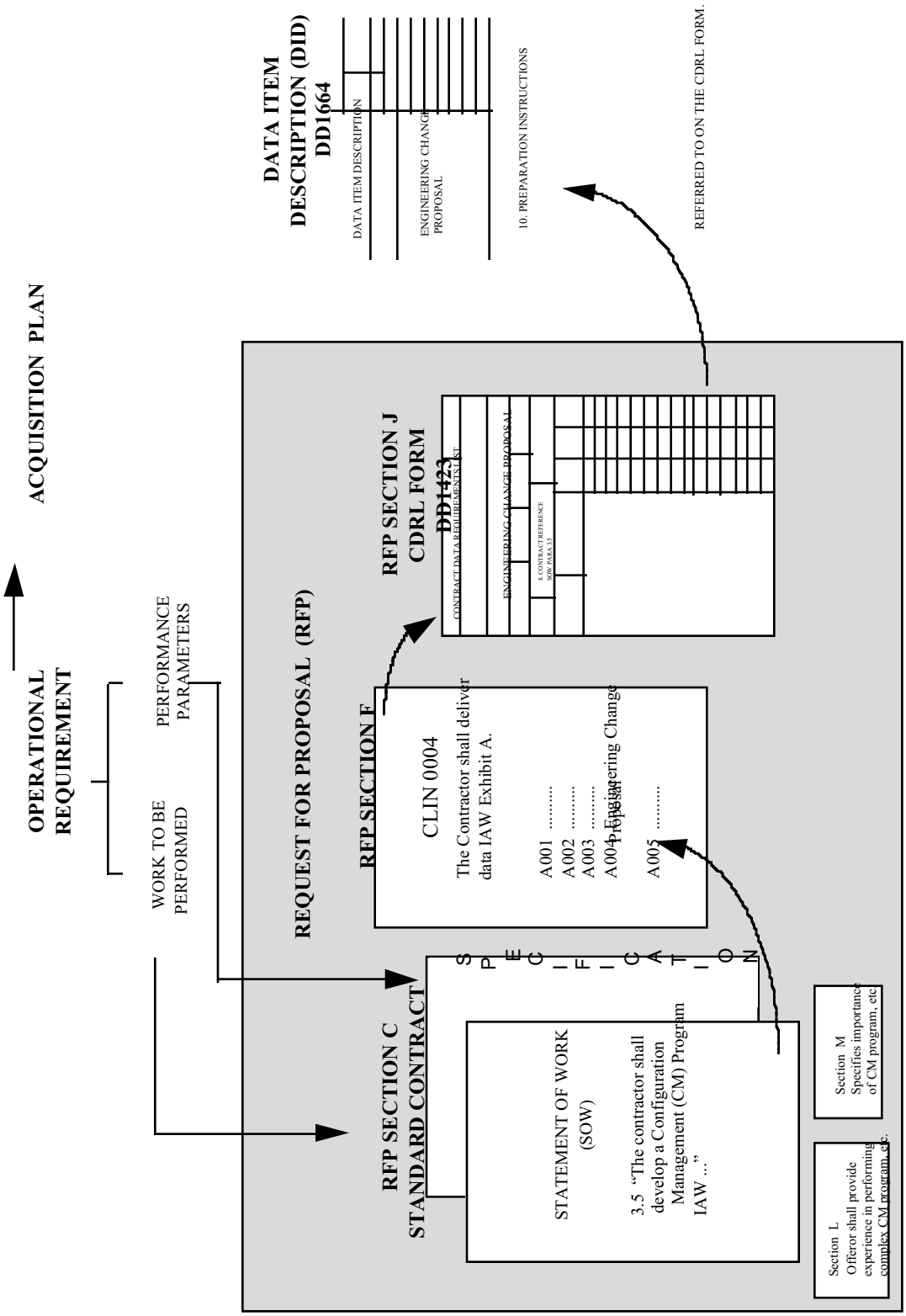

FIGURE 5. SPEC-SOW-CDRL-DID Relationship.

3.8.2 Development Approach. A systematic process is essential for SOW development. Select a competent team (expert in managerial, technical and contractual fields) with a team leader who is experienced in systems acquisition and SOW development. The SOW preparer and all contract section authors must first understand all program requirements to be supported. Following the systematic process shown on figure 6, the team should:

a. Ensure that only those tasks which add value to the product, whether a management system or technical requirement, are included in the SOW. (See DFAR 211.002 policy.)

b. Conduct market research to determine whether commercial items or nondevelopmental items are available to meet program requirements.

c. Review the requirements documents which authorize the program and define its basic objectives.

d. Review the various DoD/Services/Joint Services requirements documents for program management, acquisition and control impact.

e. Prepare a bibliography citing the specific portions of all applicable governing instructions, directives, specifications, and standards with which the program must comply. Keep these requirements to the absolute minimum and do not include citings that direct "how" work is to be performed.

f. Categorize the work described by the program WBS into that which will be done in-house and that which needs to be contracted.

g. Compile all work that needs to be contracted into an Acquisition Plan (if applicable) which will identify the various RFPs/contracts required, type of contract, the time-phasing, estimated cost, method of contractor selection/award, and period of performance among other things. For each RFP/contract so identified, a SOW must be prepared covering all of the WBS work elements included in that RFP/contract.

h. Identify all organizations and persons who will participate in preparing the SOW, and determine the participants' areas of responsibility.

i. Prepare the SOW following the guidelines of this handbook. For each WBS work element, identify tasks that define the scope of the work effort to satisfy the minimal needs of the program and identify required data deliverables.

j. Ensure that the specifications are consistent with the SOW. Ensure technical performance requirements are properly contained in the system specification and not in the SOW.

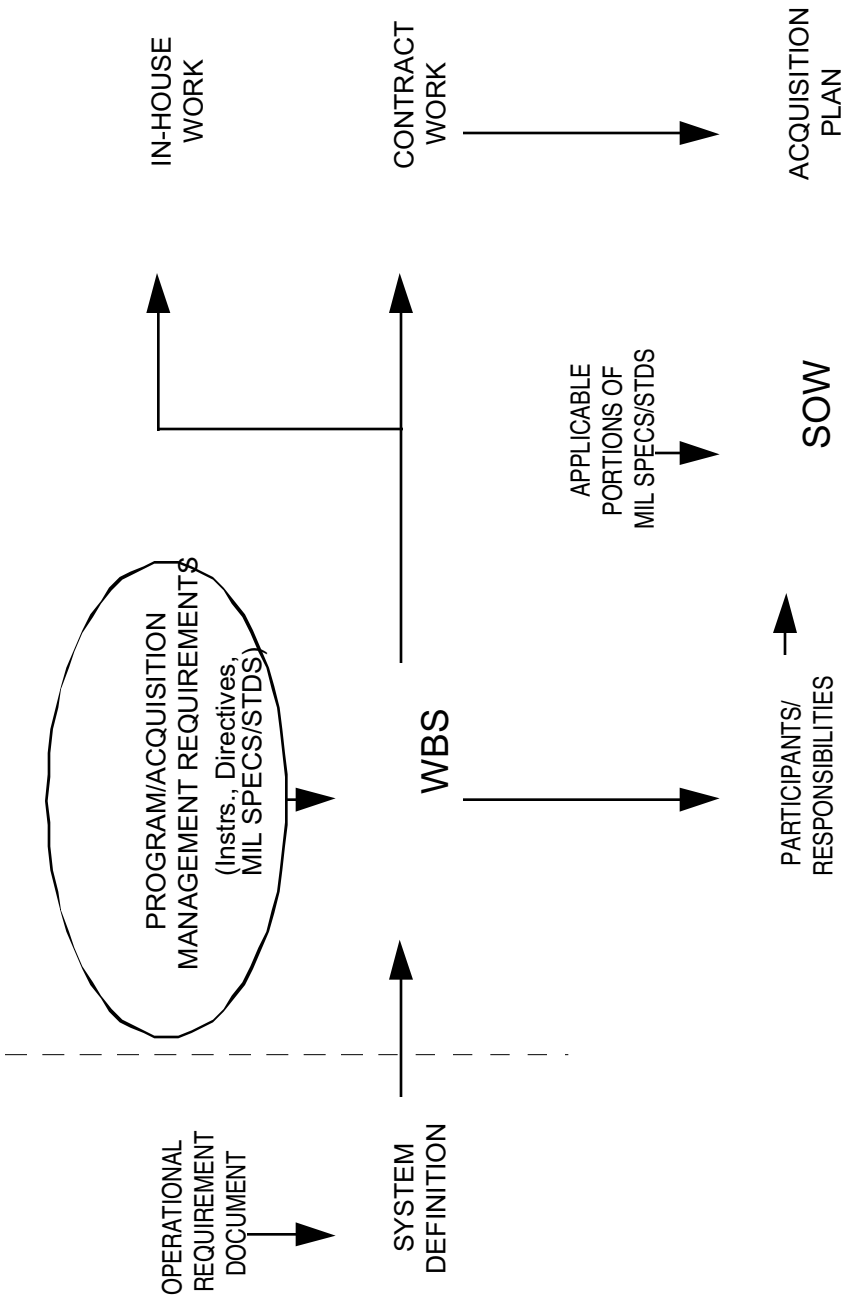

FIGURE 6. Systematic approach to SOW preparation.

k. Utilize the SOW and WBS in preparing the corresponding CDRL, Section L Instructions to Offerors, Section M Evaluation Factors for Award, and other parts of the RFP/contract following DFARS.

3.8.3 Non-Complex SOW Development. It is essential to establish a SOW outline for non-complex acquisitions which do not lend themselves to utilization of a WBS.

a. Define end items (line items) to be acquired, such as hardware, software, engineering analysis, software validation or simulation, etc.

b. Establish the requirements which apply to each end item and, as a minimum, develop a bibliography as described in 3.8.2.e above.

c. Determine what services or data will be needed to support each end item after delivery to the Government.

d. Identify all participants (see 3.8.2.h)

e. Prepare the SOW following the guidelines of this handbook.

4 DETAIL REQUIREMENTS

4.1 SOW Phasing and Results. All programs, including highly classified programs, should accomplish certain core activities. These activities must be tailored to satisfy an identified need using common sense and sound business practices. The acquisition process is structured in logical phases separated by major decision points called milestones. Each milestone is an opportunity for a review to determine if the program should continue. The decision to enter the next phase or not is based on results obtained in the acquisition phase preceding that milestone. SOW requirements are tailored to support the acquisition of information, hardware, software, technical data and the logistic support required during any particular life cycle phase.

4.1.1 Determining Mission Needs and Identifying Deficiencies. All acquisition programs are based on identified, documented, and validated mission needs. Mission needs result from assessments of current and projected capability requirements. Mission needs may establish a new operational capability, improve an existing capability, or exploit an opportunity to reduce costs or enhance performance. If the potential solution results in a new program, an appropriate level review should be held to document its validity and joint potential, and confirm that the requirements have been met or considered.

4.1.1.1 Elements of Information. Where preliminary studies involving systems analyses, preliminary cost effectiveness, or trade-off studies are to be contracted, there are certain distinctive elements of information to be included in the SOW. These can be included in either the introduction or background descriptions of the Scope in Section 1.

These areas are as follows:

a. *Statement of the problem(s).* A brief description and background of the problem(s) to be solved, and a succinct discussion of the need giving rise to this requirement.

b. *System description.* A short functional description of the overall system. If practicable, a pictorial representation that will quickly orient the reader to the desired system and the proposed use should be considered for inclusion in this Section of the SOW.

c. *Major milestones. A* graphic display of major program milestones should be included in the background information.

4.1.1.2 Requirements. The Section 3 paragraphs will establish what the contractor shall do, and may properly contain discussions of the following requirements and conditions:

a. *Component and subsystem relationships. A* functional flow diagram, explaining what is visualized as possible or practical at this time and showing the system and each associated subsystem (or major component).

b. *Alternative courses of development.* A summation of the alternatives for development as they are visualized at this time, pointing out the possible differences in operational effectiveness in terms of performance, reliability, maintainability and operability. The SOW should clearly indicate the basis of comparison, e.g., previous experience or extrapolations.

c. *Phasing.* Where the studies to be accomplished are divisible into time phases or into other separable areas of work. The SOW should spell out these requirements.

4.1.2 Phase O: Concept Exploration - Examining Alternative Concepts to Meet Deficiencies. Phase objective is to define and evaluate alternative system design concepts which fulfill mission needs and program objectives. During this phase, technological advances, concept feasibility, schedules and costs are evaluated by the program manager in order to identify a viable solution to a military requirement. Because of the evolving nature of the desired product, the SOW used during this phase must be limited to an expression of the mission need objectives and goals. The precision with which operational goals or technical objectives can be defined during this phase will impact the Government's and the contractor's ability to estimate cost and risk. In the majority of early stage research programs, including preliminary explorations and studies, the work to be performed cannot be described precisely. When preliminary exploration and studies have indicated a high probability that the development is feasible a more definitive SOW can be drawn. Based on program needs, the contractor in this phase may develop a Type A system or system/segment specification for use by the Government in the solicitation for the next phase.

4.1.2.1 Detailed Requirements. The Concept Exploration Phase SOW instructs the contractor to assess the merits of the concepts and define the most promising concepts in broad terms of objectives for cost, schedule, performance and overall acquisition strategy. Initial measures of effectiveness and performance are also identified in this phase.

4.1.3 Phase I: Program Definition and Risk Reduction. During this Phase, the program becomes defined as one or more concepts, designs, and/or technologies are investigated. Early development models, demonstrations, and operational assessments are conducted as required to reduce risks prior entering the program's next phase. Cost, schedule and performance trade-offs are conducted. Key activities include: strategy review, identification of program specific accomplishments for the next phase, initial manpower estimates, and the identification of potential environmental impacts.

4.1.3.1 Detailed Requirements. The Program Definition phase SOW should contain enough detail to enable the successful bidders to translate program requirements into an effective development program. It should delineate specific tasks for evolving the system requirements into system type specifications or system segment specifications.

4.1.4 Phase II: Engineering and Manufacturing Development - Detailed Design, Integration Testing, and Establishing a Manufacturing Capability. The objectives of this phase are: to translate the selected design into a stable, producible, supportable, and cost effective design; to

validate the manufacturing or production process; and to demonstrate system capabilities through testing.

4.1.4.1 Detailed Requirements. The Engineering and Manufacturing Development phase SOW efforts include verification that adequate resources have been programmed to support production, deployment, and logistics support of the operational system; verification of the system's software design, coding, integration and tests.

4.1.5 Phase III: Production, Deployment, and Operational Support. In the Production, Deployment, and Operational Support Phase, the system developed in the previous phases is produced and installed and any support required for operational use is provided. All tasks which were deferred until the Production Phase are addressed and action is initiated for their completion. These include efforts deferred in support areas such as, supply support (provisioning), technical publications and training. Systems engineering management will ensure on a continuing basis that the design is feasible and sound. Additionally, they will initiate, evaluate and integrate engineering changes throughout the Production Phase to provide the capability for continued support after the system is deployed. The evaluation of system Engineering Change Proposals (ECPs) and value engineering changes, and the preparation for turnover of system operation to the using service are important tasks to be accomplished during this phase. The need for continued system effectiveness and product assurance work as well as CM work will be based on the impact of engineering changes. Operation and Maintenance manuals, and supply support documents, are updated during this Phase and the finished system is tested and approved for DoD use.

4.1.5.1 Product Specifications. The product specification is the primary procurement control document used during the production phase to determine the product baseline, control design, and establish system performance. The content of the specifications is limited to requirements intended to control design and establish performance requirement of the purchased product. The SOW should not conflict with the product specification. Typical SOW requirements which should be tailored to the minimal Production Phase needs are: ILS, CM, technical manuals and publications, training, quality program requirements, calibration and instrumentation, reliability, maintainability, human factors, safety, Planned Maintenance Subsystem (PMS) and other contractor provided services needed in conjunction with the production buy. Many of these areas have already been addressed during the development phases and should now be well defined and documented. Some SOW tasks are no longer required, while others require continued effort or the introduction of new tasks compatible with the Production Phase.

4.1.6 Examples. Figure 7 provides a standard SOW format, and Appendix D illustrates an example of SOWs for both products and services. The example SOWs are intentionally incomplete in the interest of brevity.

4.2 Services (Non-personal). The product of a non-personal services SOW (Appendix D2) is the result of some work task being performed. The requirements that establish the work must be

defined in terms of work words and not product words. The need for non-personal services may occur at any time. If the work to be performed is painting a building, the task

STATEMENT OF WORK FORMAT

1 Scope. Include a statement about what this SOW covers. Some background information may be helpful to clarify the needs of the procurement.

1.1 Background. Do not discuss work tasks in Section 1.

2 Applicable Documents. All documents invoked in the requirements section of the SOW must be listed in this section by document number and title. These documents may include Standards, Specifications and other reference documents needed to identify and clarify the work task or deliverable product. However, DoD and Departmental Instructions are provided to control in-house work effort and should not be used in the SOW to control contractor effort. Also, any document listed in this section must be invoked and selectively tailored to meet minimal needs of the planned procurement in the requirements section. The exact version of any document cited in the SOW should be specified in this section.

2.1 Department of Defense specifications.

2.2 Department of Defense standards.

2.3 Other Government documents.

2.4 Industry documents.

3 Requirements. The arrangement of technical tasks and subtasks within the Requirements section will be dictated by program requirements. If a WBS is being used in the program, tasks should be arranged in accordance with that WBS. It may be helpful to have a general task to orient the planning and use of the subsequent subtasks. The following outline is a generalization. Care should be exercised to scope the program tasks to meet only the minimal needs for the phase SOW or requirements.

3.1 General.

3.2 Detail tasks.

3.2.1 System engineering.

a. Technical studies - including life cycle costs.

b. System effectiveness planning, for example, reliability, maintainability, and human factors.

FIGURE 7. SOW format.

must define what is to be painted and to what standards. The product of such a contract is obviously a building painted and completed by a certain time. If the SOW is prepared properly, contractor monitoring can be kept to a minimum as long as the task is completed on time and within cost. This would be a proper non-personal services contract. The Government is then left with the requirement to inspect the product and either accept or reject it based on the contractor's conformance to the prescribed work requirement. The wide variety of non-personal services requirements cause this type of contract to take on many forms. However, in all applications, two factors are important to ensure that the services purchased are indeed non-personal. These factors are: (a) the SOW must establish explicitly what work is to be done and require the delivery of a product or result other than periodic progress reports and (b) the contractor's employees must not be supervised or controlled by the Government during the execution of the work and production of the product or result. In this regard, the SOW must be explicit, inclusive and comprehensive in prescribing the work requirements. For a more complete discussion of a personal versus a non-personal services contract, refer to DFARS 237.104.

4.2.1 Product Definition. As the product or service becomes more involved and technical in nature, defining in adequate detail what is needed to enable a contractor to produce the product independently becomes more difficult. If the job is an analysis, the task must say precisely what is to be analyzed and the criteria for performing the analysis, including any particular elements to be considered. If some conclusion is to be drawn as a result of the analysis, be precise about what the DoD needs to obtain as a result of this analytic work. If it is important how or in what sequence the analysis is to be conducted, spell it out. Specify explicit needs, leaving nothing to the contractor's imagination.

4.2.2 Terminology. A frequent problem encountered in defining the tasks in an SOW is the use of non-specific words and phrases such as: “any”, “assist”, “as required”, “as applicable/as necessary” and “as directed”. Do not use any of these words. The following rationale for precluding their use is provided:

a. *Any.* "Any" is an ambiguous word. Writers may intend it to denote "plurality" and readers may interpret it to denote "oneness”. Also, when "any" is used to describe the selection of items from a list, it's the reader who does the selecting, not the writer. Which items, and how many the reader selects are beyond the control of the writer.

b. *Assist.* “Assist” connotes personal services. It infers working side-by-side, being subject to supervision. The word is totally undefined in terms of identifying the work and its range and depth. Spell out explicitly what the contractor must do.

c. *As required.* The result of this approach is an undefined work condition. It has no expressed limitations. It places the Government in a position of not expressing its minimal needs. It could lead to a debatable condition concerning the contractor's compliance with the contract or order. The SOW must be declarative as to its minimal needs.

d. *As applicable/As necessary.* If the Government does not know what is necessary or applicable, it must not leave to the contractor the responsibility for determining the minimal needs of the contract. The SOW should forthrightly state the requirements so that the contractor can comply with the requirement using his best efforts and expertise to accomplish the tasks.

e. As *directed.* This condition, as a part of a work task in a SOW, connotes a personal services situation in which the contractor is placed under direct supervision. "When directed" may be used in conjunction with a task order contract to indicate that specific tasks may be initiated at various times during the period of contracted performance.

f. *Including but not limited to.* This term is generally inserted when the drafter is unsure of requirement or criteria. However, it creates an unspecific requirement which creates ambiguity. Only list known requirements.

g. *Etc.* This word also introduces potentially more unidentified ambiguous requirements.

4.2.3 Word Usage. Another area of concern in establishing the SOW for non-personal services is the overuse of the words and phrases "support" and "engineering and technical services".

a. Support is an ambiguous term. Specify the specific type of support needed.

b. The terms "engineering and technical services" encompass a broad area of expertise. The SOW must state the minimal needs, even if it means broadening the work limitations to cover anticipated work tasks. For clarification, the SOW may include some examples of typical work to be done.

c. Perhaps one of the most vexing problems in contracting is the problem of loopholes. Contractors and inspectors go by the letter of the contract SOW. In one instance, an engineer intended to have a damaged roof edge repaired and repainted. He wrote "match existing," but did not specify "repaint." The contractors who did the work matched the existing metal flashing strip but refused to paint the new flashing. The inspector could only agree with the contractor, since the engineer had not adequately described what was intended. The writer and reviewers at all levels of review have a responsibility to ensure that loopholes do not exist in the final SOW.

5 STATEMENT OF OBJECTIVES (SOO) METHOD

5.1 SOO Introduction. The SOO is a Government prepared document incorporated into the RFP that states the overall solicitation objectives. It can be used in those solicitations where the intent is to provide the maximum flexibility to each offeror to propose an innovative development approach. Offerors use the RFP, product performance requirements, and SOO as a basis for preparing their proposals including a SOW and CDRL. Note: The SOO is not retained as a contract compliance item.

5.1.1 SOO Purpose. The program SOO should provide the basic, top level objectives of the acquisition and is provided in the RFP in lieu of a Government written SOW. This approach provides potential offerors the flexibility to develop cost effective solutions and the opportunity to propose innovative alternatives meeting the stated objectives. It also presents the Government with an opportunity to assess the offeror's understanding of all aspects of the effort to be performed, by eliminating the 'how to' instructions to accomplish the required effort normally contained in the SOW the Government provides to prospective offerors.

5.2 SOO Content. The Government may include a SOO as part of the RFP, listed in Section J, attached at the end of the RFP, or referenced in Section L and/or M, defining the top level program objectives. Alternatively, the SOO may be placed in Section L of the RFP (e.g., as an annex). Figure 8 provides a notional SOO format. It is developed to be compatible with the mission need statement (MNS); operational requirements document (ORD), technical requirements from the system requirements document (SRD)/systems specification; and the draft work breakdown structure (WBS)/dictionary. The SOO should address product oriented goals rather than performance requirements. SOOs are normally in the 2-4 page range. The SOO is not a one for one replacement of the SOW. Sections L and M should logically follow with instructions to the offerors asking for proposal information supporting the objectives and evaluation criteria that clearly identify how the offerors' responses will be evaluated. Each portion of the RFP must support one another. The key is to keep the SOO clear and concise and to provide potential offerors with enough information and detail to structure a sound program, designed to be executable and satisfy government objectives. The SOO is used, along with other information and instructions in the RFP, by offerors, to develop the contract work breakdown structure, statement of work, and other documents supporting and defining the offerors proposed effort. SOO content depends both on the type of program and on the program phase. It is possible that a 'mature' program, such as one which has been fielded for some time, could require slightly more detail in the SOO to properly integrate with other, ongoing parts of the program. The SOO is replaced at contract award in the contract by the proposed SOW.

1.0 Program Objectives

(a) multi-phased program
(b) one program, multi-contractor
(c) one phase contract

2.0 Contract Objectives (WBS 00000)

(a) Objectives in paragraph 2.0 are traceable to Level 0 WBS
(b) For multi-phase programs, describe objectives for each phase in a format similar to an indentured list (clearly indicate which phases are part of the anticipated contract and any phases that will involve separate contracts).

Note: The SOO should not address each WBS element, but each WBS element should be traceable to something in the SOO. For example, a SOO may instruct the bidder to address his engineering approach. That is not a particular WBS element, but several WBS elements might be created to breakout the engineering tasks. Generally, a broad and sweeping objective statement will trace to more WBS elements than would be the case for a very narrowly focused objective statement.

FIGURE 8. Notional Statement of objectives (SOO) format.

5.3 SOO Development Approach. A systematic process is essential for SOO development. The following steps are an integral part of that process:

a. Conduct market research to determine whether commercial items or nondevelopmental items are available to meet program requirements.

b. Review the requirement documents which authorize the program and define its basic objectives. Complete a risk assessment and expound the basic objectives of the program to incorporate the major technical and programmatic risks.

c. Review the various DoD/services/joint services requirements documents for program management, acquisition and control impact.

d. Prepare a bibliography citing the specific portions of all applicable governing instructions, directives, specifications and standards with which the program must comply. Keep these requirements to the absolute minimum.

e. Categorize the work described by the program WBS into that which will be done in-house and the objectives of that work which needs to be contracted.

f. For each RFP/contract defined, prepare a SOO from the objectives identified.

5.4 SOO-RFP Relationships.

a. Section L: Section L of the RFP must include instructions to the offeror that require using the SOO to construct and submit a SOW and CDRL. An example of such wording follows:

"The Statement of Objectives (SOO), included as (cite location of SOO in the RFP), provides the Government's overall objectives for this solicitation. Offerors shall use the SOO, together with other applicable portions of this RFP, as the basis for preparing their proposal, including the CWBS, SOW and CDRL. The offeror shall ensure all aspects of the SOO are addressed. The SOW should specify in clear, understandable terms the work to be done in developing or producing the goods to be delivered or services to be performed by the contractor. Preparation of an effective SOW requires both an understanding of the goods or services that are needed to satisfy a particular requirement and an ability to define what is required in specific, performance based, quantitative terms. The offerors understanding of both required goods/services, and work effort required to accomplish should be fully demonstrated in the offeror's proposed CWBS, SOW, and CDRL. For complex interrelationships among RFP/contract documents, use of a cross-reference matrix may be helpful (see figure 2 in Section 3 of this handbook).

The offeror shall use his proposed SOW to prepare a CDRL including appropriately tailored data item description references. The requirements listed below (if any) are known minimum Government data requirements. The offeror may include additional data requirements. All data requirements shall be traceable to specific tasks defined in the SOW. Each specific data requirement shall be selected from DoD 5010.12-L and specified on DD Form 1423.

(1) (cite minimum data requirements here if any)
(2) . . .
(3) . . ."

(End of Section L example wording.)

b. Section M: Evaluation Factors for Award should include sufficient criteria to:

(1) Evaluate the offeror's ability to successfully achieve the SOO objectives,
(2) Ensure a sound approach is proposed, and
(3) Verify that all requirements can be met.

The Government's intention to evaluate the proposed SOW should be stressed in both Section L and Section M. The offeror's proposed CWBS, SOW, and CDRL's will be evaluated as critical elements in assessing the offerors understanding of both required goods/services, and work effort required to accomplish them.

6 NOTES

6.1 Subject term (key word) listing.

Acquisition Plan (AP)
Contract Data Requirements List (CDRL)
Contract Line Item Number (CLIN)
Commercial off-the-shelf (COTS)
Data Item Description (DID)
Non-Developmental Item (NDI)
Operational Requirement Document (ORD)
Request for Proposal (RFP)
Statement of Objectives (SOO)
Statement of Work (SOW)
Work Breakdown Structure (WBS)
Work Breakdown Structure, Contract (CWBS)

6.2 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

APPENDIX A

ACRONYMS

ADM	Advanced Development Model
AMSDL	Acquisition Management Systems and Data Requirements Control List
AP	Acquisition Plan
ASP	Acquisition Strategy Panel
CDRL	Contract Data Requirements List
CLIN	Contract Line Item Number
CM	Configuration Management
COTS	Commercial off-the-shelf
CWBS	Contract Work Breakdown Structure
D&V	Demonstration and Validation
DAB	Defense Acquisition Board
DFARS	Defense Federal Acquisition Regulation Supplement
DID	Data Item Description
DoD	Department of Defense
ECP	Engineering Change Proposal
EDM	Engineering Development Model
EMC	Electromagnetic Compatibility
FAR	Federal Acquisition Regulation
FMS	Foreign Military Sales
ILS	Integrated Logistics Support
IPS	Integrated Program Summary
LSA	Logistic Support Analysis
LSAR	Logistics Support Analysis Records
MILDEP	Military Department
MNS	Mission Needs Statement
MTBF	Mean-Time-Between-Failure
MTTR	Mean-Time-To-Repair
NDI	Non-Developmental Item
ORD	Operational Requirement Document
PMS	Planned Maintenance Subsystem
R&D	Research and Development
RDT&E	Research, Development, Test, and Evaluation
RFP	Request for Proposal
SOO	Statement of Objectives
SOW	Statement of Work
SPEC	Specification
SRD	System Requirements Document
STD	Standard

T&E	Test and Evaluation
WBS	Work Breakdown Structure

APPENDIX B

WORK WORDS/PRODUCT WORDS

B.1 Select the key word that properly expresses the degree of contractor involvement. Specify what is to be done and the total nature of the work requirement. The word list provided in this Appendix is not complete but is provided to stimulate the thinking of the SOW writer by pointing out the critical differences in the meaning of work words versus the product words identified in connection with deliverable data.

B.2 Work words. When selecting the key work word that properly expresses contractor's involvement, the SOW writer must define explicitly the total nature of the work requirement in terms of what is to be done. In some cases, the "why" or the application of the results of the performed work may be stated if it clarifies the requirement. The following sample list contains words which have the inherent value of work. This list is offered as a reminder of the various shades of meaning conveyed by choice of words.

analyze	(solve by analysis)
annotate	(provide with comments)
ascertain	(find out with certainty)
attend	(be present at)
audit	(officially examine)
build	(make by putting together)
calculate	(find out by computation)
consider	(think about, to decide)
construct	(put together; build)
control	(direct; regulate)
contribute	(give along with others)
compare	(find out likeness or differences)
create	(cause to be; make)
determine	(resolve; settle; decide)
differentiate	(make a distinction between)
develop	(bring into being or activity)
define	(make clear; settle the limits)
design	(perform an original act)
evolve	(develop gradually, work out)
examine	(look at closely; test quality of)
explore	(examine for discovery)
extract	(take out; deduce, select)
erect	(put together; set upright)
establish	(set up; settle; prove beyond dispute)

estimate	(approximate an opinion of)
evaluate	(find or fix the value of)
fabricate	(build; manufacture, invent)
form	(give shape to; establish)

APPENDIX B

formulate	(to put together add express)
generate	(produce, cause to be)
identify	(to show or to find)
implement	(to carry out, put into practice)
install	(place; put into position)
inspect	(examine carefully or officially)
institute	(set up; establish, begin)
interpret	(explain the meaning of)
inquire	(ask, make a search of)
integrate	(to add parts to make whole)
investigate	(search into; examine closely)
judge	(decide; form an estimate of)
make	(cause to come into being)
maintain	(to keep in an existing state, to continue in, carry on)
manufacture	(fabricate from raw materials)
modify	(to change, alter)
monitor	(to watch or observe)
notice	(comment upon, review)
observe	(inspect, watch)
originate	(initiate, to give rise to)
organize	(integrate, arrange in a coherent unit)
perform	(do, carry out, accomplish)
plan	(devise a scheme for doing, making, arranging activities to achieve objectives)
probe	(investigate thoroughly)
produce	(give birth or rise to)
pursue	(seek, obtain or accomplish)
reason	(think, influence another's actions)
resolve	(reduce by analysis, clear up)
record	(set down in writing or act of electronic reproduction of communications)
recommend	(advise, attract favor of)
review	(inspection, examination or evaluation)
revise	(to correct, improve)
study	(careful examination or analysis)
seek	(try to discover; make an attempt)
search	(examine to find something)
scan	(look through hastily, examine intently)
screen	(to separate, present, or shield)

solve	(find an answer)
test	(evaluate, examine)
trace	(to copy or find by searching)
track	(observe or plot the path of)
update	(modernize, make current)

APPENDIX B

B.3 PRODUCT WORD LIST. Although Non-personal Services contracts may not result in data as a deliverable product, a large portion do. This list of product words is provided to assist in identifying those products.

agenda
audio visual aids
books
cards
certificates
charts
decks
disc-magnetic
documentation
drafts
drawings
drums-magnetic
equipment
files
findings
forms
guides
graphics
handbooks
illustrations
lists
ledgers
logs
manuals
manuscript
materials
minutes
outlines
proposals
pamphlets
plans
procedures
publications
recommendations
records
recordings
reproducible
reports
requests
sheets
specifications
standards
systems
tapes
transparencies

APPENDIX C

PHRASES HAVING MULTIPLE MEANINGS

C.1 This list of phrases having multiple meanings is provided as an example of those to be avoided.

To the satisfaction of the contracting officer,

As determined by the contracting officer,

In accordance with instructions of the contracting officer,

As directed by the contracting officer,

In the opinion of the contracting officer,

In the judgment of the contracting officer,

Unless otherwise directed by the contracting officer,

To furnish if requested by the contracting officer,

All reasonable requests of the contracting officer shall be compiled with,

Photographs shall be taken when and where directed by the contracting officer.

In strict accordance with,

In accordance with best commercial practice,

In accordance with best modern standard practice,

In accordance with the best engineering practice,

Workmanship shall be of the highest quality,

Workmanship shall be of the highest grade,

Accurate workmanship,

Securely mounted,

Installed in a neat and workmanlike manner,

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Skillfully fitted,

Properly connected,

Properly assembled,

Good working order,

Good materials,

In accordance with applicable published specifications,

Products of a recognized reputable manufacturer,

Tests will be made unless waived,

Materials shall be of the highest grade, free from defects or imperfections, and of grades approved by the contracting officer.

Kinks and bends may be cause for rejection,

Carefully performed,

Neatly finished,

Metal parts shall be cleaned before painting,

Suitably housed,

Smooth surfaces,

Pleasing lines,

Of an approved type,

Of standard type,

Any phrases referring to "The Government inspector".

APPENDIX D - STATEMENT OF WORK EXAMPLES

APPENDIX D1: EXAMPLE SOW FOR PRODUCTS

APPENDIX D2: EXAMPLE SOW FOR SERVICES

APPENDIX D1

EXAMPLE SOW FOR PRODUCTS

1 SCOPE. This Statement of Work (SOW) defines the effort required for the design, engineering development, fabrication, and test of an Advanced Development Model (ADM) of the _____ System for the Program Definition and Risk Reduction Phase. It includes the associated program management, human engineering, and logistic support planning requirements.

1.1 Background. The _____ program has been initiated to design, develop, produce, and deploy an _____improved system that will fulfill the_____ requirements as specified in Operational Requirement No._____. The _____ System will replace the XYZ System, and will significantly improve _____ capabilities. The _____ System specification for the ADM was developed during the Concept Exploration Phase conducted over the past two years. Upon successful testing and acceptance of the ADM developed during this Program Definition and Risk Reduction Phase, it is intended to obtain Department of Defense approval to competitively procure Engineering Development Models (EDMs) using performance specifications and program plans developed under this SOW.

2 APPLICABLE DOCUMENTS. The following documents are applicable to this Statement of Work and attached appendices to the extent specified herein.

2.1 Department of Defense Specifications.
(List documents as appropriate.)

2.2 Department of Defense Standards
(List documents as appropriate.)

2.3 Availability of DoD Documents. Unless otherwise indicated, copies of specifications, standards and handbooks listed above are available from the Standardization Document Order Desk, 700 Robbins Ave, Bldg 4D, Philadelphia PA 19111-5094

2.4 Non-Government standards and other publications.
(List documents as appropriate.)

2.5 Availability of Non-Government standards and other publications. Application for copies should be addressed to the (name and address of the source).

3 REQUIREMENTS.

3.1 General. The work required by this contract shall be performed in accordance with _____ System Specification (#) and this Statement of Work (SOW).

APPENDIX D1

The contractor shall design, develop, fabricate, and test an Advanced Development Model as listed in Section C of this contract to meet the performance criteria specified by _____ System Specification (#) and in accordance with the detailed requirements in paragraph 3.2.1 below.

The contractor shall provide program management, human engineering management, and logistic support planning in accordance with the detail requirements of 3.2.2 below.

3.2 Detail Tasks.

3.2.1 Design, Engineering, Fabrication and Test.

3.2.1.1 Design and Engineering. The contractor shall design and develop an ADM of the _____ System to meet the specification and criteria of _____ System Specification (#) utilizing engineering trade-offs between performance, reliability, maintainability, supportability, producibility, and life cycle costs. The _____ System design shall include the equipment performance and physical characteristics, subsystem component location, materials, the software program design elements of a top-down design, basic module description, and interface design.

3.2.1.2 Design Analysis. The contractor shall conduct a detail design analysis of the selected design. Detailed physical and performance design characteristics shall be specifically identified including the engineering decision process for using one methodology over another. Design documentation shall include discussion of alternatives and the ramifications thereof, risk assessments, and trade-offs made.

3.2.1.3 Preliminary Design Review (PDR) and Design Formalization. The contractor shall conduct a Preliminary Design Review. Informal design reviews may be held at times agreed to by the Government and the Contractor.

As a result of the design analysis conducted in paragraph 3.2.1.2 and the PDR in 3.2.1.3, the contractor shall finalize and formalize the design for fabrication. Written procuring activity approval of the design is required before the contractor is authorized to proceed with ADM fabrication.

3.2.1.4 Fabrication. The contractor shall correct and document any design characteristics that are found to inhibit or make fabrication unnecessarily costly but that do not otherwise alter performance or system effectiveness characteristics.3.2.1.5 Test and Evaluation. The contractor shall conduct and evaluate the results of environmental and performance tests on the ADMs to demonstrate full compliance of all equipment and software with _____ System Specification (#). The tests shall be conducted in accordance with the developmental test plan developed by

the contractor and approved by the Government. The tests may be conducted at the contractor's facilities or at an independent laboratory or commercial testing facility.

APPENDIX D1

3.2.1.6 Critical Design Review (CDR). The contractor shall conduct a Critical Design Review. At the CDR, the contractor shall formally report the results of the developmental tests, address design changes made during the fabrication process, and recommend design changes as a result of the developmental tests including trade-off impacts. The contractor shall incorporate all design changes approved during the CDR.

3.2.2 Program Planning

3.2.2.1 Program Management. The contractor shall establish and maintain management operations that shall include the following areas:

(a) Program Planning and Control
(b) Subcontractor Control
(c) Financial Management
(d) Data Management
(e) Management and Accountability for Government Furnished Equipment, Material or Information.
(f) Risk Management

The contractor shall develop and implement a Management Program that clearly defines how the _____ Program Definition and Risk Reduction Project will be managed and controlled. A task matrix keyed to the Work Breakdown Structure (WBS) shall be developed in sufficient detail to identify Contractor and subcontractor responsibilities. The Contractor shall develop and implement a management program that clearly defines how the _____ Program Definition and Risk Reduction Project will be managed and controlled.

The contractor shall establish and implement a program management office function to manage all technical performance, including reliability, maintainability, ILS, cost, schedule, and data delivery requirements of the contract.

3.2.2.2 Human Engineering Program. The contractor shall develop and implement a Human Engineering Program (HEP) to ensure that appropriate studies are performed and that human engineering criteria are applied to subsystem hardware and computer software design.

3.2.2.3 Logistic Support Planning. The contractor shall implement an ILS program to ensure that supportability design criteria and characteristics are considered and incorporated into the design consistent with the trade-off studies and that meet the operational availability

requirements of _____ System Specification (_#_). The ILS program shall use a Logistic Support Analysis (LSA) as the principal analytic effort within the design process.

APPENDIX D2

EXAMPLE SOW FOR SERVICES

1 SCOPE. This SOW covers systems engineering, technical and management support services to the _____ Program Office This support encompasses engineering analysis and recommendations for technical logistical and life cycle support for _____ system.

2 APPLICABLE DOCUMENTS.

3 REQUIREMENTS.

3.1 Production Support.

3.1.1 Conduct independent review of _____ production programs to identify requirements consistent with directives governing the acquisition of system and equipment.

3.1.2 Using acquisition plans, existing hardware contracts and inherent lead-time items, construct schedules for inclusion in documentation for weapon system and equipment acquisitions.

3.1.3 Based on production program schedules as well as weapon system configurations, formulate technical documentation for these programs itemizing all supplies, data and services to be obtained.

3.1.4 Provide impact statements when deviations or changes occur and alternative recommendations when required to maintain individual program production integrity.

3.1.5 Identify, compile, and utilize available information, update and input data for manual or automated production scheduling information systems, prepare government production reports germane to maintaining weapons system production status and inventory.

3.1.6 Prepare production documentation for input into the applicable Management Information System (MIS).

3.1.7 Prepare recommendation for identifying project data to be entered into existing Automatic Data Processing (ADP) programs. When data system deficiencies are discovered, provide recommendations for solutions.

3.2 Foreign Military Sales (FMS) Support.

3.2.1 Compare actual deliveries with contract schedules for Military Departments (MILDEP) and FMS.

3.2.2 Track components and deliverable end items, and compile monthly acceptance reports and quarterly production reports. Consolidate delivery schedules by fiscal year, weapons, components, support equipment and manufacturer.

3.2.3 Compare schedule with industrial capacities and weapon station buildup capabilities and identify shortcomings and problem areas in meeting these requirements.

3.2.4 Correlate consignment instructions, acceptance reports and production/weapon build-up capabilities.

3.2.5 Maintain and track material inspection receiving reports status reports of system components and support equipment.

3.3 MILDEP Support.

3.3.1 Identify unique MILDEP requirements for the system, its components and associated equipment, based on MILDEP production planning and production support requirements.

3.3.2 Compare current MILDEP acquisition plans and project directive with MILDEP delivery and performance requirements to identify firm and provisioned requirements by component and associated support equipment.

3.3.3 Determine the compatibility of requirements, military specifications and engineering documentation with MILDEP standard and specifications.

3.3.4 Provide recommendations to incorporate MILDEP stated requirements into the overall program schedules. Correlate and maintain the status of MILDEP monthly status reports thereof.

APPENDIX E

EXAMPLE SOO

E.1 Refer to Figure 8 in the body of this document for a general example. For specific examples of SOOs, contact Air Force Custodian - Code 10 (see DoD Standardization Directory (SD-1), which has all Preparing Activity codes, addresses, and telephone numbers).

Custodians:
Army - CR
Navy - EC
Air Force - 10

Review activities:
Army - AT
Navy - SH, AS, MC
Air Force - 11, 13

User Activities:
Army - SC
Navy - YD

Preparing activity:
Navy - EC
(Project Number MISC-0214)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-HDBK-245D

2. DOCUMENT DATE (*YYMMDD*))
960403

3. DOCUMENT TITLE
PREPARATION OF STATEMENT OF WORK (SOW)

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed* .)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include Zip Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial (2) AUTOVON (*if applicable*)	7. DATE SUBMITTED (*YYMMDD*)

8. PREPARING ACTIVITY

a. NAME
COMMANDER,
SPACE AND NAVAL WARFARE
SYSTEMS COMMAND (SPAWAR 05L1)

b. TELEPHONE ((Include Area Code)
(1) Commercial
(703) 602-7234

(2) AUTOVON
332-7234

c. ADDRESS (Include Zip Code)

2451 CRYSTAL DRIVE
ARLINGTON, VA 22245-5200

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340

[24] Templates for Streamlining Acquisitions

AMC PAMPHLET 70-25

Research, Development, and Acquisition

TEMPLATES FOR STREAMLINING ACQUISITIONS

GUIDE FOR DETERMINING STREAMLINED FUNCTIONAL REQUIREMENTS FOR ARMY ACQUISITION PROGRAMS

HEADQUARTERS, UNITED STATES ARMY MATERIEL COMMAND, 1 JULY 1990

AMC PAMPHLET 70-25

Research, Development, and Acquisition

TEMPLATES FOR STREAMLINING ACQUISITIONS

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HEADQUARTERS, UNITED STATES ARMY MATERIEL COMMAND, 1 JULY 1997

*AMC-P 70-25

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY MATERIEL COMMAND
5001 EISENHOWER AVENUE, ALEXANDRIA, VA 22333-0001

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GUIDE FOR DETERMINING FUNCTIONAL REQUIREMENTS FOR ARMY ACQUISITION PROGRAMS

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CHAPTER 1

INTRODUCTION

1.1 PURPOSE

This guide is to assist Program Executive Officers (PEO), Project managers (PM) and Army Materiel Command (AMC) Commanders in determining the minimum essential functional requirements for a streamlined acquisition program. Users should think about specific functional requirements and to question perceived solutions to those requirements, particularly those that create needs for functional oversight and add contract costs, but result in little or no value to the acquisition program.

1.2 CONCEPT

The Functional Templates are used to consider, at the earliest stages of an acquisition program, as streamlined approaches compared to the traditional methods of specifying all functional requirements. The streamlined approaches focus on improved methods of describing functional requirements, resulting in reduced oversight, inspections, and cost.

1.3 OBJECTIVES

This guide describes the Functional Template application process. The templates can be used to evaluate program requirements in an organized manner and minimize functional oversight work load.

1.4 TEMPLATE APPLICATION

The templates should be applied in the initial stages of a program to structure the framework for the acquisition strategy. The templates may be tailored to adjust program needs and management structures. This application will establish initial functional requirements.

For programs with established acquisition strategies, the templates can be applied when a solicitation is prepared. Examples of how to apply the templates to develop language for streamlining solicitations are presented in Chapter 5, Applications of Templates in Solicitations.

CHAPTER 2

BACKGROUND

2.1 FUNCTIONAL SPECIALIZATION

Both the government and defense industry have organizations which are functionally specialized. Each acquisition program requires a wide variety of functional support for its execution. Government functional specialists, through experience, continue to evolve more rules and practices for applying their functional areas to acquisition programs.

Through iterative applications of lessons learned, the functional practices tend to become more detailed and restrictive on the contractors. As these more stringent practices evolve, the boundaries between functional areas become more distinct, often leading to the functions being described as stovepipes. Although they may have assured the delivery of quality products at one time, these functional specialization practices significantly increase defense acquisition costs, make it very difficult for defense industry to adopt commercial practices, create barriers to commercial firms participating in defense work, and obstruct the flow of advanced technology between the defense and commercial industrial sectors.

2.2 ARMY ACQUISITION GOALS

The U.S. Army is pursuing the following goals:

a. Integrate the U.S. defense and commercial industrial sectors to achieve an efficient industrial base.

b. Remove barriers that prevent defense industry from making full use of commercial markets to support the industrial base.

c. Produce the highest quality solicitations and reduce unnecessary, non-value-added, government-imposed requirements.

d. Select and award contracts to the highest quality, best value contractors.

2.3 ACQUISITION REFORM INITIATIVES

In acknowledgment of the above goals, the Department of Defense initiated major acquisition reforms. Acquisition reform encourages the use of integrated product teams to manage risks in lieu of an independent functional approach to risk avoidance. Risk management uses such techniques as teaming, functional integration, performance specifications, contractor flexibility, commercial practices, process controls, best value contracting and past performance.

CHAPTER 3

FUNCTIONAL SUPPORT CATEGORIES

3.1 INTRODUCTION

Functional requirements for acquisition programs can be classified into four primary categories. These are **engineering management, specialty engineering, integrated logistics support, and risk management.** Each of these categories can be further subdivided, as indicated in the paragraphs below. All of these functional areas were categorized from analysis of the statements of work in several solicitations prepared by the subordinate commands of the Army Materiel Command. These categories and subcategories normally describe the minimum essential functional requirements.

3.1.1 ENGINEERING MANAGEMENT

Engineering management areas include systems engineering, engineering data and specifications, configuration management, and life cycle software engineering.

3.1.2 SPECIALITY ENGINEERING

Specialty engineering includes reliability, availability and maintainability; safety; environmental/pollution prevention; packaging and transportability; manufacturing and producibility; MANPRINT and human factors; value engineering; parts control; electromagnetic environmental effects; and special support and test equipment.

3.1.3 INTEGRATED LOGISTICS SUPPORT

Integrated logistics support includes integrated support planning, logistics support analysis, technical publications, provisioning, and training.

3.1.4 RISK MANAGEMENT

Risk management includes program management, system test and evaluation, and quality assurance.

3.2 PROGRAM APPLICATION

The application of the functional specialties will vary by the type of commodity, life cycle phase, type of contract, extent of competition and acquisition strategy. For each application, there may also be tailoring of the many specific requirements found within each functional area to fit the characteristics of the acquisition program. Requirements for these functional areas will invariably be included in advanced development, engineering and manufacturing development, and production contracts in some form.

CHAPTER 4

TEMPLATES AND THEIR RATIONALE

4.1 INTRODUCTION

All rationales are predicated on using the concept of best value in executing programs. Emphasis is placed on assessing the value added to the accomplishment of the program goals when data requirements are included in solicitations and contracts.

4.2 ENGINEERING MANAGEMENT

Success can be achieved in these functional areas if the contract specifies "what" is required and relies on performance specifications which provide a contractor more responsibility and flexibility to meet the government's needs.

4.2.1 INTEGRATED PROGRAM MASTER PLAN

a. A contractor's systems engineering ability and his/her past performance are evaluated during source selection. If the contractor is deemed capable of satisfying the requirements at this point, government oversight and review requirements can be minimized. Thus, the contractor is required to demonstrate his/her capability and past performance in the response to the request for proposal.

b. The contractor is required to incorporate his/her approach to accomplish functional requirements into an Integrated Program Master Plan. The contractor is no longer required to submit his/her program plans for government approval. Also, great care is used to not compromise the contractor's responsibility for design through government approval of incremental design review results. Government participation in design reviews focuses on determining that the contractor is demonstrating satisfactory accomplishment of the process.

c. Integrated Product and Process Management are used to achieve integration of all functional requirements and to prepare an "integrated" request for proposal. This type of proposal motivates the contractor to use multidisciplinary management techniques in preparing his/her response. We also establish an Integrated

Project Team (IPT) led by a program manager. The IPT conducts integrated program reviews where the whole team participates as a body. This greatly minimizes separate functional-only reviews.

d. The contractor is required to employ maximum use of simulation and modeling in the design process. The government is willing to accept results of simulation and modeling for continuing use in subsequent design iterations and in lieu of, or to compliment, hardware test and demonstrations. This reduces risk and cost by providing for more rapid design iteration and alternatives for accelerating testing.

e. Performance specifications are used instead of detailed technical specifications. A properly constructed performance specification can assure the government a quality product at reduced cost and greatly reduce government oversight and contract administration. In addition, the use of performance specifications allows the contractor to become more efficient in manufacturing operations; to incorporate product enhancements; and to reduce both direct and indirect costs associated with product manufacture.

f. Utilizing the principles of Cost as an Independent Variable (CAIV), Acquisition strategies must set aggressive, achievable cost constraints. Only key critical performance parameters will be established. Other system performance parameters must be defined in terms of "Thresholds" and "Objectives." Acquisition requirements packages need to provide contractors the flexibility to propose an optimum combination of system performance requirements while not exceeding the cost constraints.

INTEGRATED PROGRAM MASTER PLAN TEMPLATE

• Government Integrated Product Teams are used to prepare integrated system performance specification and contract statement of work.

• System performance specifications are utilized. Interface control requirements are included in specification.

• Contractor required to describe his approach to integrated program management and all relevant previous experiences in response to request for proposal. Government does not require submission of post award Systems Engineering Management plan. Progress assessed at periodic integrated reviews.

• Contractor retains design responsibility throughout contract. Government does not "approve" design status at design reviews, but reviews IPMP process.

• Design to cost considerations are integrated with design engineering efforts. No program plans are required.

• Functional reviews are integrated and scheduled concurrently with prime contractor management reviews.

• Acquisition requirements packages need to provide contractors maximum flexibility to achieve system performance specification requirements without exceeding cost constraints.

4.2.2 ENGINEERING DATA AND SPECIFICATIONS

a. Buying "build-to-print" technical data packages and avoiding expending large in-house resources on their upkeep is to be avoided. Detailed product drawings and specifications are replaced by the use of performance specifications, supplemented by drawings and specifications, only if needed. Further, only that data needed for competition is acquired. In all cases, commercial drawing formats are encouraged and the contractor maintains all the technical data throughout the contract.

ENGINEERING DATA AND SPECIFICATIONS TEMPLATE

• Government's essential requirements are defined on the basis of performance characteristics. Performance specifications take precedence over drawing packages, generally provided as advisory only.

• Performance specifications are supplemented with drawings and process control specifications, if needed to fully define item.

• Performance specifications are required to the lowest work breakdown structure selected for breakout. Breakout decision is integrated part of design process.

• Commercial drawings are used to the maximum possible extent.

• The contractor is required to maintain the Technical Data Package (TDP) for the life of the contract.

• The Government only requires delivery of the portions of the TDP required to support breakout and spares procurement. Has option to take delivery of contractor's drawing package, if required.

4.2.3 CONFIGURATION MANAGEMENT (CM)

a. Coupled with use of the performance specification, the contractor retains control of the system configuration throughout the development and production of the system. The government retains control of those changes that affect form, fit, function and interchangeability requirements of the performance specification.

b. Another aspect of control is for the government to protect against the possibility of having to procure spare parts from a sole-source contractor if there were no technical data available. To counter this situation, there may be a contractual requirement that the contractor deliver a current drawing package to the government at the Government's option with the right to procure the parts in the competitive market, using the same performance requirements as the prime contractor does with his/her subcontractors. The alternative to buying this data is to develop

performance specifications for each spare part. These performance specifications may then be used to competitively process the parts.

c. Yet another aspect of configuration control is that the government must ensure any contractor’s changes made to improve the system do not negate support for systems produced earlier or render obsolete the spares and repair parts already in the support system. To ensure satisfaction of this requirement, the government must use interchangeability and interoperability criteria as key elements of its control, and these must be clearly spelled out as part of the contractual requirements.

d. Under a performance specification approach, the government's primary requirement becomes the performance of the system, i.e., does it meet the requirements of the specification. The "appearance" of the system is less important, since the contractor is free to make changes, as long as the changes do not breach the performance requirements of the specification. As a result, requirements for a Physical Configuration Audit may no longer apply, whereas the results of a Functional Configuration Audit become a key measure of contractor compliance with the requirements of the performance specification.

e. The burden of configuration status accounting will rest with the contractor. The government would not, as a matter of course, have visibility below the level of the configuration item, unless there are changes to the performance specification. As a result, the contractor will be operating under a system that provides for approved configuration item documentation, the status of proposed and approved changes to that documentation, the status of waivers and deviations, and the configuration of all end items produced under the configuration items. Automated data transfer systems shall be used by both contractor and government in lieu of "paper" systems.

CONFIGURATION MANAGEMENT TEMPLATE

• Prime contractor maintains configuration control and status accounting by using commercial practices throughout the contract.

• Government maintains control of system performance specifications.

• Prime contractor describes CM system in response to Request For Proposal (RFP).

• Interchangeability and interoperability criteria are clearly spelled out as contractual requirements to be controlled by the government.

• Functional Configuration Audit key measure of contractor compliance with performance specification requirements.

• CM status included in integrated reviews.

4.2.4 LIFE CYCLE SOFTWARE ENGINEERING

a. In today's global economy, industry standardization efforts are driven primarily by market demands. In view of this trend, the Army needs to take advantage of existing and emerging industry software standards and processes. This approach will enable the Army to maintain a technical edge by broadening the supplier base and capitalizing on the latest industry technologies. Thus, the use of commercial standards, products, industry software processes, Contractor Off The Shelf/Non-Developmental Item (COTS/NDI) software and intensified software reuse for development and support of computer resources for Army systems is emphasized.

b. Software development is streamlined consistent with the complexity and program risk. Contractors are required to utilize a disciplined software development approach which minimizes the need for extensive documentation.

c. The extent of government oversight on the software development effort is based on the maturity level of the contractor's software development capability. If the contractor has

experience in software development and knows how to comply with the government's requirements, then reduced oversight is acceptable.

d. The contractor is held completely responsible for the design effort. The government now reviews the software development processes and their results and advises the contractor on deficiencies.

e. In line with total contractor responsibility, a separate software quality assurance program is not required. Quality is an integral requirement for design and methods of assuring software quality are a matter for the contractor to decide. Government risk is managed by observing and reviewing the contractor's software testing and verification and validation activities.

f. To achieve affordable postdeployment software support, the design requirement for facilitation of software reengineering and fielding of new versions to make software support more efficient should be considered. In addition, transition of postdeployment software support to the government should be scheduled at the latest possible time. However, planning for software support should be initiated during the formulation of the acquisition strategy.

LIFE CYCLE SOFTWARE ENGINEERING TEMPLATE

• Utilize commercial standards for software development management tasks and processes as guidance.

• Apply only minimum essential requirements consistent with the complexity of the software development effort.

• Place software development responsibility on the contractor. Government does not "approve" software designs during incremental reviews.

• Government oversight and documentation requirements are tailored to maturity level of contractor's software development capability.

• Contractor is required to perform software verification and quality assurance functions. Government does not perform independent verification and validation of software.

• Contractor provides software support for duration of development and production contracts. Support is transitioned to government upon completion of production.

• Software development and support status is included in periodic integrated reviews.

4.3 FUNCTIONAL ENGINEERING

In the functional engineering specialties, the contractor is provided the maximum flexibility to achieve system performance specification requirements. Government review and oversight has traditionally been excessive and not really necessary for accomplishing the requirements.

4.3.1 RELIABILITY, AVAILABILITY, MAINTAINABILITY

Best value source selection focuses on technical capabilities of contractors. The government's risk of nonperformance of reliability, availability, and maintainability with a technically capable contractor will be reduced. The government, rather than specifying in detail, requires the contractors to describe how they would meet the requirements in responses to the request for

proposals. This gives the government the opportunity to assess technical capability and tailor program tasks and oversight accordingly. Also, past performance evaluations during the source selection process can look at areas of relevant contractor past experience and be used to reduce requirements and oversight.

RELIABILITY, AVAILABILITY AND MAINTAINABILITY TEMPLATE

• Tailor RAM program tasks to characteristics of acquisition (commercial, NDI, development, production, sole source, competitive).

• Require contractor to describe the tasks needed to meet RAM requirements in response to RFP. Do not require a post award RAM plan.

• Analyze during past performance evaluation reliability test data on similar systems manufactured by contractor to reduce testing on system being procured.

• Hold contractor responsible for meeting RAM requirements. Do not approve plans and reports. Do not hold separate RAM reviews.

• Make RAM demonstration an option. If the contractor has a history of exceeding RAM requirements and if RAM growth has consistently exceeded the planned growth during development, a RAM demonstration should not normally be required.

• Include RAM status in periodic integrated reviews.

4.3.2 SAFETY

Safety activities (i.e., plans, audits, reports, etc.) are the IPT safety issues and analysis results are included in the comprehensive program/design reviews.

SAFETY TEMPLATE

• Specific safety engineering requirements are included in the system performance specification, along with methods to determine.

• Specific radiological requirements and constraints are included in the system performance specification, including methods to determine compliance.

• Results of safety hazard analyses and assessments are presented at periodic integrated functional reviews.

• Comprehensive data associated with the hazard analyses and assessments are available for on-site review by government to facilitate review.

4.3.3 ENVIRONMENTAL

a. Environmental considerations (hazardous materials, pollution prevention, noise reduction, etc.) are an integral part of the IPT activities. Environmental considerations are tending to evolve more and more into a separate functional specialty.

b. The preferred approach to achieving environmental requirements is to place the responsibility firmly on the contractor. This can be done by including those requirements in the system performance specification. The risk of contractor nonperformance is managed by having environmental considerations addressed at integrated program reviews, not by a separate program plan and status reports.

ENVIRONMENTAL TEMPLATE

• Contractor is required to describe approach to preventing generation of, or controlling environmental hazards in system development and production in response to RFP. Do not require post award program plan.

• Specific environmental requirements are in system performance specification, including methods of determining compliance.

• Status of environmental engineering is addressed at periodic integrated functional reviews.

4.3.4 PACKAGING AND TRANSPORTABILITY

a. Unless carefully specified, packaging requirements can easily become excessive. For example, the situation where elaborately packaged parts are shipped to a depot, opened, and the parts stored in supply bins should be avoided. Packaging requirements should be carefully tailored to the intended environment which the package will incur. The contractor should use best commercial packaging practices when they meet military needs.

b. Excessive oversight is avoided by giving the contractor flexibility to meet the packaging requirements of the system performance specification. Monitoring progress can be reviewed through the IPT process.

c. Overspecification of transportability requirements should be avoided. The contractor’s progress in meeting transportability requirements can be reviewed by the IPT.

PACKAGING AND TRANSPORTABILITY TEMPLATE

• Specific transportability requirements are in system performance specification, including methods of determining compliance. Do not require program plan.

• Specific packaging requirements are in system performance specification, including methods of determining compliance. Do not require program plan.

• Packaging requirements are tailored to end use of package.

• Best commercial packaging processes that meet needs are permitted.

• Packaging and Transportability Engineering status is included in periodic integrated functional reviews.

4.3.5 MANUFACTURING AND PRODUCIBILITY

a. Commercial industries have clearly demonstrated the benefits of integrating manufacturing and producibility considerations into the design process. More robust designs can be achieved by developing the product and its manufacturing processes concurrently.

b. Integrated product and process development will not occur if all functional engineering requirements are not integrated. As with other specialty engineering areas, the practice of specifying detailed management plans, reviews and reports sends the wrong signal to the contractor. It is sufficient to require the contractor to develop products and processes concurrently, and then assess his/her process in doing so in periodic integrated reviews.

MANUFACTURING AND PRODUCIBILITY TEMPLATE

• Integrate manufacturing and producibility design considerations during development through concurrent engineering concepts.

• Do not require post award Producibility Engineering Planning or Manufacturing program plans.

• Independent assessments of Production Readiness Reviews eliminated. PEO approves PRR results.

• Producibility and manufacturing planning status included in integrated functional reviews.

4.3.6 MANPRINT AND HUMAN FACTORS

a. The inclusion of MANPRINT and human engineering requirements in the system performance specification and the tailored application of these requirements in the contract should be sufficient guidance for a reputable contractor to accomplish these requirements. The generation of program plans, reviews and reports by the contractor add little value to his/her ability to achieve the specification requirements.

b. The contractor's progress toward meeting the specification requirements for human factors can be assessed by the IPT using the results of contractor tests and demonstrations.

MANPRINT AND HUMAN FACTORS TEMPLATE

• Specific MANPRINT/Human Factors Engineering requirements are included in the system performance specification, along with methods of determining compliance.

• MANPRINT/Human Factors Engineering status is presented at periodic integrated functional reviews.

4.3.7 VALUE ENGINEERING (VE)

a. Value Engineering (VE) is the principal process to incentivize the contractor to upgrade the government’s legacy technical data packages. The VE concept should be aggressively used to insert modern technology into these legacy technical data packages to reduce the production and operating and support costs. Contractor value engineering efforts (VECP) can also be assessed during program reviews.

VALUE ENGINEERING TEMPLATE
Standard VECP clause is included in prime contracts.

4.3.8 PARTS CONTROL

a. When a parts control program is desirable, it should be tailored to the acquisition characteristics. For example, when buying a commercial item, it is not realistic to expect the contractor to use standard parts when the system has already been designed. In these cases, the contractor is required to recommend which of the existing parts to accept as standard parts. The government then uses the contractor drawings and specifications to review these parts.

b. In cases where the contractor is in the process of designing a system and parts control, the use of standard parts are required whenever possible. If it is not possible, the nonstandard parts must be documented and approved by the government. The government should accept the contractor's drawings and specifications to accomplish this review.

PARTS CONTROL TEMPLATE
• Contractor drawings and specifications are used for reviewing nonstandard parts requested.

4.3.9 ELECTROMAGNETIC ENVIRONMENTAL EFFECTS

Since system specifications usually contain requirements and compliance methods for electromagnetic effects, oversight is tailored to

provide the contractor flexibility. This effort is also integrated by the IPT to ensure proper design consideration and to optimize testing. Review of these activities is accomplished during the IPT reviews.

ELECTROMAGNETIC ENVIRONMENTAL EFFECTS TEMPLATE

• Requirements are included in system performance specification, including methods of determining compliance.

• Testing is integrated within the overall contractor testing program.

• Status is addressed at periodic integrated functional reviews.

4.3.10 SPECIAL SUPPORT AND TEST EQUIPMENT

a. Emphasis is placed on using commercial support and test equipment or existing government-owned equipment and facilities to avoid proliferation of different makes and models in the inventory. Design of any special support or diagnostic equipment is fully integrated with the design effort of the system. The use of build-in test capabilities is considered for potential costs saving.

b. The use of performance specifications places the responsibility for special support and test equipment on the contractor. All requirements and limitations are included in the performance specification. The government could then limit its oversight to reviewing status at periodic integrated reviews.

SPECIAL SUPPORT AND TEST EQUIPMENT TEMPLATE

• Requirements are integrated in systems engineering effort. Same design and documentation processes are used.

• Commercial equipment is used to maximum possible extent.

• Requirements are included in system performance specifications. Contractor given total responsibility for design, documentation, testing and control.

• Government reviews status at periodic integrated functional reviews.

4.4 INTEGRATED LOGISTICS SUPPORT

a. For integrated logistics support requirements, the templates are based on the premise that a best value contractor will be capable of meeting these requirements without the traditional levels of government review and approval. Contractor capability to perform integrated logistics support requirements can be evaluated through consideration of past performance evaluations in source selection. Government risk management efforts can then be tailored based on the contractor's assessed capability.

b. The selection of a support concept will drive all subsequent government and contractor activities in the areas of integrated support planning, logistics support analysis, technical publications, provisioning and maintenance training. The support concept may call for organic support, contractor logistics support, or a combination of both. In addition to the actual support concept chosen, government and contractor integrated logistics support efforts will also be influenced by whether the strategy is to acquire existing commercial or nondevelopmental items, or to undertake a new development. Government risk management efforts must also be tailored to account for these aspects.

INTEGRATED SUPPORT PLANNING TEMPLATE

• Require contractor to describe his past performance of integrated support planning in response to request for proposal. Tailor requirements for plans, reviews and reports to contractors' capability.

• Tailor planning requirements to the support concept specified in acquisition strategy.

• Minimize separate functional planning conferences by including progress reporting in periodic integrated functional reviews.

LOGISTICS SUPPORT ANALYSIS TEMPLATE

• Tailor the requirements for delivery of Logistics Support Analysis Records documentation based on contractor's demonstrated capability to perform analysis.

• Minimize guidance conferences and reviews by including progress reporting in periodic integrated functional reviews.

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TECHNICAL PUBLICATIONS TEMPLATE

• Utilize commercial off-the shelf manuals to maximum extent.

• Utilize joint contractor/government validation.

• Minimize guidance conferences and reviews by including progress reporting in periodic integrated functional reviews.

PROVISIONING TEMPLATE

• Require contractor to describe past performance of provisioning in response to request for proposal. Tailor requirements for plans, reviews and reports to contractor's capability.

• Minimize provisioning conferences by including progress reporting in periodic integrated functional reviews.

MAINTENANCE TRAINING TEMPLATE

• Require contractor to describe past performance of maintenance training course development. Tailor requirements for plans, reviews and reports to contractor's capability.

• Government participate in contractor validation and verification activities to avoid separate government inspections.

• Minimize training conference by including progress reporting in periodic integrated functional reviews.

4.5 RISK MANAGEMENT

a. Risk management includes those activities required to assure efficient management of the acquisition program, determine the degree to which system specification and operational requirements have been met, assess risks in proceeding to the next phase of the program (including mission impact of any requirements not met), and verifying that all contract tasks have been accomplished satisfactorily.

b. Each of the risk management activities contribute to assuring that specified requirements are addressed by the contractor. However, each adds cost to the resulting product for some degree of risk reduction that the requirements will not be satisfied. While recognizing the need for program management, systems test and evaluation and quality assurance, the acquisition strategy and the quality assurance provisions of the specification is structured to minimize the added cost.

4.5.1 PROGRAM MANAGEMENT

a. It is reasonable to believe that a best value contractor has an acceptable capability to manage the contract effort. This capability is assessed to decide on how much control the government needs on the contractor. This is done in the source selection process to structure the program management tasks in the resulting contract.

b. Integrated reviews are critical to influencing how the contractor integrates the design effort. Separate government

routine functional reviews should be minimized. Reviews are scheduled for the government's IPT as a body. Existing data from government auditors and contract administration sources on contract status is used. Further, the use of the IPT performing periodic integrated reviews may produce adequate information to obviate the need for some status reports.

PROGRAM MANAGEMENT TEMPLATE

• Government degree of control determined through evaluation of overall contractor management capabilities through past performance evaluation in source selection.

• Type of reviews, reports, management structure tailored to contract purpose, type and value.

• Management information from government auditors and contract administers is not duplicated by other government support.

• Government Integrated Product teams are formed and are required to conduct integrated functional reviews of contractor's progress as a body.

4.5.2 SYSTEMS TEST AND EVALUATION (T&E)

a. Test and evaluation is conducted to determine the degree to which the system meets the requirements, to evaluate the impact of shortfalls, to determine the risk of proceeding to the next program phase, to assess system safety, and to evaluate system performance throughout the operating environments. Also, the system must be tested in an operational environment prior to full rate production to verify operational effectiveness and suitability. The continuous feedback and communication between test and evaluation community and developer and producer will improve design and performance of the system. Risk is reduced through integrated evaluation and communication.

b. In addition, it is the responsibility of the contractor to control the manufacturing processes and verify conformance to the technical requirements. Either the contractor, the government, or a combination of both may be responsible for performing those tests required to verify compliance with contractual performance requirements. The government may witness these tests or verify the results by conducting an operational test or having them performed by an independent testing or inspection organization.

c. The test and evaluation process, for both contractor and government conducted tests, is continuous; and large amounts of data and analysis are accumulated to substantiate performance. This large body of evidence is the foundation of the evaluation process and should be kept in mind when establishing requirements for evaluations. Early involvement of the T&E community in the IPT, particularly in the development of the request for proposal, can help to identify the most advantageous source for any given set of test requirements.

d. Contracting officers may reduce all or some of the government or contractor conducted tests required by the contract, under the following conditions (these conditions apply to Army customers and other customers as well):

(1) The contractor has previously supplied the identical item(s) to the government and the government has accepted it(them), or

(2) The government has commercial test reports, performance data, analytical data, and/or vendor reports demonstrating that the item meets the contract requirements. The data have recently been obtained and there have been no changes to the end item design and/or configuration since collecting the data. The government may accept the results of equivalent tests from identical production processes which have been approved for other customers in determining whether the contract requirements have been met.

e. Before contract award, the contractor can submit equivalent test data along with the bid or proposal. This bid or proposal must also include an alternate price that reflects how the bid or proposal price would change if the government approved the test data. However, the contractor must also propose to meet all required tests, and propose a price for those tests, in the event the contracting officer denies the request.

f. After contract award, the contractor can submit requests to delete a certain test before the delivery of the affected end item. If the government agrees to delete a test after contract award, a downward adjustment in the contract price may be negotiated. All requests for test deletion must contain:

(1) the specific identity of the prospective test deletion;

(2) demonstration of the condition in d (1) and d (2) above;

(3) a certificate of completion per DI-MISC-80678.

g. The technical data contained in this contract may provide direction as to the frequency or sample size for specified tests and inspections of the items supplied under this contract. In following this guidance, you may combine the total quantity of the equivalent product supplied to the Army, or any other customer, during the contract period in question in determining the amount of test or inspection required.

In making this determination you should consider product produced on all Army contracts, as well as that which is being supplied to other customers, and those items being provided to system or subsystem manufactures who are also supplying the subject end items to the Army or other customers as well.

h. Some manufacturing processes required by this contract may require government approval. Approval, once received, will be valid for all future contracts containing a requirement for approval of the same process, unless specifically stated otherwise.

I. Simulation and continuous evaluation can be effective techniques for reducing developmental testing. Involving both the government developmental tester and evaluator as a member of the program's integrated product team can improve communications and assist in tailoring requirements to minimize risk reduction costs.

SYSTEMS TEST AND EVALUATION TEMPLATE

• Utilize continuous evaluation to integrate and reduce testing.

• Involve the government development tester and evaluator up front in the preparation of the acquisition strategy and on the concurrent engineering team.

• Utilize simulation in development to combine and reduce testing.

• Utilize statistical process control to reduce in-process inspections and tests.

• Utilize available test facilities rather than construction of new facilities.

• Test integration is accomplished within the boundaries of the periodic integrated functional reviews.

4.5.3 QUALITY ASSURANCE

a. It is appropriate that the contractor develop the testing regime and conduct the testing program based on factory equipment and processes. Specifying specific inspection equipment and the amount of inspection will limit the efficiency of the manufacturing facility, add cost and limit competition.

b. Many companies have quality systems which comply with commercial standards, such as ANSI Standard Q90-94 or ISO Standard 9000-9004, for product design, production, installation, servicing and inspection.

c. Since the quality of every product is determined primarily by the product design and the manufacturing process, the past performance of a contractor and the quality of his/her product are evaluated in source selection.

QUALITY ASSURANCE TEMPLATE

• Have contractor describe quality approach in response to RFP.

• Evaluate contractor past quality performance in source selection.

• Provide for contractors' use of commercial and international standards and practices for assuring product quality.

• Do not specify inspection equipment and sampling plans as contract or specification requirements.

CHAPTER 5

APPLICATION OF TEMPLATES IN SOLICITATIONS

5.1 SETTING THE STAGE FOR SOLICITATION STREAMLINING

5.1.1 Make sure the acquisition strategy facilitates streamlining. The acquisition strategy should be developed by a team representing all the required disciplines and should use risk management versus risk avoidance concepts. We cannot afford to try to eradicate all risk any more. Use risk management techniques such as teaming, functional integration, performance specifications, contractor flexibility, commercial practices, process controls, and best value. Don't require specific functional "programs" in the acquisition strategy. Don't specify any constraints on design and development.

5.1.2 There are several obvious pitfalls to avoid in writing an RFP: unnecessary boilerplate; goldplating; disconnects between RFP sections; and an evaluation scheme which doesn't match what the offeror is asked to submit. Using a team which represents all the disciplines and starting with a blank sheet of paper can help avoid these pitfalls. The RFP also has to match the acquisition strategy so using the same team to do both is probably the best approach. At the very least, the RFP drafting team has to be very familiar with the strategy.

5.1.3 The team should develop, and challenge, the requirements. The team should have the sponsors of requirements justify their value. We should target for elimination any overspecification, excessive paperwork, detailed military specifications and standards and detailed oversight. A Functional Requirements Authentication Board, chaired by the Project Manager, can decide if the remaining requirements meet the value-added test. Again, the objective should be to use the concept of risk management, not risk avoidance, for deciding which requirements have value. The amount of risk that we should be willing to accept has to be determined on a case-by-case basis.

5.1.4 Your source selection plan has to state what is important for the evaluation and its relative importance. It also describes how the proposals will be evaluated, designates who does the evaluation, sets security requirements, states how negotiations will be conducted, and includes a timetable for contract execution.

Keep the plan simple, but make sure that it covers all elements of the evaluation process.

5.2 CONTENTS OF THE SOLICITATION

5.2.1 The **Solicitation** has a standard format with 13 sections:

A Solicitation/Contract Form and Executive Summary
B Supplies or Services and Prices/Costs
C Description/Specifications/Work Statement
D Packaging and Marking
E Inspection and Acceptance
F Deliveries or Performance
G Contract Administration Data
H Special Contract Requirements
I Contract Clauses
J List of Attachments
K Offerors Representations and Certifications
L Instructions, Conditions and Notices to Offerors
M Evaluation Factors for Award

Section J attachments are the System Specification, Contract Data Requirements List (CDRL), and the Document Summary List (DSL), among others.

5.2.2 The most important thing about the RFP is that it has to contain all the necessary information for the offeror to be able to respond to our requirements. The sections of the RFP should not conflict with or duplicate each other and it should be written in plain English.

5.2.3 We should use the tools we have available to make sure our RFPs meet these requirements. Use draft RFPs and presolicitation and preproposal conferences to get feedback, questions, and suggestions for improving the RFP and making our requirements clear and concise.

5.3 STREAMLINING LANGUAGE FOR THE STATEMENT OF WORK

5.3.1 Section C, Description/Specifications/Work Statement, contains the technical requirements that the offeror has to respond to. We need to emphasize the use of performance and commercial specifications as much as possible. We also need to work hard to

reduce the occasions when military specifications or build-to-print drawings are referenced.

5.3.2 There are a few basic principles to keep in mind as you develop your Section C:

a. Tell what has to be done in simple and direct terms.

b. Provide an integrated approach which gives contractors maximum flexibility to determine structure and content.

c. You should not have any functional "programs" as separate contract requirements.

d. Integrate the testing requirements and hold them to the minimum essential. Use modeling and simulation to reduce overall testing requirements, and streamline test planning, data collection, and analysis and reporting.

e. Use the following statement whenever appropriate in both Section C and in the Executive Summary in Section A.

"You shall use commercial products, processes and practices to reduce development, production and operational support costs."

5.3.3 There are some statements that we have typically seen in the truly streamlined Section C SOW during our review of RFPs. These examples reflect an engineering and manufacturing development effort but they can be used on other program types through tailoring and modification.

a. As a capstone requirement statement which might also be included in the Executive Summary:

You shall develop, fabricate, integrate, test, document, deliver and support the XYZ System to meet the requirements of the XYZ System Performance Specification at Attachment A and this SOW.

b. As an integrated approach giving offerors maximum flexibility to determine structure and content and with no functional "programs" as separate contract requirements:

You shall integrate all the functional disciplines required to do the work.

a. Use Integrated Product and Process Development (IPPD) to incorporate the functional areas of systems engineering, engineering data and specifications, software engineering, configuration management, product assurance, integrated logistics support and specialty engineering into a single Integrated Program Master Plan (IPMP) and Master Program Schedule (MPS).

b. Use Integrated Product Teams (IPT) in the design, test, production and management processes. Include Government and subcontractor participation on the IPTs.

c. This example establishes the requirements for technical documentation and configuration control throughout the contract. The contractor controls the product baseline which avoids the cost for our control:

Configuration identification for the XYZ System shall be the Functional Baseline (FBL), the Allocated Baseline (ABL) and the Product Baseline (PBL).

a. We shall control the FBL and the ABL, defined by the System Performance Specification, Prime Item Development Specifications, Interface Control Documents, and Software Requirements Specifications. You shall conduct a functional configuration audit to verify that the FBL and ABL adequately reflect system performance requirements.

b. You shall control the PBL using your change control and engineering release processes. The PBL is the product performance specifications for replacement assemblies and spare parts, engineering drawings, parts lists, process specifications and computer software configuration items. Your PBL shall support interchangeability and interoperability to the replaceable part level. All baselines shall be documented in your configuration status accounting data base.

d. This example makes software engineering integral to the IPPD process but doesn't specify design techniques for software development.

You shall develop the software required to meet the performance requirements of the XYZ System Performance Specification. Integrate your software engineering tasks in the IPPD process. Accomplish these tasks with IPTs. Document and control the

software configuration items. Utilize our integration facilities "ABC" and use simulation for the development and prove out of software configuration items.

e. In this example, testing is integrated and held to the minimum essential. Modeling and simulation could be used to reduce overall testing requirements. Streamlined test planning, data collection, analysis and reporting will avoid duplication and excessive documentation.

Your test effort shall consist of a logical sequence of component, subsystem and system level hardware and software tests and simulations.

a. You have maximum flexibility in the development and conduct of your test effort in meeting system performance and safety requirements. Make your "test, analyze, fix, test" approach integral to the IPPD process.

b. Conduct tests on the dates established by the Master Program Schedule. Use your existing or leased facilities to the maximum possible extent. You may use alternate test procedures instead of the methods required in the System XYZ Performance Specification if these alternatives will work and avoid acquisition of new facilities and equipment.

c. Use IPTs to do test planning. Use your format for planning. Cover the status of test planning and execution in Integrated Program Reviews.

f. Here, product assurance considerations are integral to the IPPD process. Unique product assurance programs, plans, reviews and audits aren't required and requalifying a defense-unique offeror to MIL-Q-9858A isn't done. This example eliminates barriers to the use of commercial products, processes and practices.

You have the option of selecting a quality process. Use process controls to assure the product meets the requirements of the system performance specification. Use the latest technologies and commercial products in selecting and controlling parts. Use recognized industry standards for calibration processes and design of automated process control equipment. Integrate quality in the IPPD process. Cover status at the Integrated Program Reviews.

g. This example reduces meetings and paper submissions of data and data is in digital format:

You shall develop, implement and maintain a Contractor Integrated Technical Information Service (CITIS) to generate, integrate, store, view and retrieve digital data on-line. All CDRLs and your technical documentation shall be available for our on-line review. Index and control the version of all documentation. Have the IPTs use the CITIS for data interchange and review. Archive CITIS data.

h. These examples don't establish separate "programs" for the specialty engineering areas. Notice that no detail "how-to" program management requirements appear in the SOW.

Your IPPD process shall address MANPRINT and human engineering design criteria, principles and practices to achieve system performance requirements for safe and reliable use by operator, maintainer and support personnel.

Design the system to achieve the level of safety required in the ZYX System Performance Specification. Conduct safety analyses, hazard identification and classification and hazards tracking integral to the system design effort.

Don't generate industrial pollution or hazardous wastes in the XYZ System design, development, test, and production and operation activities under this contract. You may use NAS-411 as guidance.

Design the system to be free of electromagnetic interference (EMI). The design effort shall concentrate on: ...

Design the system to prevent damage from inadvertent electrostatic discharge by users.

Design the system to economically achieve its reliability and maintainability requirements.

Design the system to make it producible.

Use the recognized industry standards in the development of packaging and preservation.

i. This example integrates design reviews to include participation of relevant functional disciplines and limits reviews to the minimum essential:

Use technical reviews to assess completion of major scheduled technical efforts before you proceed with further technical effort. Conduct the following technical reviews:

a. You shall participate in quarterly Integrated Program Reviews, beginning 90 days after contract award. These reviews shall be held at _____. Report the status of the IPT activities and address progress on performance, cost, schedule, support and risk assessment of all aspects of the program.

b. Hold a post award conference not later than 15 days after contract award at your facility. Allow 3 days to develop a common understanding of all contract requirements.

c. Hold Test Readiness Reviews prior to each test series. Support our Test Readiness Reviews. IPTs shall conduct these reviews.

d. Use design reviews as necessary to review the plans and progress towards meeting all specification requirements to assure all success criteria have been met. The IPTs shall conduct these reviews.

j. This example tailors logistic support analysis to fit the acquisition requirements and integrates logistics technical documentation requirements with the design and engineering data. It also causes contractor logistics support and use of commercial off-the-shelf manuals to be considered.

You shall accomplish integrated logistics support.

a. Use only the form, fit, function and interface requirements in the military specifications and standards for provisioning, training and maintenance planning, as specified on the Document Summary List at Attachment B. You may use a combination of your support and our organic support.

b. Conduct a level of repair analysis. Perform trade studies and optimize the total operation and maintenance concept and procedures for each configuration of the system. Develop diagnostic, preventative maintenance and repair procedures and identify repair parts and special tools required to perform tasks. Use commercial-off-the-shelf manuals when feasible. Make all manuals in the interactive electronic format.

5.4 HOW MUCH DATA IS ENOUGH?

5.4.1 One of the difficult areas to contend with in streamlining the RFP is scrubbing the data items in order to buy only what data is really necessary. Types of data that probably add value are test plans, test reports, cost reports, specifications, technical data, manuals, provisioning documentation, schedule reports, and safety assessments. Some things that don't add much value are the functional plans and status reports. You can remove these, since the IPTs will be operating in an integrated fashion.

5.4.2 In the final analysis, it's all a matter of good judgment for cost versus value received. There should be, however, a sound value-added justification for ordering data and as with anything else in the RFP, the requirement should be challenged if it seems questionable. The functional area that requests questionable data should be required to justify the need before it is included in the RFP.

5.4.3 Use a common sense approach to ordering data: Does having this data contribute anything of value to our ability to manage the contractor effort?

5.5 SOME WORDS ABOUT MILITARY SPECIFICATIONS AND STANDARDS

5.5.1 The policies related to the use of military specifications and standards in solicitations are in the Army Implementation Plan: Implementing the Report of the DOD Process Action Team on Military Specifications and Standards, 23 November 1994. Army Acquisition Organizations also have individual Master Action Plans for implementing the Army plan.

5.5.2 You now need a waiver to use a military specification or standard in a solicitation. Exceptions to this requirement occur when any of the following conditions apply:

a. You use military specifications and standards "for guidance only."

b. The contractor unilaterally proposes the use of a military specification or standard.

c. The military specification or standard is exempt from the waiver process.

5.5.3 The term, "For Guidance Only," doesn't mean business as usual and it isn't a work around to the waiver process. It doesn't mean citing a military specification or standard in a solicitation with the unspoken understanding that if someone wants a contract, they'd better comply with the military specification or standard. You should use clear performance requirements in your solicitations. You'll face a challenge if your use of military specifications and standards cited as guidance documents appears unnecessary or there is a potential for abuse.

5.5.4 Only the Army Acquisition Executive or the Milestone Decision Authority may approve a waiver. You should contact your Departmental Standardization Office (AMCRD-IEE) or local Standards Improvement Executive to get a copy of the waiver request format and any specific instructions for submission.

5.5.5 You don't need waivers to use the following: Any document required by law, the Federal Acquisition Regulation, or the Defense Federal Acquisition Regulation Supplement; nongovernment standards; Federal Information Processing Standards; Government specifications shown in the DOD Index of Specifications (DODISS) as performance specifications; and documents in the DODISS that are either commercial item descriptions, guide specifications, interface standards, standard practices, acquisition guides, or handbooks.

5.5.6 The Army Standards Improvement Executive exempts from the waiver process the use of Paragraph 1, Scope and Paragraph 3, Requirements, of the set of Technical Manual Specifications and Standards (TMSS). This exemption is good for a 2-year period from 17 March 1995; then they must be revised and justified as unique military specifications.

5.5.7 Include the following statement in Section L to instruct offerors on the voluntary use of military specifications and standards:

You shall use the best available technology to comply with the system performance requirements. You shall propose performance solutions in lieu of military specifications or standards. When no available performance solutions exist, use recognized industry standards in lieu of military specifications or standards. When you decide that, as a last resort, no other cost effective solution other than the military specification or standard is available,

then you may use the approach contained in the military specification or standard for contract compliance.

5.6 INSTRUCTIONS, CONDITIONS AND NOTICES TO OFFERORS

5.6.1 One of the more important considerations in writing an RFP is making sure that the Sections C, L, and M work together. Don't ask the contractor to propose something or provide information (Section L) that doesn't have a requirement (Section C) or won't be evaluated (Section M).

5.6.2 Ask offerors to describe their approaches to the critical requirements in the system performance specification and the SOW. Evaluate the offerors **capability** to meet the requirements so that the best value source can be determined. Apply the concept of risk management versus risk avoidance.

5.6.3 We have some examples of language that would be in Section L that instructs offerors on how to describe their capabilities to achieve the critical requirements that are in Section C. As usual, you should tailor these examples to fit the circumstances of your solicitation:

a. These statements get the offerors to discuss their abilities to accomplish the technical and engineering work necessary to meet the requirements of the system performance specification:

Describe your systematic approach to meeting the specifications of the XYZ System. Discuss the following topics:

a. System design and performance, considering subsystem selection and integration and how the complete system will achieve specification requirements.

b. Subsystem interfaces.

c. Technical trades.

d. Plans to evolve the system, including use of risk reduction, evaluations of man-machine interfaces, and development and validation of operation and maintenance procedures for the system crew and maintainers.

This is another example that does the same thing:

Your proposed system shall integrate subsystems utilizing 'off-the-shelf' technology wherever possible. Explain the following for each requirement and subsystem:

a. Current status of subsystem and system integration.

b. A detail scheme for integration of all outstanding requirements, subsystems and software into the proposed system.

c. The time line for integration of capabilities and subsystems, with detail of factors affecting those time lines, providing convincing evidence that responsive integration of capabilities and subsystems shall take place.

b. In this example, offerors are required to submit their Integrated Program Master Plan with the proposal:

You shall provide an initial Integrated Program Master Plan (IPMP). It shall detail the IPPD methodology to align all functional disciplines toward the accomplishments of the RFP requirements. The IPMP shall also provide sufficient evidence that the proposal activities, processes and procedures shall accomplish the SOW and specification requirements.

c. This is language that has been used to tell offerors how to explain the proposed schedule:

You shall propose an Integrated Program Master Schedule (IPMS) for all activities down to a level corresponding to your contract work breakdown structure.

a. Make the milestones, stages, and activities in the IPMS consistent with the proposed Integrated Program Master Plan (IPMP). Cross reference the IPMS to the contract line item number structure, the contract work breakdown structure and the appropriate SOW and system specification paragraph.

b. Show task interdependencies by identifying the task sequencing relationships and the duration of all tasks. Indicate the critical path for the most likely duration of the IPMS. Provide the ground rules and assumptions used in estimating task

durations. Explain the tasks which involve critical risk, technologies, and any unusual aspects of the proposed approach.

d. Here we tell the offeror how to discuss its capability to perform IPPD:

Describe your approach to Integrated Product and Process Development (IPPD). Provide sufficient detail to enable the evaluation of the approach and how it will accomplish the requirements of the RFP. Place emphasis on the establishment of Integrated Product Teams (IPT) to execute the IPPD process. Address the overall IPT commitment, the use of multidisciplinary decision teams, metrics used to measure IPT effectiveness, and IPT lessons learned. Explain the integration and interdependency of all the functional disciplines required to execute the effort.

e. This example describes testing separately from the IPMP to obtain detailed knowledge of the offeror's capabilities and scope of the testing effort. You may need to expand this for more information on specific tests or approaches to testing for individual specification requirements:

Provide descriptions and results of equipment performance testing, detailing test methodologies and their relationship to the requirements of the specification. Propose your initial Test Scenario. Detail the test support requirements from our test activities. Describe how IPTs will execute the test and qualification efforts. Describe the testing environment and facilities, and their certification to meet specification requirements. Provide estimates of resources to perform the testing tasks.

f. If software is a critical element of your requirement, you'll need this information:

Describe your effort to develop and field system software for the XYZ System.

a. Submit sufficient technical information to describe the software's life cycle supportability. Include descriptions of the computer and software architecture and the practices used for software development, integration, testing and subsequent support.

b. For nondevelopmental software, describe selection and integration methodology, functionality, verification and supportability provisions, and license rights. For software you develop, describe the development and integration methodology, architecture and any supportability considerations. Also describe the current software condition and characterize any remaining software development requirements to permit technical and cost assessments.

g. This example tells offeror's to describe their capability to accomplish ILS activities:

Describe how you will accomplish all integrated logistics support elements. Cover the elements for maintenance and maintenance planning; supply support; interim contractor support; support and test equipment; MANPRINT facilities; packaging, handling and shipping; training; and fielding support. Describe how you will integrate ILS activities one to another and the engineering design through the IPT and IPPD processes. Describe how you will integrate the ILS task elements in the Integrated Master Program Schedule.

h. Managing risk is becoming an important concept. In this example the offerors are to describe how they will control the work and manage information, and thus manage risk:

Describe how you will use your management information systems to control the schedule, risk and program costs. Show management responsibilities, data collection and reporting processes, IPT relationship to and use of information systems, control review process, corrective action processes and a time line relationship of these. Describe the CITIS and how it will be implemented. Show relationship to the MPS and the work breakdown structure. Describe management control systems to be used by key subcontractors.

This additional language provides insights on the offeror's capability to identify and mitigate risks:

Discuss your risk management approach. Address how you will integrate risk management effort within the overall IPPD process. Discuss all aspects which entail a level of risk that could disrupt the effort, describing the severity of the risk and approaches to reduce the identified risk.

5.7 IS THE SOLICITATION REALLY STREAMLINED?

5.7.1 Once you've finished writing the RFP, the drafting team can take one last hard look at the complete document. Now the team can look for the pitfalls that we are trying to avoid: unnecessary boilerplate; goldplating; disconnects in RFP sections; overspecification; excessive paperwork; detailed oversight; and risk management versus risk avoidance.

5.7.2 Here are some final thoughts and telltale signs that the RFP needs more streamlining work:

a. The Executive Summary is a cut and paste job using extracts from the Statement of Work (SOW). It isn't a succinct, executive level statement of the acquisition's objectives.

b. The RFP requirements are inconsistent with a risk management approach. Examples are excessive management reviews and quality assurance/testing requirements. Such excessive requirements indicate risk avoidance instead of risk management.

c. Section C and the CDRL aren't integrated. Data is being ordered for work not required in Section C. Section C discusses requirements for data delivery and report formats. Data Item Descriptions contain work statements that should be in Section C.

d. Section C requires functional "programs" or "systems." The CDRL requires plans and status reports for these functional "programs." Contractor told how to organize and staff a functional "program." Requires separate functional reviews on a regularly scheduled basis. Government approves functional processes or results.

e. The unique System Specification is not a performance specification. It contains requirements from, or references to, military specifications and standards. Includes requirements for parts, materials, processes, fabrication and construction. Also includes requirements for functional "programs." To be truly performance, the system specification should include only those requirements which define performance, form, fit, function and interoperability.

f. Section C, D and E require mandatory use of management and manufacturing military standards. Use of "for guidance only" is excessive. No flexibility to use commercial processes and practices. Waivers haven't been obtained to use essential military specifications and standards.

g. The delivery schedule isn't clear. Program planning isn't mature.

h. Equipment/material that is expendable or has low residual value is provided as Government Furnished Material (GFM) and Government Furnished Equipment (GFE). Detailed accounting procedures control this GFM and GFE. No evidence of alternatives to avoid this cost.

I. Clauses included by reference aren't relevant, such as, specifying the use of anchor chain in an ammunition program. Such clauses may be automatically included in the RFP.

j. Local special clauses are used. This means an old format was used for the RFP. Justify the local clauses.

k. Section L does not have appropriate limits on the number of pages and copies of proposals to be submitted by offerors. Limit proposal length based on requirements being solicited and evaluation criteria being used.

l. Section L requires proposal data that doesn't relate to the evaluation factors of Section M. This wastes bid and proposal costs.

m. The work breakdown structure (WBS) is to the lowest level as a contract requirement. Contractor has no flexibility to develop an optimum WBS, or tailor the existing WBS. The contract line item number (CLIN) structure of Section B is different from the WBS, which results in more costs for aggregating cost data.

n. The cost performance reporting isn't tailored to fit the acquisition. Cost reports should be for management of the program, rather than for historical cost collection purposes. Be wary of such reports on firm fixed-price contracts. For cost data that is really needed, make sure it is relevant and real time data.

o. Certified cost and pricing data is being required although competition is anticipated and price is an evaluation factor greater than 20 percent. Don't use the SF 1411 when only limited data is required by the contracting officer.

p. Section C, Section L and Section M aren't integrated with each other or the source selection plan. The Sections C and L requirements don't relate to the Section M evaluation factors for award. If it doesn't count in the evaluation for award, challenge the requirement.

q. Section M doesn't clearly convey how proposals will be evaluated or the basis for the source selection decision. Evaluation factors, subfactors and elements should be limited to true discriminators that have value. Large numbers of factors will dilute the importance of those that are most significant to making the best value decision.

r. Past performance isn't given enough weight to assure that it will be a valid discriminator among the offers received.

s. Section J contains attachments with instructions on how to do things. This may reinstate the functional requirements streamlined out of the Section C SOW.

The proponent of this pamphlet is the United States Army Materiel Command. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to the Commander, HQ AMC, ATTN: AMCRDA-TE, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001.

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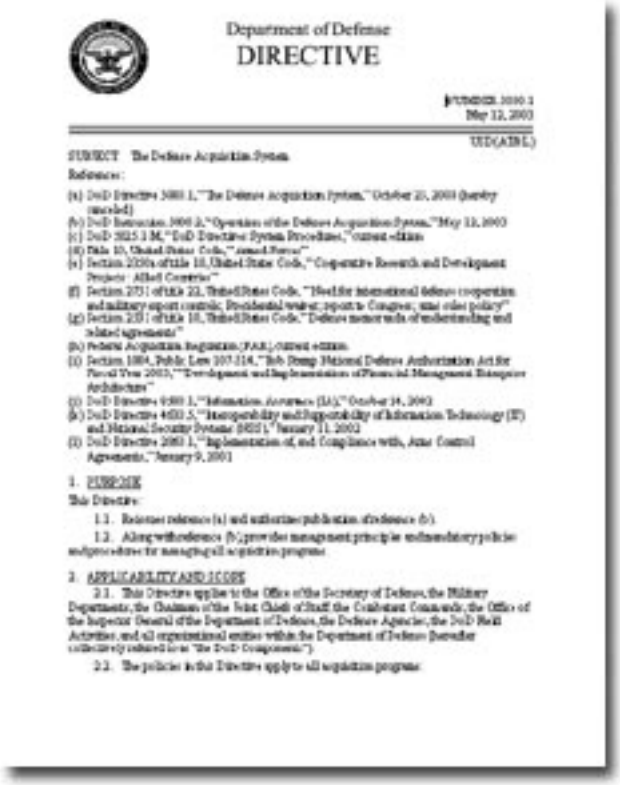

Department of Defense
DIRECTIVE

NUMBER 5000.1
May 12, 2003

UD(AT&L)

SUBJECT: The Defense Acquisition System

References:

(a) DoD Directive 5000.1, "The Defense Acquisition System," October 23, 2000 (hereby canceled)
(b) DoD Instruction 5000.2, "Operation of the Defense Acquisition System," May 12, 2003
(c) DoD 5025.1-M, "DoD Directives System Procedures," current edition
(d) Title 10, United States Code, "Armed Forces"
(e) Section 2350a of title 10, United States Code, "Cooperative Research and Development Projects: Allied Countries"
(f) Section 2751 of title 22, United States Code, "Need for international defense cooperation and military export controls; Presidential waiver; report to Congress; sale of defense policy"
(g) Section 2321 of title 10, United States Code, "Defense memorandums of understanding and related agreements"
(h) Federal Acquisition Regulation (FAR), current edition
(i) Section 1004, Public Law 107-314, "Bob Stump National Defense Authorization Act for Fiscal Year 2003," "Development and Implementation of Financial Management Enterprise Architecture"
(j) DoD Directive 8500.1, "Information Assurance (IA)," October 24, 2002
(k) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," January 11, 2002
(l) DoD Directive 2060.1, "Implementation of, and Compliance with, Arms Control Agreements," January 9, 2001

1. PURPOSE

This Directive:

1.1. Reissues reference (a) and authorizes publication of reference (b).

1.2. Along with reference (b), provides management principles and mandatory policies and procedures for managing all acquisition programs.

2. APPLICABILITY AND SCOPE

2.1. This Directive applies to the Office of the Secretary of Defense, the Military Departments, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all organizational entities within the Department of Defense (hereafter collectively referred to as "the DoD Components").

2.2. The policies in this Directive apply to all acquisition programs.

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(f) Section 2751 of title 22, United States Code, "Need for international defense cooperation and military export controls; Presidential waiver; report to Congress; arms sales policy"
(g) Section 2531 of title 10, United States Code, "Defense memoranda of understanding and related agreements"
(h) Federal Acquisition Regulation (FAR), current edition
(i) Section 1004, Public Law 107-314, "Bob Stump National Defense Authorization Act for Fiscal Year 2003," "Development and Implementation of Financial Management Enterprise Architecture"
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This Directive:

1.1. Reissues reference (a) and authorizes publication of reference (b).

1.2. Along with reference (b), provides management principles and mandatory policies and procedures for managing all acquisition programs.

2. APPLICABILITY AND SCOPE

2.1. This Directive applies to the Office of the Secretary of Defense, the Military Departments, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all organizational entities within the Department of Defense (hereafter collectively referred to as "the DoD Components").

2.2. The policies in this Directive apply to all acquisition programs.

3. DEFINITIONS

3.1. The Defense Acquisition System is the management process by which the Department of Defense provides effective, affordable, and timely systems to the users.

3.2. An Acquisition Program is a directed, funded effort that provides a new, improved, or continuing materiel, weapon or information system or service capability in response to an approved need.

3.3. The Defense Acquisition Executive (DAE) is the USD(AT&L) who has responsibility for supervising the Defense Acquisition System. The DAE takes precedence on all acquisition matters after the Secretary and the Deputy Secretary.

3.4. The Milestone Decision Authority (MDA) is the designated individual with overall responsibility for a program. The MDA shall have the authority to approve entry of an acquisition program into the next phase of the acquisition process and shall be accountable for cost, schedule, and performance reporting to higher authority, including Congressional reporting.

3.5. The Program Manager (PM) is the designated individual with responsibility for and authority to accomplish program objectives for development, production, and sustainment to meet the user's operational needs. The PM shall be accountable for credible cost, schedule, and performance reporting to the MDA.

4. POLICY

4.1. The Defense Acquisition System exists to manage the nation's investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support the United States Armed Forces. The investment strategy of the Department of Defense shall be postured to support not only today's force, but also the next force, and future forces beyond that.

4.2. The primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price.

4.3. The following policies shall govern the Defense Acquisition System:

4.3.1. Flexibility. There is no *one* best way to structure an acquisition program to accomplish the objective of the Defense Acquisition System. MDAs and PMs shall tailor program strategies and oversight, including documentation of program information, acquisition phases, the timing and scope of decision reviews, and decision levels, to fit the particular conditions of that program, consistent with applicable laws and regulations and the time-sensitivity of the capability need.

4.3.2. Responsiveness. Advanced technology shall be integrated into producible systems and deployed in the shortest time practicable. Approved, time-phased capability needs matched with available technology and resources enable evolutionary acquisition strategies. Evolutionary acquisition strategies are the preferred approach to satisfying operational needs. Spiral development is the preferred process for executing such strategies.

4.3.3. Innovation. Throughout the Department of Defense, acquisition professionals shall continuously develop and implement initiatives to streamline and improve the Defense

Acquisition System. MDAs and PMs shall examine and, as appropriate, adopt innovative practices (including best commercial practices and electronic business solutions) that reduce cycle time and cost, and encourage teamwork.

4.3.4. Discipline. PMs shall manage programs consistent with statute and the regulatory requirements specified in this Directive and in reference (b). Every PM shall establish program goals for the minimum number of cost, schedule, and performance parameters that describe the program over its life cycle. Approved program baseline parameters shall serve as control objectives. PMs shall identify deviations from approved acquisition program baseline parameters and exit criteria.

4.3.5. Streamlined and Effective Management. Responsibility for the acquisition of systems shall be decentralized to the maximum extent practicable. The MDA shall provide a single individual with sufficient authority to accomplish MDA-approved program objectives for development, production, and sustainment. The MDA shall ensure accountability and maximize credibility in cost, schedule, and performance reporting.

4.4. Additional policies that will be applied to the acquisition system are at enclosure 1.

5. RESPONSIBILITIES

5.1. The USD(AT&L), the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence), and the Director of Operational Test and Evaluation are key officials of the Defense Acquisition System. Consistent with their respective authorities, they may jointly issue DoD Instructions, DoD Publications, and one-time directive-type memoranda, consistent with DoD 5025.1-M (reference (c)), that implement the policies contained in this Directive. Financial Management Enterprise Architecture (FMEA) Requirements shall be addressed for all financial management and mixed (financial and non-financial) information systems and shall be certified as being compliant with the FMEA by the Under Secretary of Defense (Comptroller) (USD(C)).

5.2. The Chairman of the Joint Chiefs of Staff (CJCS) shall provide advice and assessment on military capability needs in accordance with sections 153, 163 and 181 of Title 10 (reference (d)). The CJCS shall present this advice and assessment through validated and approved capabilities documents. The CJCS may engage the components and agencies to provide this advice and assessment. Consistent with this Directive, and in coordination with the USD(AT&L), the CJCS may establish procedures to carry out this responsibility.

6. EFFECTIVE DATE

This Directive is effective immediately.

Paul Wolfowitz
Deputy Secretary of Defense

ENCLOSURE 1

ADDITIONAL POLICY

E1.1. Armaments Cooperation. PMs shall pursue international armaments cooperation to the maximum extent feasible, consistent with sound business practice and with the overall political, economic, technological, and national security goals of the United States. International agreements for international armaments cooperation programs shall complete the interagency consultation and Congressional notification requirements contained in 10 U.S.C. 2350a (reference (e)), section 2751 of the Arms Export Control Act (reference (f)), and 10 U.S.C. 2531 (reference (g)).

E1.2. Collaboration. The DoD acquisition, capability needs, and financial communities, and operational users shall maintain continuous and effective communications with each other by using Integrated Product Teams (IPTs). Teaming among warfighters, users, developers, acquirers, technologists, testers, budgeters, and sustainers shall begin during capability needs definition. MDAs and PMs are responsible for making decisions and leading execution of their programs, and are accountable for results.

E1.3. Competition. Competition shall provide major incentives to industry and Government organizations to innovate, reduce cost, and increase quality. All of the DoD Components shall acquire systems, subsystems, equipment, supplies, and services in accordance with the statutory requirements for competition. Acquisition managers shall take all necessary actions to promote a competitive environment, including the consideration of alternative systems to meet stated mission needs; structuring S&T investments and acquisition strategies to ensure the availability of competitive suppliers throughout a program's life, and for future programs; ensuring that prime contractors foster effective competition for major and critical products and technologies; and ensuring that qualified international sources are permitted to compete. If competition is not available, PMs shall consider alternatives that will yield the benefits of competition.

E1.4. Cost and Affordability. All participants in the acquisition system shall recognize the reality of fiscal constraints. They shall view cost as an independent variable, and the DoD Components shall plan programs based on realistic projections of the dollars and manpower likely to be available in future years. To the greatest extent possible, the MDAs shall identify the total costs of ownership, and at a minimum, the major drivers of total ownership costs. The user shall address affordability in establishing capability needs.

E1.5. Cost Realism. Contractors shall be encouraged to submit cost proposals that are realistic for the work to be performed. “Buy-ins” shall be discouraged because they may subvert competition or lead to poor contract performance or cost overruns. Proposals shall be evaluated for cost realism in accordance with the Federal Acquisition Regulation (reference (h)).

E1.6. Cost Sharing. The PM shall structure the acquisition in a way that neither imposes undue risk on contractors, nor requires unusual contractor investment. Contractors shall not be encouraged nor required to invest their profit dollars or independent research and development funds to subsidize defense research and development contracts, except in unusual situations where there is a reasonable expectation of a potential commercial application. Contractors are entitled to earn reasonable rewards on DoD contracts, including competitively awarded contracts.

E1.7. Financial Management. The USD(C) shall develop a FMEA and a transition plan in accordance with section 1004 of the Bob Stump National Defense Authorization Act for Fiscal Year 2003 (Pub. L. 107-314) (reference (i)) and shall approve any obligation of funds in excess of $1M for a defense financial system improvement.

E1.8. Independent Operational Test Agency (OTA). Each Military Department shall establish an independent OTA, reporting directly to the Service Chief, to plan and conduct operational tests, report results, and provide evaluations of effectiveness and suitability.

E1.9. Information Assurance. Acquisition managers shall address information assurance requirements for all weapon systems; Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance systems; and information technology programs that depend on external information sources or provide information to other DoD systems. DoD policy for information assurance of information technology, including NSS, appears in DoD Directive 8500.1, reference (j).

E1.10. Information Superiority. Acquisition managers shall provide U.S. Forces with systems and families of systems that are secure, reliable, interoperable, compatible with the electromagnetic spectrum environment, and able to communicate across a universal information technology infrastructure, including NSS, consisting of data, information, processes, organizational interactions, skills, analytical expertise, other systems, networks, and information exchange capabilities.

E1.11. Integrated Test and Evaluation. Test and evaluation shall be integrated throughout the defense acquisition process. Test and evaluation shall be structured to provide essential information to decision-makers, assess attainment of technical performance parameters, and determine whether systems are operationally effective, suitable, survivable, and safe for intended use. The conduct of test and evaluation, integrated with modeling and simulation, shall facilitate learning, assess technology maturity and interoperability, facilitate integration into fielded forces, and confirm performance against documented capability needs and adversary capabilities as described in the system threat assessment.

E1.12. Intelligence Support. Intelligence and understanding threat capabilities are integral to system development and acquisition decisions. PMs shall keep threat capabilities current and validated in program documents throughout the acquisition process.

E1.13. Interoperability. Systems, units, and forces shall be able to provide and accept data, information, materiel, and services to and from other systems, units, and forces and shall effectively interoperate with other U.S. Forces and coalition partners. Joint concepts and integrated architectures shall be used to characterize these interrelationships. DoD policy for the information technology, including NSS, aspects of interoperability and supportability appears in DoD Directive 4630.5, reference (k).

E1.14. Knowledge-Based Acquisition. PMs shall provide knowledge about key aspects of a system at key points in the acquisition process. PMs shall reduce technology risk, demonstrate technologies in a relevant environment, and identify technology alternatives, prior to program initiation. They shall reduce integration risk and demonstrate product design prior to the design readiness review. They shall reduce manufacturing risk and demonstrate producibility prior to full-rate production.

E1.15. Legal Compliance. The acquisition and procurement of DoD weapons and weapon systems shall be consistent with all applicable domestic law and treaties and international

agreements (for arms control agreements, see DoD Directive 2060.1, reference (l)), customary international law, and the law of armed conflict (also known as the laws and customs of war). An attorney authorized to conduct such legal reviews in the Department shall conduct the legal review of the intended acquisition of weapons or weapons systems.

E1.16. Performance-Based Acquisition. To maximize competition, innovation, and interoperability, and to enable greater flexibility in capitalizing on commercial technologies to reduce costs, acquisition managers shall consider and use performance-based strategies for acquiring and sustaining products and services whenever feasible. For products, this includes all new procurements and major modifications and upgrades, as well as reprocurements of systems, subsystems, and spares that are procured beyond the initial production contract award. When using performance-based strategies, contract requirements shall be stated in performance terms, limiting the use of military specifications and standards to Government-unique requirements only. Acquisition managers shall base configuration management decisions on factors that best support implementing performance-based strategies throughout the product life cycle.

E1.17. Performance-Based Logistics. PMs shall develop and implement performance-based logistics strategies that optimize total system availability while minimizing cost and logistics footprint. Trade-off decisions involving cost, useful service, and effectiveness shall consider corrosion prevention and mitigation. Sustainment strategies shall include the best use of public and private sector capabilities through government/industry partnering initiatives, in accordance with statutory requirements.

E1.18. Products, Services, and Technologies. The DoD Component(s) shall consider multiple concepts and analyze possible alternative ways to satisfy the user need. System concepts shall be founded in an operational context, consistent with the National Military Security Strategy, Defense Planning Guidance, Joint Concepts, and joint integrated architectures. The DoD Components shall seek the most cost-effective solution over the system's life cycle. They shall conduct market research and analysis to determine the availability, suitability, operational supportability, interoperability, safety, and ease of integration of the considered and selected procurement solutions. The DoD Components shall work with users to define capability needs that facilitate the following, listed in descending order of preference:

E1.18.1. The procurement or modification of commercially available products, services, and technologies, from domestic or international sources, or the development of dual-use technologies;

E1.18.2. The additional production or modification of previously-developed U.S. and/or Allied military systems or equipment;

E1.18.3. A cooperative development program with one or more Allied nations;

E1.18.4. A new, joint, DoD Component or Government Agency development program; or

E1.18.5. A new DoD Component-unique development program.

E1.19. Professional Workforce. The Department of Defense shall maintain a fully proficient acquisition, technology, and logistics workforce that is flexible and highly skilled across a range of management, technical, and business disciplines. To ensure this, the USD(AT&L) shall establish education, training, and experience standards for each acquisition position based on the level of complexity of duties carried out in that position.

E1.20. Program Information. Complete and current program information is essential to the acquisition process. Consistent with the tables of required regulatory and statutory information appearing in reference (b), decision authorities shall require PMs and other participants in the defense acquisition process to present only the minimum information necessary to establish the program baseline, describe program plans, understand program status, and make informed decisions. The MDA shall "tailor-in" program information. IPTs shall facilitate the management and exchange of program information.

E1.21. Program Stability. The DoD Components shall develop realistic program schedules, long-range investment plans, and affordability assessments, and shall strive to ensure stable program funding. The MDA shall determine the appropriate point at which to fully fund an acquisition program, generally when a system concept and design have been selected, a PM has been assigned, capability needs have been approved, and system-level development is ready to begin. Full funding shall be based on the cost of the most likely system alternative.

E1.22. Research and Technology Protection. Acquisition managers shall identify classified and controlled unclassified research and technology information requiring additional counter intelligence and security support early in the research and development, capability needs generation, and acquisition processes.

E1.23. Safety. Safety shall be addressed throughout the acquisition process. Safety considerations include human (includes human/system interfaces), toxic/hazardous materials and substances, production/manufacturing, testing, facilities, logistical support, weapons, and munitions/explosives. All systems containing energetics shall comply with insensitive munitions criteria.

E1.24. Small Business Participation. Acquisition strategies shall be structured to facilitate small business participation throughout a program's life cycle through direct participation or, where such participation is not available, through fostering teaming with small business concerns.

E1.25. Software Intensive Systems. Acquisition of software intensive systems shall use process improvement and performance measures. Selection of sources shall include consideration of product maturity and past performance.

E1.26. Streamlined Organizations. The Department of Defense shall use a streamlined management structure in the acquisition system, characterized by short, clearly defined lines of responsibility, authority, and accountability. In no case, shall there be more than two levels of review between a PM and the MDA.

E1.27. Systems Engineering. Acquisition programs shall be managed through the application of a systems engineering approach that optimizes total system performance and minimizes total ownership costs. A modular, open-systems approach shall be employed, where feasible.

E1.28. Technology Development and Transition. The Science and Technology (S&T) program shall:

E1.28.1. Address user needs;

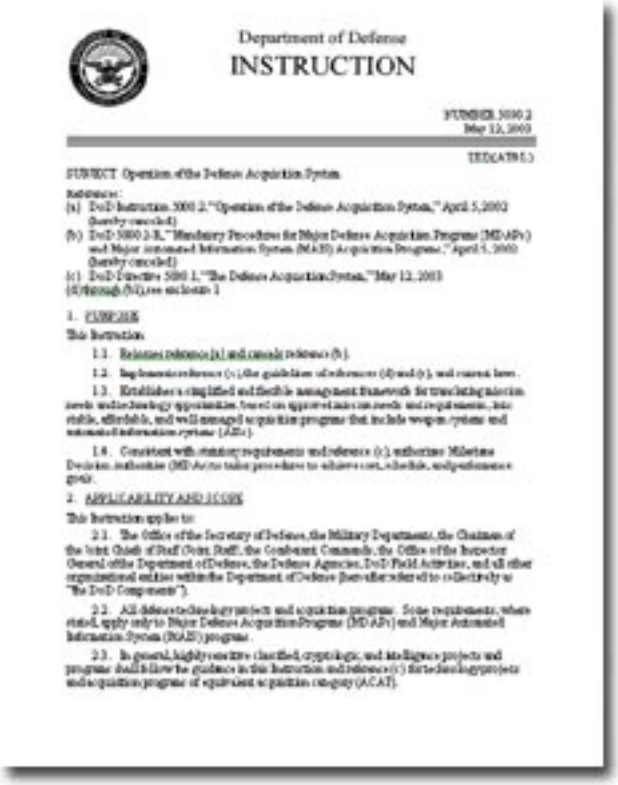
E1.28.2. Maintain a broad-based program spanning all Defense-relevant sciences and technologies to anticipate future needs and those not being pursued by civil or commercial communities;

E1.28.3. Preserve long-range research; and

E1.28.4. Enable rapid, successful transition from the S&T base to useful military products.

E1.29. Total Systems Approach. The PM shall be the single point of accountability for accomplishing program objectives for total life-cycle systems management, including sustainment. The PM shall apply human systems integration to optimize total system performance (hardware, software, and human), operational effectiveness, and suitability, survivability, safety, and affordability. PMs shall consider supportability, life cycle costs, performance, and schedule comparable in making program decisions. Planning for Operation and Support and the estimation of total ownership costs shall begin as early as possible. Supportability, a key component of performance, shall be considered throughout the system life cycle.

[26] Department of Defense Instruction 5000.2 - Operation of the Defense Acquisition System



Department of Defense

INSTRUCTION

NUMBER 5000.2
May 12, 2003

TEXCATEG:

SUBJECT: Operation of the Defense Acquisition System

References:
(a) DoD Instruction 5000.2, "Operation of the Defense Acquisition System," April 5, 2002 (hereby canceled)
(b) DoD 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," April 5, 2002 (hereby canceled)
(c) DoD Directive 5000.1, "The Defense Acquisition System," May 12, 2003
(d) through (h), see enclosure 1

1. PURPOSE

This Instruction:

1.1. Reissues reference (a) and cancels reference (b).

1.2. Implements reference (c), the guidelines of references (d) and (e), and current laws.

1.3. Establishes a simplified and flexible management framework for translating mission needs and technology opportunities, based on approved mission needs and requirements, into stable, affordable, and well managed acquisition programs that include weapon systems and automated information systems (AISs).

1.4. Consistent with statutory requirements and reference (c), authorizes Milestone Decision Authorities (MDAs) to tailor procedures to achieve cost, schedule, and performance goals.

2. APPLICABILITY AND SCOPE

This Instruction applies to:

2.1. The Office of the Secretary of Defense, the Military Departments, the Chairman of the Joint Chiefs of Staff (Joint Staff), the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, DoD Field Activities, and all other organizational entities within the Department of Defense (hereafter referred to collectively as "the DoD Components").

2.2. All defense technology projects and acquisition programs. Some requirements, where stated, apply only to Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) programs.

2.3. In general, highly sensitive classified, cryptologic, and intelligence projects and programs shall follow the guidance in this Instruction and reference (c) for technology projects and acquisition programs of equivalent acquisition category (ACAT).

Department of Defense
INSTRUCTION

NUMBER 5000.2
May 12, 2003

USD(AT&L)

SUBJECT: Operation of the Defense Acquisition System

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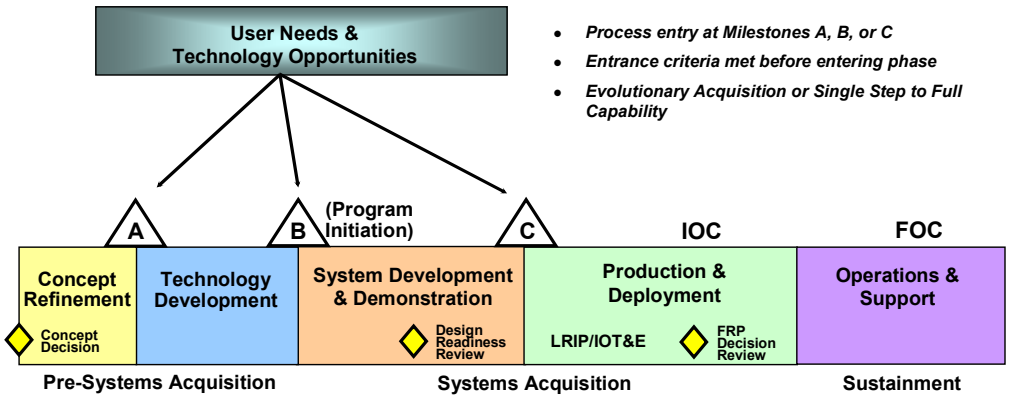
Figure 1. The Defense Acquisition Management Framework.



3. PROCEDURES

3.1. Defense Acquisition Management Framework. Figure 1 depicts the Defense Acquisition Management Framework.

3.1.1. Consistent with reference (c), the program manager (PM) and the MDA shall exercise discretion and prudent business judgment to structure a tailored, responsive, and innovative program.

3.1.2. The MDA may authorize entry into the acquisition system at any point, consistent with phase-specific entrance criteria and statutory requirements. Progress through the acquisition life cycle depends on obtaining sufficient knowledge to continue to the next stage of development.

3.1.3. The tables at enclosure 3 identify the statutory and regulatory information requirements of each milestone and decision point. Additional non-mandatory guidance on best practices, lessons learned, and expectations is available in a guidebook at http://dod5000.dau.mil/.

3.2. Requirements and Acquisition Integration

3.2.1. Integrated Architectures

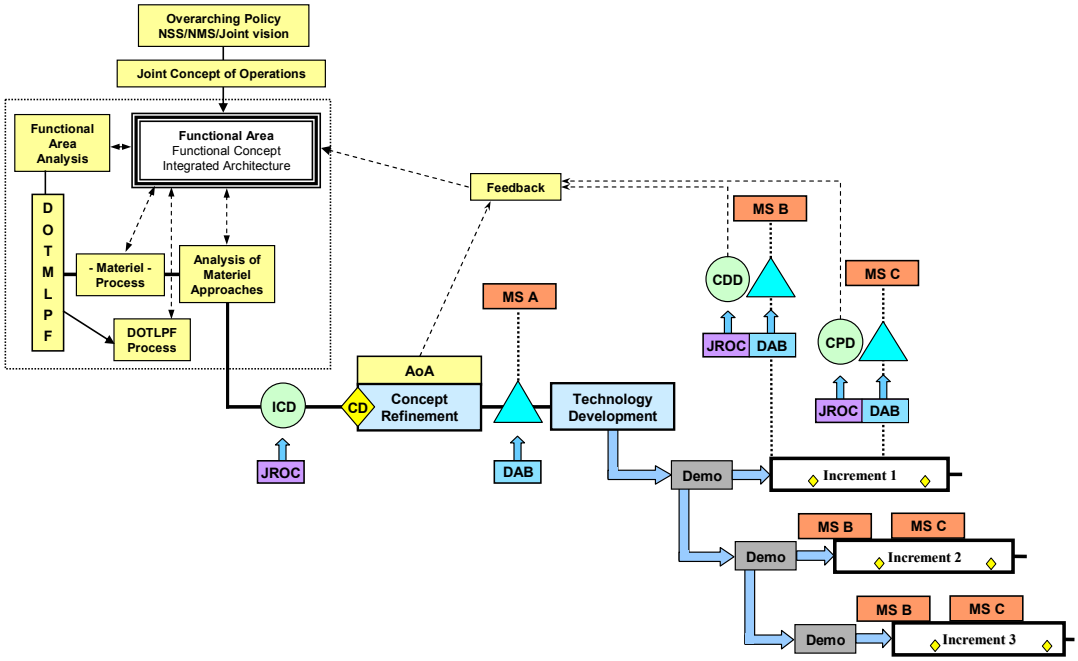
3.2.1.1. The Under Secretary of Defense (Acquisition, Technology, and Logistics) (USD(AT&L)), the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)), the Joint Staff, the Military Departments, the Defense Agencies, Combatant Commanders, and other appropriate DoD Components shall work collaboratively to develop joint integrated architectures for capability areas as agreed to by the Joint Staff. In addition, the Under Secretary of Defense (Comptroller) (USD(C)) is responsible for the development of the Financial Management Enterprise Architecture.

3.2.1.2. Each integrated architecture shall have three views: operational, systems, and technical, as defined in the current Architectural Framework guidance and have direct relationships to DoD Component-developed functional area integrated architectures. The Joint Staff (or Principal Staff Assistant (PSA) for business areas) shall lead development of the operational view, in collaboration with the Services, Agencies, and Combatant Commanders, to describe the joint capabilities that the user seeks and how to employ them. The USD(AT&L) (or PSA for business areas) shall lead development of the systems view, in collaboration with the Services, Agencies, and Combatant Commanders, to characterize available technology and

systems functionality. The systems view shall identify the kinds of systems and integration needed to achieve the desired operational capability. The DoD Chief Information Officer (CIO) shall lead the development and facilitate the implementation of the Global Information Grid Integrated Architecture, which shall underpin all mission area and capability architectures. The Military Departments and Defense Agencies shall participate in the identification of the appropriate technical view consisting of standards that define and clarify the individual systems technology and integration requirements. The standards used to form the Technical Views of integrated architectures shall be selected from those contained in the current approved version of the Joint Technical Architecture, accessible at http://jta.disa.mil/, reference (f).

3.2.2. Integrated Capability Assessments, Capability Roadmaps, and Investment Strategies. Using the integrated architectures, the USD(AT&L) shall lead the development of integrated plans or roadmaps. The Department of Defense shall use these roadmaps to conduct capability assessments, guide systems development, and define the associated investment plans as the basis for aligning resources and as an input to the Defense Planning Guidance, Program Objective Memorandum development, and Program and Budget Reviews.

Figure 2. Requirements and Acquisition Process Depiction.



3.3. Evolutionary Acquisition

3.3.1. Evolutionary acquisition is the preferred DoD strategy for rapid acquisition of mature technology for the user. An evolutionary approach delivers capability in increments, recognizing, up front, the need for future capability improvements. The objective is to balance needs and available capability with resources, and to put capability into the hands of the user quickly. The success of the strategy depends on consistent and continuous definition of requirements, and the maturation of technologies that lead to disciplined development and production of systems that provide increasing capability towards a materiel concept. (See Figure 2.)

3.3.2. The approaches to achieve evolutionary acquisition require collaboration between the user, tester, and developer. They include:

3.3.2.1. Spiral Development. In this process, a desired capability is identified, but the end-state requirements are not known at program initiation. Those requirements are refined through demonstration and risk management; there is continuous user feedback; and each increment provides the user the best possible capability. The requirements for future increments depend on feedback from users and technology maturation.

3.3.2.2. Incremental Development. In this process, a desired capability is identified, an end-state requirement is known, and that requirement is met over time by developing several increments, each dependent on available mature technology.

3.4. User Needs and Technology Opportunities

3.4.1. The capability needs and acquisition management systems shall use Joint Concepts, integrated architectures, and an analysis of doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) in an integrated, collaborative process to define desired capabilities to guide the development of affordable systems. The Chairman of the Joint Chiefs of Staff, with the assistance of the Joint Requirements Oversight Council, shall assess and provide advice regarding military capability needs for defense acquisition programs. The process through which the Chairman provides his advice is described in Chairman of the Joint Chiefs of Staff Instruction 3170.01(reference (g)). Representatives from multiple DoD communities shall assist in formulating broad, time-phased, operational goals, and describing requisite capabilities in the Initial Capabilities Document (ICD). They shall examine multiple concepts and materiel approaches to optimize the way the Department of Defense provides these capabilities. The examination shall include robust analyses that consider affordability, technology maturity, and responsiveness.

3.4.2. Technologists and industry shall identify and protect promising technologies in laboratories and research centers, academia, and foreign and domestic commercial sources; reduce the risks of introducing these technologies into the acquisition process; and promote coordination, cooperation, and mutual understanding of technology issues. The conduct of Science & Technology (S&T) activities shall not preclude, and where practicable, shall facilitate future competition.

3.5. Concept Refinement

3.5.1. Purpose. The purpose of this phase is to refine the initial concept and develop a Technology Development Strategy (TDS). Entrance into this phase depends upon an approved ICD resulting from the analysis of potential concepts across the DoD Components, international systems from Allies, and cooperative opportunities; and an approved plan for conducting an analysis of alternatives (AoA) for the selected concept, documented in the approved ICD.

3.5.2. Concept Refinement begins with the Concept Decision. The MDA designates the lead DoD Component(s) to refine the initial concept selected, approves the AoA plan, and establishes a date for a Milestone A review. The MDA decisions shall be documented in an Acquisition Decision Memorandum (ADM). This effort shall normally be funded only for the concept refinement work. The MDA decision to begin Concept Refinement DOES NOT mean that a new acquisition program has been initiated. The tables in enclosure 3 identify all statutory and regulatory requirements for the Concept Refinement decision.

3.5.3. The ICD and the AoA plan shall guide Concept Refinement. The focus of the AoA is to refine the selected concept documented in the approved ICD. The AoA shall assess

the critical technologies associated with these concepts, including technology maturity, technical risk, and, if necessary, technology maturation and demonstration needs. To achieve the best possible system solution, emphasis shall be placed on innovation and competition. Existing commercial-off-the-shelf (COTS) functionality and solutions drawn from a diversified range of large and small businesses shall be considered.

3.5.4. The results of the AoA shall provide the basis for the TDS, to be approved by the MDA at Milestone A for potential ACAT I and IA programs. The TDS shall document the following:

3.5.4.1. The rationale for adopting an evolutionary strategy (for most programs) or a single-step-to-full-capability strategy (e.g., for common supply items or COTS items). For an evolutionary acquisition, either spiral or incremental, the TDS shall include a preliminary description of how the program will be divided into technology spirals and development increments, an appropriate limitation on the number of prototype units that may be produced and deployed during technology development, how these units will be supported, and specific performance goals and exit criteria that must be met before exceeding the number of prototypes that may be produced under the research and development program.

3.5.4.2. A program strategy, including overall cost, schedule, and performance goals for the total research and development program.

3.5.4.3. Specific cost, schedule, and performance goals, including exit criteria, for the first technology spiral demonstration.

3.5.4.4. A test plan to ensure that the goals and exit criteria for the first technology spiral demonstration are met.

3.5.5. Concept Refinement ends when the MDA approves the preferred solution resulting from the AoA and approves the associated TDS.

3.6. Technology Development

3.6.1. Purpose. The purpose of this phase is to reduce technology risk and to determine the appropriate set of technologies to be integrated into a full system. Technology Development is a continuous technology discovery and development process reflecting close collaboration between the S&T community, the user, and the system developer. It is an iterative process designed to assess the viability of technologies while simultaneously refining user requirements.

3.6.2. The project shall enter Technology Development at Milestone A when the MDA has approved the TDS. The tables in enclosure 3 identify all statutory and regulatory requirements applicable to Milestone A. This effort normally shall be funded only for the advanced development work. For business area capabilities, commercially available solutions shall be employed. (A toolkit of best practices is available at http://deskbook.dau.mil). A favorable Milestone A decision DOES NOT mean that a new acquisition program has been initiated.

3.6.3. Shipbuilding programs may be initiated at the beginning of Technology Development. The information required in the tables at enclosure 3 shall support program initiation. A cost assessment shall be prepared in lieu of an independent cost estimate (ICE), and a preliminary assessment of the maturity of key technologies shall be provided.

3.6.4. Before requesting a Milestone A decision for an AIS program, DoD Components shall affirmatively answer the following questions:

3.6.4.1. Does the acquisition support core/priority mission functions that need to be performed by the Federal Government?

3.6.4.2. Does the acquisition need to be undertaken by the DoD Component because no alternative private sector or governmental source can better support the function?

3.6.4.3. Does the acquisition support work processes that have been simplified or otherwise redesigned to reduce costs, improve effectiveness, and make maximum use of commercial off-the-shelf technology?

3.6.5. The ICD and the TDS shall guide this effort. Multiple technology development demonstrations may be necessary before the user and developer agree that a proposed technology solution is affordable, militarily useful, and based on mature technology. The TDS shall be reviewed and updated upon completion of each technology spiral and development increment. Updates shall be approved to support follow-on increments.

3.6.6. If an evolutionary strategy is used, the initial capability represents only partial fulfillment of the overall capability described in the ICD, and successive technology development efforts continue until all capabilities have been satisfied. In an evolutionary acquisition, the identification and development of the technologies necessary for follow-on increments continues in parallel with the acquisition of preceding increments, allowing the mature technologies to more rapidly proceed into System Development and Demonstration (SDD). Each increment of an evolutionary acquisition program shall have an associated MDA-approved TDS.

3.6.7. The project shall exit Technology Development when an affordable increment of militarily-useful capability has been identified, the technology for that increment has been demonstrated in a relevant environment, and a system can be developed for production within a short timeframe (normally less than five years); or when the MDA decides to terminate the effort. During Technology Development, the user shall prepare the Capability Development Document (CDD) to support program initiation, refine the integrated architecture, and clarify how the program will lead to joint warfighting capability. The CDD builds on the ICD and provides the detailed operational performance parameters necessary to design the proposed system. A Milestone B decision follows the completion of Technology Development.

3.7. System Development and Demonstration

3.7.1. Purpose

3.7.1.1. The purpose of the SDD phase is to develop a system or an increment of capability; reduce integration and manufacturing risk (technology risk reduction occurs during Technology Development); ensure operational supportability with particular attention to reducing the logistics footprint; implement human systems integration (HSI); design for producibility; ensure affordability and the protection of critical program information (CPI) by implementing appropriate techniques such as anti-tamper; and demonstrate system integration, interoperability, safety, and utility. Development and demonstration are aided by the use of simulation-based acquisition and test and evaluation integrated into an efficient continuum and guided by a system acquisition strategy and test and evaluation master plan (TEMP). The independent planning of dedicated Initial Operational Test and Evaluation (IOT&E), as required

by law, and Follow-on Operational Test and Evaluation (FOT&E), if required, shall be the responsibility of the appropriate operational test agency (OTA). A Director, Operational Test & Evaluation (DOT&E)-approved live-fire test and evaluation (LFT&E) strategy shall guide LFT&E activity.

3.7.1.2. SDD has two major efforts: System Integration and System Demonstration. The entrance point is Milestone B, which is also the initiation of an acquisition program. There shall be only one Milestone B per program or evolutionary increment. Each increment of an evolutionary acquisition shall have its own Milestone B. The tables in enclosure 3 identify the statutory and regulatory requirements that shall be met at Milestone B. For Shipbuilding Programs, the required program information shall be updated in support of the Milestone B decision, and the ICE shall be completed. The lead ship in a class shall normally be authorized at Milestone B. Technology readiness assessments shall consider the risk associated with critical subsystems prior to ship installation. Long lead for follow ships may be initially authorized at Milestone B, with final authorization and follow ship approval by the MDA dependent on completion of critical subsystem demonstration and an updated assessment of technology maturity.

3.7.2. Entrance Criteria. Entrance into this phase depends on technology maturity (including software), approved requirements, and funding. Unless some other factor is overriding in its impact, the maturity of the technology shall determine the path to be followed. Programs that enter the acquisition process at Milestone B shall have an ICD that provides the context in which the capability was determined and approved, and a CDD that describes specific program requirements.

3.7.2.1. Before proposing a new acquisition program, the DoD Components shall affirmatively answer the questions at paragraphs 3.6.4.1. through 3.6.4.3.

3.7.2.2. The management and mitigation of technology risk, which allows less costly and less time-consuming systems development, is a crucial part of overall program management and is especially relevant to meeting cost and schedule goals. Objective assessment of technology maturity and risk shall be a routine aspect of DoD acquisition. Technology developed in S&T or procured from industry or other sources shall have been demonstrated in a relevant environment or, preferably, in an operational environment to be considered mature enough to use for product development in systems integration. Technology readiness assessments, and where necessary, independent assessments, shall be conducted. If technology is not mature, the DoD Component shall use alternative technology that is mature and that can meet the user's needs.

3.7.2.3. Prior to beginning SDD, users shall identify and the requirements authority shall approve a minimum set of key performance parameters (KPPs), included in the CDD, that shall guide the efforts of this phase. These KPPs may be refined, with the approval of the requirements authority, as conditions warrant. Each set of KPPs shall only apply to the current increment of capability in development and demonstration (or to the entire system in a single step to full capability). At Milestone B, the PM shall prepare and the MDA shall approve an acquisition strategy to guide activity during SDD. The acquisition strategy shall include a TDS for the next technology spiral(s) (see paragraph 3.3.2.1, above).

3.7.2.4. In an evolutionary acquisition program, the development of each increment shall begin with a Milestone B, and production resulting from that increment shall

begin with a Milestone C. The requirements of the tables at enclosure 3 shall apply to each increment based on the ACAT level of the entire planned program.

3.7.2.5. Each program or increment shall also have an Acquisition Program Baseline establishing program goals—thresholds and objectives—for the minimum number of cost, schedule, and performance parameters that describe the program over its life cycle.

3.7.2.6. An affordability determination results from the process of addressing cost during the requirements process and is included in each CDD using life-cycle cost or, if available, total ownership cost. Transition into SDD also requires full funding (i.e., inclusion of the dollars and manpower needed for all current and future efforts to carry out the acquisition strategy in the budget and out-year program), which shall be programmed when a system concept and design have been selected, a PM has been assigned, requirements have been approved, and system-level development is ready to begin. In the case of a replacement system, when the Milestone B is projected to occur in the first 2 years of the Future Years Defense Program under review, the program shall be fully funded in that Planning, Programming, and Budgeting System cycle. In no case shall full funding be done later than Milestone B, unless a program first enters the acquisition process at Milestone C. The DoD Components shall fully fund their share of approved joint and international cooperative program commitments.

3.7.3. System Integration. This effort is intended to integrate subsystems, complete detailed design, and reduce system-level risk. The program shall enter System Integration when the PM has a technical solution for the system, but has not yet integrated the subsystems into a complete system. The CDD shall guide this effort. This effort shall typically include the demonstration of prototype articles or engineering development models (EDMs).

3.7.4. Proceeding beyond the Design Readiness Review. The Design Readiness Review during SDD provides an opportunity for mid-phase assessment of design maturity as evidenced by measures such as the number of subsystem and system design reviews successfully completed; the percentage of drawings completed; planned corrective actions to hardware/software deficiencies; adequate development testing; an assessment of environment, safety and occupational health risks; a completed failure modes and effects analysis; the identification of key system characteristics and critical manufacturing processes; an estimate of system reliability based on demonstrated reliability rates; etc. Successful completion of the Design Readiness Review ends System Integration and continues the SDD phase into the System Demonstration effort. MDAs may, consistent with the intent of this paragraph, determine the form and content of the review.

3.7.5. System Demonstration. This effort is intended to demonstrate the ability of the system to operate in a useful way consistent with the approved KPPs. The program shall enter System Demonstration when the PM has demonstrated the system in prototypes or EDMs. This effort shall end when a system is demonstrated in its intended environment, using the selected prototype; meets approved requirements; industrial capabilities are reasonably available; and the system meets or exceeds exit criteria and Milestone C entrance requirements. Successful development test and evaluation to assess technical progress against critical technical parameters, early operational assessments, and, where proven capabilities exist, the use of modeling and simulation to demonstrate system integration are critical during this effort. The completion of this phase is dependent on a decision by the MDA to commit to the program at Milestone C or a decision to end this effort.

3.7.6. The Department of Defense may not conduct operational testing (i.e., operational assessment (OA), IOT&E, or FOT&E) until the DOT&E approves, in writing, the OT&E portions of the combined developmental and operational test plan for programs on the OSD T&E Oversight List, and the adequacy of the plans (including the projected level of funding) for the OT&E to be conducted in connection with that program (reference (h)). Deficiencies encountered in testing prior to Milestone C shall be resolved prior to proceeding beyond Low-Rate Initial Production (LRIP) (at the Full-Rate Production Decision Review) and any fixes verified in FOT&E.

3.8. Production and Deployment

3.8.1. Purpose

3.8.1.1. The purpose of the Production and Deployment phase is to achieve an operational capability that satisfies mission needs. Operational test and evaluation shall determine the effectiveness and suitability of the system. The MDA shall make the decision to commit the Department of Defense to production at Milestone C. Milestone C authorizes entry into LRIP (for MDAPs and major systems), into production or procurement (for non-major systems that do not require LRIP) or into limited deployment in support of operational testing for MAIS programs or software-intensive systems with no production components. The tables at enclosure 3 identify the statutory and regulatory requirements that shall be met at Milestone C.

3.8.1.2. For MDAPs and other DOT&E Oversight programs, Production and Deployment has two major efforts, LRIP and Full-Rate Production and Deployment, and includes a Full-Rate Production Decision Review.

3.8.2. Entrance Criteria. Entrance into this phase depends on the following criteria: acceptable performance in development, test and evaluation and operational assessment; mature software capability; no significant manufacturing risks; manufacturing processes under control (if Milestone C is full-rate production); an approved ICD (if Milestone C is program initiation); an approved Capability Production Document (CPD); acceptable interoperability; acceptable operational supportability; compliance with the DoD Strategic Plan; and demonstration that the system is affordable throughout the life cycle, optimally funded, and properly phased for rapid acquisition. The CPD reflects the operational requirements resulting from SDD and details the performance expected of the production system. If Milestone C approves LRIP, a subsequent review and decision shall authorize full-rate production.

3.8.3. LRIP

3.8.3.1. This effort is intended to result in completion of manufacturing development in order to ensure adequate and efficient manufacturing capability and to produce the minimum quantity necessary to provide production or production-representative articles for IOT&E, establish an initial production base for the system; and permit an orderly increase in the production rate for the system, sufficient to lead to full-rate production upon successful completion of operational (and live-fire, where applicable) testing.

3.8.3.2. LRIP quantities shall be minimized. The MDA shall determine the LRIP quantity for MDAPs and major systems at Milestone B. The LRIP quantity for an MDAP (with rationale for quantities exceeding 10 percent of the total production quantity documented in the acquisition strategy) shall be included in the first Selected Acquisition Report after its determination. Any increase in quantity after the initial determination shall be approved by the

MDA. The LRIP quantity shall not be less than one unit. When approved LRIP quantities are expected to be exceeded because the program has not yet demonstrated readiness to proceed to full-rate production, the MDA shall assess the cost and benefits of a break in production versus continuing annual buys.

3.8.3.3. DOT&E shall determine the number of production or production-representative test articles required for LFT&E and IOT&E of DOT&E Oversight Programs (MDAPs as defined in paragraph a(2)(B) of 10 U.S.C. 139) (reference (i)). For a system that is not a DOT&E Oversight Program, the OTA shall determine the number of test articles required for IOT&E. Modifications to an existing system with an established production base may not require low-rate production to provide production or production-representative articles for operational testing; test articles, if needed, may come from the existing production line.

3.8.3.4. LRIP is not applicable to AISs or software-intensive systems with no developmental hardware; however, a limited deployment phase may be applicable. Software shall have demonstrated the maturity level required in the CPD prior to deploying it to the operational environment. Once the maturity level has been demonstrated, the system or increment is baselined, and a methodical and synchronized deployment plan is implemented for all applicable locations.

3.8.3.5. LRIP for ships and satellites is production of items at the minimum quantity and rate that is feasible and that preserves the mobilization production base for that system.

3.8.4. Full-Rate Production Criteria. An MDAP may not proceed beyond LRIP without approval of the MDA. The available knowledge to support this approval shall include demonstrated control of the manufacturing process and acceptable reliability, the collection of statistical process control data, and the demonstrated control and capability of other critical processes. The decision to continue beyond low-rate to full-rate production, or beyond limited deployment of AISs or software-intensive systems with no developmental hardware, shall require completion of IOT&E, submission of the Beyond LRIP Report for DOT&E Oversight Programs, and submission of the LFT&E Report (where applicable) to Congress, to the Secretary of Defense, and to the USD(AT&L).

3.8.5. Full-Rate Production and Deployment. Continuation into full-rate production results from a successful Full-Rate Production Decision Review by the MDA (or person designated by the MDA). This effort delivers the fully funded quantity of systems and supporting materiel and services for the program or increment to the users. During this effort, units shall attain Initial Operational Capability. The tables at enclosure 3 identify the statutory and regulatory requirements associated with this decision.

3.9. Operations and Support

3.9.1. Purpose. The objective of this activity is the execution of a support program that meets operational support performance requirements and sustains the system in the most cost-effective manner over its total life cycle. When the system has reached the end of its useful life, it shall be disposed of in an appropriate manner. Operations and Support has two major efforts: Sustainment and Disposal.

3.9.2. Sustainment

3.9.2.1. Sustainment includes supply, maintenance, transportation, sustaining engineering, data management, configuration management, manpower, personnel, training,

habitability, survivability, environment, safety (including explosives safety), occupational health, protection of critical program information, anti-tamper provisions, and information technology (IT), including National Security Systems (NSS), supportability and interoperability functions.

3.9.2.2. Effective sustainment of weapon systems begins with the design and development of reliable and maintainable systems through the continuous application of a robust systems engineering methodology. As a part of this process, the PM shall employ human factors engineering to design systems that require minimal manpower; provide effective training; can be operated and maintained by users; and are suitable (habitable and safe with minimal environmental and occupational health hazards) and survivable (for both the crew and equipment).

3.9.2.3. The PM shall work with the users to document performance and support requirements in performance agreements specifying objective outcomes, measures, resource commitments, and stakeholder responsibilities. The Military Services shall document sustainment procedures that ensure integrated combat support.

3.9.2.4. The DoD Components shall initiate system modifications, as necessary, to improve performance and reduce ownership costs.

3.9.2.4.1. PMs shall optimize operational readiness through affordable, integrated, embedded diagnostics and prognostics, and embedded training and testing; serialized item management; automatic identification technology (AIT); and iterative technology refreshment.

3.9.2.4.2. PMs shall ensure that data syntax and semantics for high capacity AIT devices conform to International Organization for Standardization (ISO) 15434 and ISO 15418, references (j) and (k).

3.9.2.5. The Services, in conjunction with users, shall conduct continuing reviews of sustainment strategies, utilizing comparisons of performance expectation as defined in performance agreements against actual performance measures. PMs shall revise, correct, and improve sustainment strategies as necessary to meet performance requirements.

3.9.2.6. Sustainment strategies shall evolve and be refined throughout the life cycle, particularly during development of subsequent increments of an evolutionary strategy, modifications, upgrades, and reprocurement. The PM shall ensure that a flexible, performance-oriented strategy to sustain systems is developed and executed.

3.9.3. Disposal. At the end of its useful life, a system shall be demilitarized and disposed in accordance with all legal and regulatory requirements and policy relating to safety (including explosives safety), security, and the environment. During the design process, PMs shall document hazardous materials contained in the system, and shall estimate and plan for the system's demilitarization and safe disposal.

3.10. Review Procedures

3.10.1. Review of ACAT ID and IAM Programs. The USD(AT&L) shall designate programs as ACAT ID, and the ASD(C3I) shall designate programs as ACAT IAM, when the program has special interest based on one or more of the following factors: technological complexity; Congressional interest; a large commitment of resources; the program is critical to achievement of a capability or set of capabilities; or the program is a joint program. Exhibiting

one or more of these characteristics, however, shall not automatically lead to an ACAT ID or IAM designation.

3.10.2. Defense Acquisition Board (DAB) Review. The DAB shall advise the USD(AT&L) on critical acquisition decisions. The USD(AT&L) shall chair the DAB, and the Vice Chairman of the Joint Chiefs of Staff shall serve as the co-chair. An ADM shall document the decision(s) resulting from the review.

3.10.3. IT Acquisition Board (ITAB) Review. The ITAB shall advise the ASD(C3I)/DoD CIO on critical acquisition decisions. These reviews shall enable the execution of the DoD CIO's acquisition-related responsibilities for IT, including NSS, under the Clinger-Cohen Act (CCA), reference (l), and Title 10 of United States Code, reference (m). An ADM shall document the decision(s) resulting from the review.

3.10.4. Overarching Integrated Product Team (OIPT). An OIPT shall facilitate program communications and issue resolution, and support the MDA, for ACAT I and IA programs.

4. RESPONSIBILITIES

MDAs shall establish mandatory procedures for assigned programs. These procedures shall not exceed the requirements for MDAPs and MAIS acquisition programs established in this Instruction or in reference (c). The Heads of the DoD Components shall keep the issuance of any directives, instructions, policy memorandums, or regulations necessary to implement the mandatory procedures contained in this Instruction and reference (c) to a minimum. Waivers or requests for exceptions to the provisions of this Instruction shall be submitted to the USD(AT&L), ASD(C3I), or DOT&E, as appropriate via the Component Acquisition Executive (CAE). Statutory requirements cannot be waived unless the statute specifically provides for waiver of the stated requirements.

5. EFFECTIVE DATE

This Instruction is effective immediately.

Under Secretary of Defense (Acquisition, Technology, and Logistics)	Assistant Secretary of Defense (Command, Control, Communications, and Intelligence)	Director, Operational Test and Evaluation

Enclosures – 9

E1. References, continued
E2. ACAT and MDA
E3. Statutory and Regulatory Information and Milestone Requirements
E4. IT Considerations
E5. Integrated Test and Evaluation
E6. Resource Estimation
E7. Human Systems Integration
E8. Acquisition of Services
E9. Program Management

E1. ENCLOSURE 1

REFERENCES, continued

(d) OMB Circular A-11, "Preparing, Submitting, and Executing the Budget," June 27, 2002
(e) OMB Circular A-109, "Major Systems Acquisitions," April 1976
(f) Department of Defense Joint Technical Architecture, current version
(g) Chairman of the Joint Chiefs of Staff Instruction 3170.01 Series, "Requirements Generation System," April 15, 2001
(h) Section 2399 of title 10, United States Code, "Operational Test and Evaluation of Defense Acquisition Programs"
(i) Section 139 of title 10, United States Code, "Director of Operational Test and Evaluation"
(j) ISO 15418-1999- "EAN/UCC Application Identifiers and Fact Data Identifiers and Maintenance"
(k) ISO 15434-1999 – "Transfer Syntax for High Capacity ADC Media"
(l) Subtitle III of title 40, United States Code [formerly the Clinger-Cohen Act of 1996 which was repealed and many of its provisions reenacted at 40 U.S.C. 11101 et seq.]
(m) Title 10, United States Code, "Armed Forces"
(n) Section 2430 of title 10, United States Code, "Major Defense Acquisition Program Defined"
(o) Section 2302d of title 10, United States Code, "Major system: definitional threshold amounts"
(p) Section 2302 of title 10, United States Code, "Definitions"
(q) Section 2364 of title 10, United States Code, "Coordination and Communication of Defense Research Activities"
(r) Section 2377 of title 10, United States Code, "Preference for Acquisition of Commercial Items"
(s) Section 644 of title 15, United States Code, "Procurement strategies; contract bundling"
(t) Section 8088, Public Law 107-248, "Department of Defense Appropriation Act for Fiscal Year 2003" (or successor provision)
(u) Section 306 of title 5, United States Code, "Strategic Plans" (part of the Government Performance and Results Act)
(v) Section 11313 of title 40, United States Code, untitled
(w) Section 811 of the "Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001," Public Law 106-398 Appendix
(x) Section 4321 et seq. of title 42, United States Code, "National Environmental Policy Act"
(y) Section 305 of title 47, United States Code, "Government-Owned Stations"
(z) Section 104 of the National Telecommunications and Information Organization Act (Pub. L. 102-538), "Spectrum Management Activities"
(aa) Sections 901, 902, 903, and 904 of title 47, United States Code
(ab) DoD Directive 4650.1, "Management and Use of the Radio Frequency Spectrum," June 24, 1987
(ac) Section 2432 of title 10, United States Code, "Selected Acquisition Reports"
(ad) Section 2433 of title 10, United States Code, "Unit Cost Reports"
(ae) Section 2366 of title 10, United States Code, "Major Systems and Munitions Programs: Survivability and Lethality Testing Required Before Full-Scale Production"
(af) Section 2440 of title 10, United States Code, "Technology and Industrial Base Plans"

(ag) Section 2400 of title 10, United States Code, "Low-Rate Initial Production of New Systems"
(ah) Section 2434 of title 10, United States Code, "Independent Cost Estimates; Operational Manpower Requirements"
(ai) Section 220, Public Law 103-160, as amended by Sec. 214 of Pub.L. 103-337
(aj) Section 2460 of title 10, United States Code, "Definition of Depot-Level Maintenance and Repair"
(ak) Section 2464 of title 10, United States Code, "Core Logistics Capabilities"
(al) Section 2466 of title 10, United States Code, "Limitations on the Performance of Depot-Level Maintenance of Material"
(am) Section 2469 of title 10, United States Code, "Contracts to Perform Workloads Previously Performed by Depot-Level Activities of the Department of Defense: Requirement of Competition"
(an) Section 803, Public Law 107-314, "Bob Stump National Defense Authorization Act for Fiscal Year 2003," "Spiral development under major defense acquisition programs"
(ao) Section 2435 of title 10, United States Code, "Baseline Description"
(ap) Section 2350a of title 10, United States Code, "Cooperative Research and Development Programs: Allied Countries"
(aq) DoD Directive 5105.21, "Defense Intelligence Agency (DIA)," February 18, 1997
(ar) DoD Instruction 4630.8, "Procedures for Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," May 2, 2002
(as) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," January 11, 2002
(at) CJCSI 6212.01B, "Interoperability and Supportability of National Security Systems, and Information Technology Systems," May 8, 2000
(au) DoD Directive 5200.39, "Security, Intelligence, and Counterintelligence Support to Acquisition Program Protection," September 10, 1997
(av) American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA) 748-A-1998 (R2002), August 28, 2002
(aw) DoD 5000.4-M-1, "Contractor Cost Data Reporting (CCDR) Manual," April 1999
(ax) Section 1004, Public Law 107-314, "Bob Stump National Defense Authorization Act for Fiscal Year 2003," "Development and Implementation of Financial Management Enterprise Architecture"
(ay) Section 1451 of title 40, United States Code, "Applicability to National Security Systems"
(az) Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions," January 4, 1979
(ba) Office of the Secretary of Defense Memorandum, "Designation of Programs for 200x OSD Test and Evaluation (T&E) Oversight," current edition
(bb) DoD Directive 5000.4, "Cost Analysis Improvement Group (CAIG)," November 16, 1994
(bc) DoD 5000.4-M, "Cost Analysis Guidance and Procedures," December 11, 1992
(bd) DoD Directive 1430.13, "Training Simulators and Devices," August 22, 1986
(be) Section 801(d) of the National Defense Authorization Act for Fiscal Year 2002, Public Law 107-107
(bf) Sections 1701-1764 of title 10, United States Code, "Management policies" [of the Defense acquisition workforce]
(bg) DoD Directive 5015.2, "DoD Records Management Program," March 6, 2000

(bh) Section 3101 et seq. of title 44, United States Code, "Records Management by Federal Agencies"
(bi) "Interim Defense Acquisition Guidebook," October 30, 2002
(bj) DoD Directive 5530.3, "International Agreements," June 11, 1987
(bk) Section 2341 of title 10, United States Code, "Authority to Acquire Logistic Support, Supplies, and Services for Elements of the Armed Forces Deployed Outside the U.S."
(bl) Section 2342 of title 10, United States Code, "Cross-Servicing Agreements"

E2. ENCLOSURE 2

ACAT AND MDA

E2.1. General. A technology project or acquisition program shall be categorized based on its location in the acquisition process, dollar value, and MDA special interest.

E2.2. Pre-ACAT Technology Projects. Advanced Technology Demonstrations, Joint Warfighting Experiments, Advanced Concept and Technology Demonstrations, Concept Refinement, and Technology Development occur prior to acquisition program initiation. The USD(AT&L) shall be the MDA for those projects that, if successful, will likely result in an MDAP. The ASD(C3I)/DoD CIO shall be the MDA for those projects that, if successful, will result in a MAIS.

E2.3. Table E2.T1. contains the description and decision authority for ACAT I through III programs.

Table E2.T1. Description and Decision Authority for ACAT I – III Programs

Acquisition Category	Reason for ACAT Designation	Decision Authority
ACAT I	• MDAP (10 USC 2430, reference (n))) ○ Dollar value: estimated by the USD(AT&L) to require an eventual total expenditure for research, development, test and evaluation (RDT&E) of more than $365 million in fiscal year (FY) 2000 constant dollars or, for procurement, of more than $2.190 billion in FY 2000 constant dollars ○ MDA designation • MDA designation as special interest	ACAT ID: USD(AT&L) ACAT IC: Head of the DoD Component or, if delegated, the DoD Component Acquisition Executive (CAE)
ACAT IA	• MAIS: Dollar value of AIS estimated by the DoD Component Head to require program costs (all appropriations) in any single year in excess of $32 million in fiscal year (FY) 2000 constant dollars, total program costs in excess of $126 million in FY 2000 constant dollars, or total life-cycle costs in excess of $378 million in FY 2000 constant dollars • MDA designation as special interest	ACAT IAM: ASD(C3I)/DoD CIO ACAT IAC: CAE, as delegated by the DoD CIO
ACAT II	• Does not meet criteria for ACAT I • Major system ○ Dollar value: estimated by the DoD Component Head to require an eventual total expenditure for RDT&E of more than $140 million in FY 2000 constant dollars, or for procurement of more than $660 million in FY 2000 constant dollars (10 USC 2302d, reference (o)) ○ MDA designation[4] (10 USC 2302(5), reference (p)) • MDA designation as special interest	DoD CAE or the individual designated by the CAE
ACAT III	• Does not meet criteria for ACAT II or above • Less-than a MAIS program	Designated by the DoD CAE at the lowest level appropriate

Notes:
1. In some cases, an ACAT IA program, as defined above, also meets the definition of an MDAP. The USD(AT&L) and the ASD(C3I)/DoD CIO shall decide who will be the MDA for such programs. Regardless of who is the MDA, the statutory requirements that apply to MDAPs shall apply to such programs.
2. An AIS program is an acquisition program that acquires IT, except IT that involves equipment that is an integral part of a weapon or weapons system, or is an acquisition of services program.
3. The ASD(C3I)/DoD CIO shall designate programs as ACAT IAM or ACAT IAC. MAIS programs shall not be designated as ACAT II.
4. As delegated by the Secretary of Defense or Secretary of the Military Department.

E2.4. The DoD Component shall notify the USD(AT&L) or the ASD(C3I)/DoD CIO when cost growth or a change in acquisition strategy results in reclassifying a formerly lower ACAT program as an ACAT I or IA program. ACAT-level changes shall be reported as soon as the DoD Component anticipates that the program is within 10 percent of the next ACAT level. ACAT-level reclassification shall occur upon designation by the USD(AT&L) or the ASD(C3I)/DoD CIO.

E2.4.1. The CAE shall request a reclassification of an ACAT I or IA program to a lower ACAT. The request shall identify the reasons for the reduction in category. The category reduction shall become effective upon approval of the request by the USD(AT&L) or the ASD(C3I)/DoD CIO.

E2.4.2. The USD(AT&L) or the ASD(C3I)/DoD CIO may reclassify an acquisition program as a pre-MDAP/MAIS or as an ACAT ID or IAM at any time.

E3. ENCLOSURE 3

STATUTORY, REGULATORY, AND CONTRACT REPORTING INFORMATION AND MILESTONE REQUIREMENTS

E3.1. Tables E3.T1, E3.T2, and E3.T3, below, show the information requirements for all milestones and phases, both statutory and regulatory, to include contract reporting. MDAs may tailor regulatory program information to fit the particular conditions of an individual program. A non-mandatory guidebook shall support this Instruction to provide best practices, lessons learned, and expectations for the information required by these tables. Issues regarding the intent of the expectations described in the guidebook shall be resolved by the MDA. The AT&L Knowledge Sharing System (formerly Defense Acquisition Deskbook) contains a library of mandatory policy and regulations and discretionary practices and advice. The web address is http://deskbook.dau.mil/.

E3.2. The following Statutory Information Requirements Table is divided into sections to indicate which information requirements are applicable to MDAPs, MAIS programs, or both. MAIS programs that are also MDAPs are subject to both sets of statutory requirements.

Table E3.T1. Statutory Information Requirements

INFORMATION REQUIRED	APPLICABLE STATUTE	WHEN REQUIRED
The following information requirements are statutory for both MDAPs and MAIS acquisition programs		
Consideration of Technology Issues	10 U.S.C. 2364, reference (q)	Milestone (MS) A MS B MS C
Market Research	10 U.S.C. 2377, reference (r) 15 U.S.C. 644(e)(2), reference (s)	Technology Opportunities User Needs MS A MS B
CCA Compliance (All IT–including NSS) (See enclosure 4, Table E4.T1.)	40 U.S.C. Subtitle III, reference (l) Sec. 8088, Pub.L. 107-248, reference (t) (or successor appropriations act provision)	MS A (MAIS only) Program Initiation for Ships MS B MS C (if equivalent to Full-Rate Production DR) Full-Rate Production DR
Post-Deployment Performance Review	5 U.S.C. 306, reference (u) 40 U.S.C. 11313, reference (v)	Full-Rate Production DR
Registration of mission-critical and mission-essential information systems, RCS: DD-C3I(AR)2096	Sec. 8088(a), Pub.L. 107-248, reference (t) (or successor appropriations act provision) Pub.L. 106-398, Section 811, reference (w)	Program Initiation for Ships MS B (if Program Initiation) MS C (if Program Initiation or if equivalent to Full-Rate Production DR) Full-Rate Production DR (After initial registration, shall be updated quarterly)
Benefit Analysis and Determination (applicable to bundled acquisitions) (part of acquisition strategy)	15 U.S.C. 644(e), reference (s)	MS B MS C (if no MS B)
Beyond-LRIP Report (OSD OT&E Oversight programs only)	10 U.S.C. 2399, reference (h)	Full-Rate Production DR

Programmatic Environment Safety and Occupational Health Evaluation (PESHE) (Including National Environmental Policy Act (NEPA) Compliance Schedule)	42 U.S.C. 4321, reference (x)	Program Initiation for Ships MS B MS C Full-Rate Production DR
Spectrum Certification Compliance (DD Form 1494) (applicable to all systems/equipment that require utilization of the electromagnetic spectrum)	47 U.S.C. 305, reference (y) Pub. L. 102-538, 104, reference (z) 47 U.S.C. 901-904, reference (aa) DoD Directive 4650.1, reference (ab) OMB Circular A-11, Part 2, reference (d)	MS B MS C (if no MS B)
The following information requirements are statutory but are not applicable to MAIS acquisition programs		
Selected Acquisition Report (SAR)—Reports Control Symbol (RCS): DD-AT&L(Q&A)823 (MDAPs only)	10 U.S.C. 2432, reference (ac)	Program Initiation for Ships MS B and annually thereafter End of quarter following MS C Full-Rate Production DR Breach
Unit Cost Report (UCR)— RCS: DD-AT&L(Q&R)1591 (MDAPs only)	10 U.S.C. 2433, reference (ad)	Quarterly
Live-Fire Waiver & Alternate LFT&E Plan (N/A for AISs) (Covered Systems only)	10 U.S.C. 2366, reference (ae)	MS B
Industrial Capabilities (part of acquisition strategy) (N/A for AISs)	10 U.S.C. 2440, reference (af)	MS B MS C
LRIP Quantities (N/A for AISs)	10 U.S.C. 2400, reference (ag)	MS B
Independent Cost Estimate (CAIG) and Manpower Estimate (reviewed by OUSD(P&R)) (N/A for AISs) (MDAPs Only)	10 U.S.C. 2434, reference (ah)	Program Initiation for Ships (cost assessment only) MS B MS C Full-Rate Production DR
LFT&E Report, RCS: DD-OT&E(AR)1845 (LFT&E-covered programs only)	10 U.S.C. 2366, reference (ae)	Full-Rate Production DR
Electronic Warfare (EW) T&E RCS: DD-AT&L(A)2137 (EW programs on OSD T&E Oversight List)	Sec. 220 of Pub. L. 103-160 as amended by Sec. 214 of Pub. L. 103-337, reference (ai)	Annually
Core Logistics Analysis/Source of Repair Analysis (part of acquisition strategy)	10 U.S.C. 2460, reference (aj) 10 U.S.C. 2464, reference (ak) 10 U.S.C. 2466, reference (al)	MS B MS C (if no MS B)
Competition Analysis (Depot-level Maintenance $3M rule) (part of acquisition strategy)	10.U.S.C. 2469, reference (am)	MS B MS C (if no MS B)
The following information requirements are statutory for MDAPs and are applicable to MAIS acquisition programs by this Instruction		
Technology Development Strategy (TDS)	Sec. 803, Pub.L. 107-314, reference (an)	MS A MS B MS C
Acquisition Program Baseline (APB)	10 U.S.C. 2435, reference (ao)	Program Initiation for Ships MS B MS C (updated, as necessary) Full-Rate Production DR
Program Deviation Report	10 U.S.C. 2435, reference (ao)	Immediately upon a program deviation
Operational Test Plan (DOT&E Oversight Programs only)	10 U.S.C. 2399, reference (h)	Prior to start of operational test and evaluation
Cooperative Opportunities (part of acquisition strategy)	10 U.S.C. 2350a, reference (ap)	MS B MS C

The following information requirements are statutory for MAIS acquisition programs and are not applicable to MDAPs		
Certification of compliance with the Clinger-Cohen Act	Sec. 8088, Pub.L. 107-248, reference (t) (or successor appropriations act provision)	MS A MS B MS C (if equivalent to Full-Rate Production DR) Full-Rate Production DR
Certification of compliance with the Financial Management Enterprise Architecture (Financial Management MAIS acquisition programs only)	Sec. 8088, Pub.L. 107-248, reference (t) (or successor appropriations act provision)	MS A MS B MS C (if equivalent to Full-Rate Production DR) Full-Rate Production DR

Table E3.T2. Regulatory Information Requirements

INFORMATION REQUIRED	SOURCE	WHEN REQUIRED
AoA Plan	This Instruction	Concept Decision
ICD	CJCSI 3170.01, reference (g)	Concept Decision MS A MS B MS C (if Program Initiation)
CDD	CJCSI 3170.01, reference (g)	Program Initiation for Ships MS B
CPD	CJCSI 3170.01, reference (g)	MS C
Acquisition Strategy	This Instruction	Program Initiation for Ships MS B MS C Full-Rate Production DR
Analysis of Alternatives (AoA)	This Instruction *	For MDAPs - MS A - Program Initiation for Ships - MS B - MS C (updated as necessary) For MAIS - MS A - MS B (or equivalent) - Full-Rate Production DR (or equivalent)
System Threat Assessment (AIS programs use published Capstone Information Operations System Threat Assessment) (validated by DIA for ACAT ID programs)	DoD Directive 5105.21, reference (aq)	Program Initiation for Ships MS B MS C
Technology Readiness Assessment	This Instruction	Program Initiation for Ships (preliminary assessment) MS B MS C
Independent Technology Assessment (ACAT ID only) (if required by DUSD(S&T))	This Instruction	MS B MS C
Command, Control, Communications, Computers, and Intelligence Support Plan (C4ISP) (also summarized in the acquisition strategy)	DoD Instruction 4630.8 and DoD Directive 4630.5, references (ar) and (as)	Program Initiation for Ships MS B MS C
Command, Control, Communications, Computers, and Intelligence (C4I) Supportability Certification	CJCSI 6212.01, reference (at) This Instruction	Full-Rate Production DR

Interoperability Certification	CJCSI 6212.01, reference (at) This Instruction	Full-Rate Production DR
Affordability Assessment	This Instruction	MS B MS C
Economic Analysis (MAIS only)	This Instruction *	MS A (may be combined with AoA) MS B (or equivalent) Full-Rate Production DR (or equivalent)
Component Cost Analysis (mandatory for MAIS; as requested by CAE for MDAP)	This Instruction	For MDAPs - Program Initiation for Ships - MS B - Full-Rate Production DR For MAIS - Any time an Economic Analysis is required—either by statute or by the MDA
Cost Analysis Requirements Description (MDAPs and MAIS Acquisition Programs only) (CARDs shall be prepared according to the procedures specified in enclosure 6 of this Instruction)	This Instruction	For MDAPs - Program Initiation for Ships - MS B - MS C - Full-Rate Production DR For MAIS - Any time an Economic Analysis is required—either by statute or by the MDA
Test and Evaluation Master Plan (TEMP)	This Instruction	MS A (test and evaluation strategy only) MS B MS C (update, if necessary) Full-Rate Production DR
Operational Test Agency Report of Operational Test and Evaluation Results	This Instruction	MS B MS C Full-Rate Production DR
Component Live-Fire Test and Evaluation Report (N/A for AISs) (Covered Systems Only)	This Instruction	Completion of Live Fire Test and Evaluation
Program Protection Plan (PPP) (for programs with critical program information) (includes Anti-Tamper Annex) (also summarized in the acquisition strategy)	DoD Directive 5200.39, reference (au)	MS B (based on approved requirements in CDD) MS C
Exit Criteria	This Instruction	Program Initiation for Ships MS A MS B MS C Each Review
Defense Acquisition Executive Summary (DAES) RCS: DD-AT&L(Q)1429	This Instruction	Quarterly Upon POM or BES submission Upon unit cost breach
ADM	This Instruction	Program Initiation for Ships MS A MS B MS C Each Review

Earned Value Management Systems (EVMS)	OMB Circular A-11, Part 7, reference (d)	Implement EVMS guidelines in ANSI/EIA-748-1998 (reference (av)) and conduct Integrated Baseline Reviews (applies to contracts/agreements for RDT&E over $73 million and procurement or O&M over $315 million, both in FY 2000 constant dollars)
* For a MAIS acquisition program, required by Pub.L. 107-248, Section 8088, reference (t), at Milestones A and B, and at the full-rate production decision (or their equivalents).		

Table E3.T3. Contract Reporting Requirements

REQUIRED REPORT	SOURCE	WHEN REQUIRED
Contractor Cost Data Report (CCDR)	DoD 5000.4-M-1, reference (aw) This Instruction	• All major contracts and subcontracts, regardless of contract type, for ACAT I programs valued at more than $50 million (FY 2002 constant dollars) • Not required for contracts priced below $7 million (FY 2002 constant dollars) • The CCDR requirement on high-risk or high-technical-interest contracts priced between $7 and $50 million is left to the discretion of the Cost Working Integrated Product Team (IPT) • Not required for procurement of commercial systems, or for non-commercial systems bought under competitively awarded, firm fixed-price contracts, as long as competitive conditions continue to exist
Software Resources Data Report (SRDR)	This Instruction	All major contracts and subcontracts, regardless of contract type, for contractors developing/producing software elements within ACAT I and ACAT IA programs for any software development element with a projected software effort greater than $25M (FY 2002 constant dollars). Submit data on each software element at the following times: -180 days prior to contract award -60 days after contract award -60 days after start of subsequent software releases -within 120 days after software release or final delivery

E4. ENCLOSURE 4
IT CONSIDERATIONS

E4.1. Mission-Critical/Mission-Essential Information System

E4.1.1. Mission-Critical Information System. A system that meets the definitions of "information system" and "national security system" in the CCA (reference (l)), the loss of which would cause the stoppage of warfighter operations or direct mission support of warfighter operations. (Note: The designation of mission critical shall be made by a Component Head, a Combatant Commander, or their designee. A financial management IT system shall be considered a mission-critical IT system as defined by the USD(C).) A "Mission-Critical Information Technology System" has the same meaning as a "Mission-Critical Information System."

E4.1.2. Mission-Essential Information System. A system that meets the definition of "information system" in reference (l), that the acquiring Component Head or designee determines is basic and necessary for the accomplishment of the organizational mission. (Note: The designation of mission essential shall be made by a Component Head, a Combatant Commander, or their designee. A financial management IT system shall be considered a mission-essential IT system as defined by the USD(C).) A "Mission-Essential Information Technology System" has the same meaning as a "Mission-Essential Information System."

E4.2. IT System Procedures

E4.2.1. The MDA shall not approve program initiation or entry into any phase that requires milestone approval for an acquisition program (at any level) for a mission-critical or mission-essential IT system until the DoD Component CIO confirms or certifies (for MAIS only) that the system is being developed in accordance with reference (l). At a minimum, the DoD Component CIO's confirmation or certification shall include a written description of the three materiel questions of section 3.6.4 and the considerations in Table E4.T1.

E4.2.2. PMs shall prepare a table such as the one illustrated at Table E4.T1. to indicate which acquisition documents correspond to the CCA requirements. DoD Component CIOs shall use the acquisition documents identified in the table to assess CCA compliance. The requirements for submission of written confirmation or certification (for MAIS only) shall be satisfied by the DoD Component CIO's concurrence with the PM's CCA Compliance Table. Issues related to compliance shall be resolved via the IPT process. The cognizant PSA shall coordinate on the CCA Compliance Table. No Milestone A, B, or Full-Rate Production decision (or their equivalent) shall be granted for a MAIS until the DoD CIO certifies that the MAIS program is being developed in accordance with the CCA.

E4.2.3. For MDAP and MAIS programs, the DoD Component CIO's confirmation (for MDAP) and certification (for MAIS) shall be provided to both the DoD CIO and the MDA.

E4.2.4. The DoD Components shall not award a contract for the acquisition of a mission-critical or mission-essential IT system, at any level, until the following have been accomplished:

E4.2.4.1. The DoD Component registers the system with the DoD CIO;

E4.2.4.2. The DoD CIO determines the system has an appropriate information assurance strategy; and

E4.2.4.3. The DoD Component CIO confirms that the system is being developed in accordance with the CCA by complying with paragraph E4.2.1 (above).

E4.2.5. The requirement to confirm or, for MAIS only, to certify CCA compliance applies to milestone decisions for each increment of an evolutionary acquisition. The requirements of

the CCA apply to all IT (including NSS) acquisitions, but subparagraph E4.2.4, above, applies only to mission-critical and mission-essential IT systems.

E4.2.6. At Milestone C, for MAIS, the MDA shall approve, in coordination with DOT&E, the quantity and location of sites for a limited deployment for IOT&E.

E4.2.7. When the use of commercial IT is considered viable, maximum leverage of and coordination with the DoD Enterprise Software Initiative shall be made.

E4.2.8. For financial management MAIS acquisition programs, the MDA shall not grant any milestone or full-rate production approval, or their equivalent, until the USD(C) certifies that the system is being developed and managed in accordance with the DoD Financial Management Enterprise Architecture (reference (t) and Sec.1004 of Pub.L. 107-314 (reference (ax))).

E4.2.9. An amount in excess of $1,000,000 may be obligated for defense financial system improvement (i.e., a new, or modification of, a budgetary, accounting, finance, enterprise resource planning, or mixed (financial and non-financial) information system) only if the USD(C) determines and certifies that the system is being developed or modified, and acquired and managed in a manner that is consistent with both the DoD Financial Management Enterprise Architecture and the DoD Financial Management Enterprise Architecture Transition Plan. The USD(C) shall provide such certification to the MDA before any milestone or full-rate production approval, or their equivalent, is made by the MDA.

Table E4.T1. CCA Compliance Table

Requirements Related to the Clinger-Cohen Act (CCA) of 1996 (reference (l))	Applicable Program Documentation **
*** Make a determination that the acquisition supports core, priority functions of the Department	ICD Approval
*** Establish outcome-based performance measures linked to strategic goals	ICD, CDD, CPD and APB approval
*** Redesign the processes that the system supports to reduce costs, improve effectiveness and maximize the use of COTS technology	Approval of the ICD, Concept of Operations, AoA, CDD, and CPD
* No Private Sector or Government source can better support the function	Acquisition Strategy page XX, para XX AoA page XX
* An analysis of alternatives has been conducted	AoA
* An economic analysis has been conducted that includes a calculation of the return on investment; or for non-AIS programs, a Life-Cycle Cost Estimate (LCCE) has been conducted	Program LCCE Program Economic Analysis for MAIS
There are clearly established measures and accountability for program progress	Acquisition Strategy page XX APB
The acquisition is consistent with the Global Information Grid policies and architecture, to include relevant standards	APB (Interoperability KPP) C4ISP (Information Exchange Requirements)
The program has an information assurance strategy that is consistent with DoD policies, standards and architectures, to include relevant standards	Information Assurance Strategy
To the maximum extent practicable, (1) modular contracting has been used, and (2) the program is being implemented in phased, successive increments, each of which meets part of the mission need and delivers measurable benefit, independent of future increments	Acquisition Strategy page XX
The system being acquired is registered	Registration Database

* For weapons systems and command and control systems, these requirements apply to the extent practicable (40 U.S.C. 1451, reference (ay))

** The system documents/information cited are examples of the most likely but not the only references for the required information. If other references are more appropriate, they may be used in addition to or instead of those cited.

***These requirements are presumed to be satisfied for Weapons Systems with embedded IT and for Command and Control Systems that are not themselves IT systems

E5. ENCLOSURE 5

INTEGRATED TEST AND EVALUATION (T&E)

E5.1. The PM, in concert with the user and test and evaluation communities, shall coordinate developmental test and evaluation (DT&E), operational test and evaluation (OT&E), LFT&E, family-of-systems interoperability testing, information assurance testing, and modeling and simulation (M&S) activities, into an efficient continuum, closely integrated with requirements definition and systems design and development. The T&E strategy shall provide information about risk and risk mitigation, provide empirical data to validate models and simulations, evaluate technical performance and system maturity, and determine whether systems are operationally effective, suitable, and survivable against the threat detailed in the System Threat Assessment. The T&E strategy shall also address development and assessment of the weapons support equipment during the SDD phase, and into production, to ensure satisfactory test system measurement performance, calibration traceability and support, required diagnostics, and safety. Adequate time and resources shall be planned to support pre-test predictions and post-test reconciliation of models and test results, for all major test events. The PM, in concert with the user and test communities, shall provide safety releases to the developmental and operational testers prior to any test using personnel.

E5.2. The PM shall design DT&E objectives appropriate to each phase and milestone of an acquisition program. Testing shall be event driven and monitored by the use of success criteria within each phase, OT&E entrance criteria, and other metrics designed to measure progress and support the decision process. The OTA shall design OT&E objectives appropriate to each phase and milestone of a program, and submit them to the PM for inclusion in the Test and Evaluation Master Plan (TEMP). Completed IOT&E and completed LFT&E shall support a beyond LRIP decision for ACAT I and II programs for conventional weapons systems designed for use in combat. For this purpose, OT&E shall require more than an OA based exclusively on computer modeling, simulation, or an analysis of system requirements, engineering proposals, design specifications, or any other information contained in program documents (10 U.S.C. 2399 and 10 U.S.C. 2366, references (h) and (ae)).

E5.3. T&E Strategy

E5.3.1. Projects that undergo a Milestone A decision shall have a T&E strategy that shall primarily address M&S, including identifying and managing the associated risk, and that shall evaluate system concepts against mission requirements. Pre-Milestone A projects shall rely on the ICD as the basis for the evaluation strategy. For programs on the OSD T&E Oversight List, the T&E strategy shall be submitted to USD(AT&L) and DOT&E for approval.

E5.3.2. The T&E strategy for a program using an evolutionary acquisition strategy shall remain consistent with the time-phased requirements in the CDD/CPD.

E5.4. T&E Planning

E5.4.1. TEMP. The PMs for MDAPs, MAIS Acquisition Programs, and programs on the OSD T&E Oversight List shall submit a TEMP to the USD(AT&L) and the DOT&E for approval to support Milestones B and C and the Full-Rate Production decision. The TEMP shall describe planned developmental, operational, and live fire testing, including measures to evaluate

the performance of the system during these test periods; an integrated test schedule; and the resource requirements to accomplish the planned testing. The MDA or designee shall ensure that IOT&E entrance criteria, to be used to determine IOT&E readiness certification in support of each planned operational test, are developed and documented in the TEMP.

E5.4.2. Planning shall provide for completed DT&E, IOT&E, and LFT&E, as required, before entering full-rate production.

E5.4.3. Test planning for commercial and non-developmental items shall recognize commercial testing and experience, but nonetheless determine the appropriate DT&E, OT&E, and LFT&E needed to ensure effective performance in the intended operational environment.

E5.4.4. Test planning and conduct shall take full advantage of existing investment in DoD ranges, facilities, and other resources, including the use of embedded instrumentation.

E5.4.5. Planning shall consider the potential testing impacts on the environment (42 U.S.C. 4321-4370d and E.O. 12114, references (x) and (az)).

E5.4.6. The concept of early and integrated T&E shall emphasize prototype testing during system development and demonstration and early OAs to identify technology risks and provide operational user impacts.

E5.4.7. Appropriate use of accredited models and simulation shall support DT&E, IOT&E, and LFT&E.

E5.4.8. The DOT&E and the Deputy Director, DT&E/Office of Defense Systems (DS), Office of the USD(AT&L), shall have full and timely access to all available developmental, operational, and live-fire T&E data and reports.

E5.4.9. Interoperability Testing. All DoD MDAPs, programs on the OSD T&E Oversight list, post-acquisition (legacy) systems, and all programs and systems that must interoperate, are subject to interoperability evaluations throughout their life cycles to validate their ability to support mission accomplishment. For IT systems, including NSS, with interoperability requirements, the Joint Interoperability Test Command (JITC) shall provide system interoperability test certification memoranda to the Director, Joint Staff J-6, throughout the system life-cycle and regardless of ACAT.

E5.5. Developmental Test and Evaluation (DT&E). During DT&E, the materiel developer shall:

E5.5.1. Identify the technical capabilities and limitations of the alternative concepts and design options under consideration;

E5.5.2. Identify and describe design technical risks;

E5.5.3. Stress the system under test to at least the limits of the Operational Mode Summary/Mission Profile, and, for some systems, beyond the normal operating limits to ensure the robustness of the design;

E5.5.4. Assess technical progress and maturity against critical technical parameters, to include interoperability, documented in the TEMP;

E5.5.5. Assess the safety of the system/item to ensure safety during OT and other troop-supported testing and to support success in meeting design safety criteria;

E5.5.6. Provide data and analytic support to the decision process to certify the system ready for IOT&E;

E5.5.7. Conduct information assurance testing on any system that collects, stores, transmits, or processes unclassified or classified information.

E5.5.8. In the case of IT systems, including NSS, support the DoD Information Technology Security Certification and Accreditation Process and Joint Interoperability Certification process;

E5.5.9. In the case of financial management, enterprise resource planning, and mixed financial management systems, the developer shall conduct an independent assessment of compliance factors established by the Office of the USD(C); and,

E5.5.10. Prior to full-rate production, demonstrate the maturity of the production process through Production Qualification Testing of LRIP assets.

E5.6. Readiness for IOT&E. The Services shall each establish an Operational Test Readiness Process for programs on the OSD T&E Oversight List, consistent with the following requirements:

E5.6.1. The process shall include a review of DT&E results; an assessment of the system's progress against critical technical parameters documented in the TEMP; an analysis of identified technical risks to verify that those risks have been retired during developmental testing; and a review of the IOT&E entrance criteria specified in the TEMP. Programs shall provide copies of the DT&E report and the progress assessment to USD(AT&L) and DOT&E.

E5.6.2. The Service Acquisition Executive shall evaluate and determine materiel system readiness for IOT&E.

E5.7. Operational Test and Evaluation (OT&E)

E5.7.1. OT&E shall determine the operational effectiveness and suitability of a system under realistic operational conditions, including combat; determine if thresholds in the approved CPD and critical operational issues have been satisfied; and assess impacts to combat operations.

E5.7.2. The lead OTA shall brief the DOT&E on concepts for an OT&E 120 days prior to start. They shall submit the OT&E plan 60 days prior, and shall report major revisions as they occur.

E5.7.3. Typical users shall operate and maintain the system or item under conditions simulating combat stress and peacetime conditions.

E5.7.4. The independent OTAs shall use production or production representative articles for the dedicated phase of IOT&E that supports the full-rate production decision (or for ACAT IA or other acquisition programs, the full-deployment decision).

E5.7.5. Hardware and software alterations that materially change system performance, including system upgrades and changes to correct deficiencies, shall undergo OT&E.

E5.7.6. OTAs shall conduct an independent, dedicated phase of IOT&E before full-rate production to evaluate operational effectiveness and suitability, as required by reference (h).

E5.7.7. All weapon, Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR), and information programs that are dependent on

external information sources, or that provide information to other DoD systems, shall be tested and evaluated for information assurance.

E5.7.8. The DOT&E shall determine the quantity of articles procured for IOT&E for MDAPs; the cognizant OTA shall make this decision for non-MDAPs (reference (h)).

E5.7.9. The DOT&E shall assess the adequacy of IOT&E and LFT&E, and evaluate the operational effectiveness, suitability, and survivability, as applicable, of systems under DOT&E oversight. DOT&E-oversight programs beyond LRIP, shall require continued DOT&E test plan approval, monitoring, and FOT&E reporting to:

E5.7.9.1. Complete IOT&E activity;

E5.7.9.2. Refine IOT&E estimates;

E5.7.9.3. Verify correction of deficiencies;

E5.7.9.4. Evaluate significant changes to system design or employment; and

E5.7.9.5. Evaluate whether or not the system continues to meet operational needs and retain operational effectiveness in a substantially new environment, as appropriate.

E5.7.10. OT&E Information Promulgation

E5.7.10.1. The responsible test organization shall release valid test data and factual information in as near real-time as possible to all DoD organizations and contractors with a need to know. Data may be preliminary and shall be identified as such.

E5.7.10.2. To protect the integrity of the OTA evaluation process, release of evaluation results may be withheld until the final report, according to the established policies of each OTA. Nothing in this policy shall be interpreted as limiting the statutory requirement for immediate access to all OT&E results by DOT&E.

E5.7.10.3. The primary intent of this policy is to give developing agencies visibility of factual data produced during OT&E, while not allowing the developmental agency any influence over the outcome of those evaluations.

E5.7.11. Use of Contractors in Support of OT&E

E5.7.11.1. Per reference (h), persons employed by the contractor for the system being developed may only participate in OT&E of major defense acquisition programs to the extent that is planned for them to be involved in the operation, maintenance, and other support of the system when deployed in combat.

E5.7.11.2. A contractor that has participated (or is participating) in the development, production, or testing of a system for a DoD Component (or for another contractor of the Department of Defense) may not be involved in any way in establishing criteria for data collection, performance assessment, or evaluation activities for OT&E. The DOT&E may waive such limitation if the DOT&E determines, in writing, that sufficient steps have been taken to ensure the impartiality of the contractor in providing the services. These limitations do not apply to a contractor that has participated in such development, production, or testing, solely in test or test support on behalf of the Department of Defense.

E5.8. OSD T&E Oversight List. The DOT&E and the Director, DS, shall jointly, and in consultation with the T&E executives of the cognizant DoD Components, determine the

programs designated for OSD T&E oversight. The DoD memorandum entitled "Designation of Programs for OSD Test and Evaluation (T&E) Oversight" (reference (ba)) identifies these programs.

E5.9. Live-Fire Test and Evaluation (LFT&E)[1]. Reference (ae) mandates LFT&E and formal LFT&E reporting for all covered systems. The DOT&E shall approve the LFT&E strategy for covered systems prior to Milestone B.

E5.10. Modeling and Simulation (M&S). The PM shall plan for M&S throughout the acquisition life cycle. The PM shall identify and fund required M&S resources early in the life cycle

E5.11. Foreign Comparative Testing (FCT). 10 U.S.C. 2350a(g) (reference (ap)) prescribes funding for U.S. T&E of selected allied and friendly foreign countries' equipment and technologies when such items and technologies have potential to satisfy approved DoD requirements. The USD(AT&L) shall centrally manage FCT and notify the Speaker of the House, the President of the Senate, the House Armed Services Committee, the Senate Armed Services Committee, and the Appropriations Committees of the Senate and the House of Representatives at least 30 days prior to committing funds to start a new FCT evaluation.

E5.12. Testing Increments of an Evolutionary Acquisition Program. The structure of these test activities depends on the program acquisition strategy. In general, all increment testing programs shall:

E5.12.1. Provide for early involvement of the Service OTA/JITC in DT&E and test planning;

E5.12.2. Conduct adequate DT&E, LFT&E, and IOT&E of each new incremental capability;

E5.12.3. Integrate, as appropriate, and without compromising the specific requirements of the different types of testing, successive periods of DT&E, LFT&E, and IOT&E;

E5.12.4. Tailor test content and reporting against earlier test results, evaluating at a minimum the increment of mission accomplishment and survivability required of the new increment, plus whether or not performance previously demonstrated by the previous increment has been degraded;

E5.12.5. The Service shall perform an independent operational assessment prior to release of each successive increment to the user; and

E5.12.6. For programs under OT&E and/or LFT&E oversight, support DOT&E's intended schedule for reporting to the Secretary of Defense and Congressional defense committees, whether through phased submittal of dedicated reports or through DOT&E annual reports to the Congress.

[1] Not applicable to ACAT IA programs.

E6. ENCLOSURE 6

RESOURCE ESTIMATION

E6.1. Cost Analysis Improvement Group (CAIG) Independent Life-Cycle Cost Estimates (LCCEs). The OSD CAIG shall prepare independent LCCEs per 10 U.S.C. 2434 (reference (ah)). The CAIG shall provide the MDA with an independent LCCE at major decision points as specified in statute, and when directed by the MDA. The MDA shall consider the independent LCCE before approving entry into SDD or into Production and Deployment. The CAIG shall also prepare an ICE for ACAT IC programs at the request of the USD(AT&L) or the ASD(C3I). A CAIG ICE is not required for ACAT IA programs. (DoD Directive 5000.4, (reference (bb)))

E6.2. Cost Analysis Requirements Description (CARD). For ACAT I and IA programs, the PM shall prepare, and an authority no lower than the DoD Component Program Executive Officer (PEO), shall approve the CARD. DoD 5000.4-M, reference (bc), specifies CARD content. For joint programs, the CARD shall cover the common program as agreed to by all participating DoD Components, as well as any DoD Component-unique requirements. The teams preparing the program office LCCE, the component cost analysis, if applicable, and the independent LCCE shall receive a draft CARD 180 days, and the final CARD 45 days, prior to a planned OIPT or DoD Component review, unless the OIPT leader agrees to other due dates.

E6.3. CCDR System. The CCDR system is the primary DoD means of collecting data on the costs and resource usage that DoD contractors incur in performing DoD programs. The Chair, CAIG, shall prescribe a format for the CCDR and the SRDR, and establish reporting system policies in DoD 5000.4.M-1, reference (aw). The Chair shall monitor the implementation of policy to ensure consistent and appropriate application throughout the Department of Defense. The Chair may waive the information requirements of Table E3.T3. of enclosure 3.

E6.4. CAIG Procedures. The DoD Component responsible for acquisition of a system shall cooperate with the CAIG and provide the cost, programmatic, and technical information required for estimating costs and appraising cost risks. The DoD Component shall also facilitate CAIG staff visits to the program office, product centers, test centers, and system contractor(s). The process through which the ICE is prepared shall be consistent with the following policies (reference (aw)):

E6.4.1. The CAIG shall participate in IPT meetings (Cost Working-level IPTs/Integrating IPTs/OIPTs);

E6.4.2. The CAIG, DoD Components, and PM shall share data, models and use the same CARD;

E6.4.3. The CAIG, DoD Components, and PM shall raise and resolve issues in a timely manner and at the lowest possible level;

E6.4.4. The CAIG shall brief the preliminary, independent, LCCE to the PM 45 days before the OIPT, and the final estimate 21 days before the OIPT;

E6.4.5. The CAIG, DoD Component, and PM shall address differences between the independent LCCE and the PM/Service estimate;

E6.4.6. The PM shall identify issues projected to be brought to the OIPT to the Chairman, CAIG, in a timely manner.

E6.5. Analysis of Alternatives Procedures. For potential and designated ACAT I and IA programs, the Director, Program Analysis & Evaluation (D,PA&E) shall direct development of the analysis of alternatives by preparing initial guidance, reviewing the analysis plan, and reviewing the final analysis products. The guidance shall be issued to the DoD Component, or for ACAT IA programs, to the office of the PSA responsible for the mission area. The DoD Component or the PSA shall designate responsibility for completion of the AoA, but it may not be assigned to the PM. An analysis plan shall be provided to the Office of the D,PA&E for review prior to the start of the AoA and the final AoA shall be provided to the D,PA&E not later than 60 days prior to the DAB or ITAB meeting for milestone reviews. The D,PA&E shall evaluate the AoA and provide an assessment to the Head of the DoD Component or PSA and to the MDA. In this evaluation, the D,PA&E shall assess the extent to which the AoA:

E6.5.1. Illuminated capability advantages and disadvantages;

E6.5.2. Considered joint operational plans;

E6.5.3. Examined sufficient feasible alternatives;

E6.5.4. Discussed key assumptions and variables and sensitivity to changes in these;

E6.5.5. Assessed technology risk and maturity; and

E6.5.6. Calculated costs.

E7. ENCLOSURE 7
HUMAN SYSTEMS INTEGRATION (HSI)

E7.1. General. The PM shall have a comprehensive plan for HSI in place early in the acquisition process to optimize total system performance, minimize total ownership costs, and ensure that the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the system. HSI planning shall be summarized in the acquisition strategy and address the following:

E7.2. Human Factors Engineering. The PM shall take steps (e.g., contract deliverables and Government/contractor IPT teams) to ensure human factors engineering/cognitive engineering is employed during systems engineering over the life of the program to provide for effective human-machine interfaces and to meet HSI requirements. Where practicable and cost effective, system designs shall minimize or eliminate system characteristics that require excessive cognitive, physical, or sensory skills; entail extensive training or workload-intensive tasks; result in mission-critical errors; or produce safety or health hazards.

E7.3. Personnel. The PM shall work with the personnel community to define the human performance characteristics of the user population based on the system description, projected characteristics of target occupational specialties, and recruitment and retention trends. To the extent possible, systems shall not require special cognitive, physical, or sensory skills beyond that found in the specified user population. For those programs that require skill requirements that exceed the knowledge, skills, and abilities of current military occupational specialties or that require additional skill indicators or hard-to-fill military occupational specialties, the PM shall consult with personnel communities to identify readiness, personnel tempo (PERSTEMPO), and funding issues that impact program execution.

E7.4. Habitability. The PM shall work with habitability representatives to establish requirements for the physical environment (e.g., adequate space and temperature control) and, if appropriate, requirements for personnel services (e.g., medical and mess) and living conditions (e.g., berthing and personal hygiene) for conditions that have a direct impact on meeting or sustaining system performance or that have such an adverse impact on quality of life and morale that recruitment or retention is degraded.

E7.5. Manpower. In advance of contracting for operational support services, the PM shall work with the manpower community to determine the most efficient and cost-effective mix of DoD manpower and contract support. Once the Manpower Estimate is approved by the DoD Component manpower authority, it shall serve as the authoritative source for reporting manpower in other program documentation.

E7.6. Training. The PM shall work with the training community to develop options for individual, collective, and joint training for operators, maintainers and support personnel and, where appropriate, base training decisions on training effectiveness evaluations. The PM shall address major elements of the training system described in DoD Directive 1430.13, reference (bd), and place special emphasis on options that enhance user capabilities, maintain skill proficiencies, and reduce individual and collective training costs. The PM shall develop training system plans to maximize the use of new learning techniques, simulation technology, embedded

training, and instrumentation systems that provide anytime, anyplace training and reduce the demand on the training establishment. Where possible, the PM shall maximize the use of simulation-supported embedded training, and the training systems shall fully support and mirror the interoperability of the operational system. For training programs that require training infrastructure modifications, the PM shall identify technology, schedule, and funding issues that impact program execution.

E7.7. Environment, Safety and Occupational Health (ESOH). As part of risk reduction, the PM shall prevent ESOH hazards where possible, and shall manage ESOH hazards where they cannot be avoided. The acquisition strategy shall incorporate a summary of the Programmatic ESOH Evaluation (PESHE), including ESOH risks, a strategy for integrating ESOH considerations into the systems engineering process, identification of ESOH responsibilities, a method for tracking progress, and a compliance schedule for NEPA (42 U.S.C. 4321-4370d and Executive Order 12114, references (x) and (az)). During system design, the PM shall document hazardous materials used in the system and plan for the system's demilitarization and disposal. The CAE (or for joint programs, the CAE of the Lead Executive Component) or designee, is the approval authority for system-related NEPA and E.O. 12114 documentation. For acceptance of ESOH mishap risks identified by the program, the CAE is the acceptance authority for high risks, PEO-level for serious risks, and the PM for medium and low risks as defined in the industry standard for system safety.

E7.8. Survivability. For systems with missions that might require exposure to combat threats, the PM shall address personnel survivability issues including protection against fratricide, detection, and instantaneous, cumulative, and residual nuclear, biological, and chemical effects; the integrity of the crew compartment; and provisions for rapid egress when the system is severely damaged or destroyed. The PM shall address special equipment or gear needed to sustain crew operations in the operational environment.

E8. ENCLOSURE 8

ACQUISITION OF SERVICES

E8.1. General. Section 801 of the National Defense Authorization Act for Fiscal Year 2002, Pub. L. 107-107, reference (be), required establishment of a management structure for the procurement of services by the Department of Defense. This management structure requires that the acquisition of services shall be based on clear, performance-based requirements, and require identified and measurable outcomes properly planned and administered to achieve the intended results. The following guidance shall apply.

E8.2. Outcomes

E8.2.1. All service acquisitions shall use a strategic approach that includes developing a picture of what the Department of Defense is spending on services; an enterprise-wide approach to procuring services; and developing new ways of doing business.

E8.2.2. All service acquisitions shall be acquired by business arrangements that are in the best interests of the Department of Defense and are entered into or issued and managed in compliance with applicable statutes, regulations, directives, and other requirements, regardless of whether the services are acquired by the Department of Defense or by an official of the United States outside the Department of Defense. PMs shall coordinate with the DoD Component manpower authority in advance of contracting for operational support services to ensure that tasks and duties that are designated as inherently governmental or exempt are not contracted.

E8.3. Decision Authorities shall establish mandatory procedures for assigned service acquisitions.

E8.4. Each DoD Component shall establish a management review process that provides for consistent review and approval of service acquisitions.

E8.5. Each acquisition of services shall have:

E8.5.1. A documented acquisition strategy, updated when changes occur;

E8.5.2. Metrics for cost, schedule and performance;

E8.5.3. An approved data system for the collection and reporting of required data.

E8.6. The Decision Authority shall conduct execution reviews to assess progress against the metrics.

E8.7. Management of the acquisition of services is the responsibility of the USD(AT&L), the ASD(C3I) for information technology, the CAE, the Head of Contracting Activity (HCA) (for those DoD Components without a CAE), or such designated officials in each Service/Agency as identified by the CAE or HCA (for those DoD Components without a CAE). Each of these designated officials can be a Decision Authority, and have the authority to exercise approval over the service acquisition, provided the designated official is independent of the official developing and executing the service acquisition strategy.

E8.8. The acquisition of services may require the execution of multiple contracts or other instruments for committing or obligating funds (e.g. funds transfers; placing orders under existing contracts), therefore, the management level shall be determined using the total planned dollar value (including options, contingencies, funds transfers, provisioning, etc) of the acquisition.

E9. ENCLOSURE 9

PROGRAM MANAGEMENT

E9.1. Assignment of Program Managers. A PM shall be designated for each acquisition program. This designation shall be made no later than program initiation. It is essential that the PM have an understanding of user needs and constraints, familiarity with development principles, and requisite management skills and experience. If the acquisition is for services, the PM shall be familiar with DoD guidance on acquisition of services. A PM and a deputy PM of an ACAT I, IA, or II program shall be assigned to the position at least until completion of the major milestone that occurs closest in time to the date on which the person has served in the position for 4 years in accordance with the Defense Acquisition Workforce Improvement Act (reference (bf)). Upon designation, the PM shall be given budget guidance and a written charter of his or her authority, responsibility, and accountability for accomplishing approved program objectives.

E9.2. Assignment of Program Executive Responsibility

E9.2.1. Unless a waiver is granted for a particular program by the USD(AT&L) or the ASD(C3I)/DoD CIO, CAEs shall assign acquisition program responsibilities to a PEO for all ACAT I, ACAT IA, and sensitive classified programs, or for any other program determined by the CAE to require dedicated executive management.

E9.2.2. The PEO shall be dedicated to executive management and shall not have other command responsibilities.

E9.2.3. The CAE shall make this assignment no later than program initiation; or within 3 months of estimated total program cost reaching the appropriate dollar threshold for ACAT I and ACAT IA programs. CAEs may determine that a specific PM shall report directly, without being assigned to a PEO, whenever such direct reporting is appropriate. The CAE shall notify the USD(AT&L) or the ASD(C3I)/DoD CIO of the decision to have a PM report directly to the CAE.

E9.2.4. Acquisition program responsibilities for programs not assigned to a PEO or a direct-reporting PM shall be assigned to a commander of a systems, logistics, or materiel command. In order to transition from a PEO to a commander of a systems, logistics, or materiel command, a program or increment of capability shall, at a minimum, have passed Initial Operating Capability (IOC), have achieved full-rate production, be certified as interoperable within the intended operational environment, and be supportable as planned.

E9.3. Life-Cycle Management of Information. PMs shall comply with record keeping responsibilities under the Federal Records Act for the information collected and retained in the form of electronic records. (See DoD Directive 5015.2, reference (bg)).) Electronic record keeping systems shall preserve the information submitted, as required by 44 U.S.C. 3101, reference (bh)) and implementing regulations. Electronic record keeping systems shall also provide, wherever appropriate, for the electronic acknowledgment of electronic filings that are successfully submitted. PMs shall consider the record keeping functionality of any systems that store electronic documents and electronic signatures to ensure users have appropriate access to the information and can meet the Agency's record keeping needs.

E9.4. International Cooperative Program Management

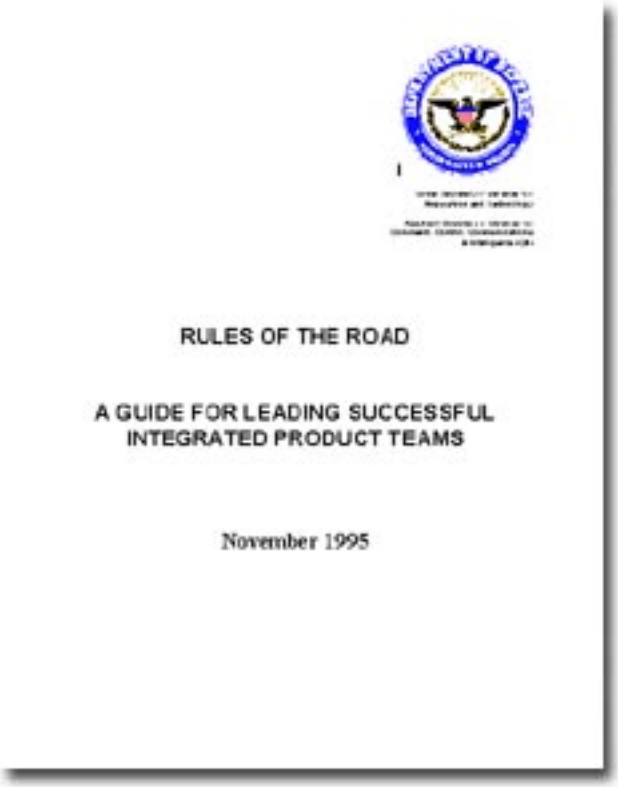
E9.4.1. An international cooperative program is any acquisition system, subsystem, component, or technology program with an acquisition strategy that includes participation by one or more foreign nations, through an international agreement, during any phase of a system's life cycle. All AT&L-related international agreements may use the USD(AT&L)-issued streamlined procedures in the Defense Acquisition Guidebook (reference (bi)) for review and approval rather than the procedures in DoD Directive 5530.3, reference (bj). All international cooperative programs shall fully comply with foreign disclosure and program protection requirements. Programs containing classified information shall have a Delegation of Disclosure Authority Letter or other written authorization issued by the DoD Component's cognizant foreign disclosure office prior to entering discussions with potential foreign partners.

E9.4.2. Acquisition and Cross Servicing Agreement (ACSA). PMs and others responsible for the acquisition and reciprocal transfer of logistic support, supplies, and services shall be aware of and understand the legal authority (10 U.S.C. 2341 and 2342, references (bk) and (bl)) for the use of ACSAs and the potential impact that ACSA acquisition and reciprocal transfers may have on their on support strategies.

E9.4.3. Additional Funding Considerations. The DoD Components shall not terminate or substantially reduce participation in international cooperative ACAT ID programs under signed international agreements without USD(AT&L) approval; or in international cooperative ACAT IAM programs without ASD(C3I) approval. A DoD Component may not terminate or substantially reduce U.S. participation in an international cooperative program until after providing notification to the USD(AT&L) or the ASD(C3I). As a result of that notification, the USD(AT&L) or the ASD(C3I) may require the DoD Component to continue to provide some or all of the funding for that program in order to minimize the impact on the international cooperative program. Substantial reduction is defined as a funding or quantity decrease of 25 percent or more in the total funding or quantities in the latest President's Budget for that portion of the international cooperative program funded by the DoD Component seeking the termination or reduced participation.

E9.5. Joint Program Management. The DoD Components shall not terminate or substantially reduce participation in joint ACAT ID programs without Requirements Authority review and USD(AT&L) approval; or in joint ACAT IA programs without Requirements Authority review and ASD(C3I) approval. The USD(AT&L) or the ASD(C3I) may require a DoD Component to continue some or all funding, as necessary, to sustain the joint program in an efficient manner, despite approving their request to terminate or reduce participation. Substantial reduction is defined as a funding or quantity decrease of 50 percent or more in the total funding or quantities in the latest President's Budget for that portion of the joint program funded by the DoD Component seeking the termination or reduced participation.

[27] A Guide for Leading Successful Integrated Product Teams



RULES OF THE ROAD

A GUIDE FOR LEADING SUCCESSFUL
INTEGRATED PRODUCT TEAMS

November 1995

Under Secretary of Defense for
Acquisition and Technology

Assistant Secretary of Defense for
Command, Control, Communications
& Intelligence (C3I)

RULES OF THE ROAD

A GUIDE FOR LEADING SUCCESSFUL INTEGRATED PRODUCT TEAMS

November 1995

Foreword

On May 10, 1995, Secretary Perry directed the Department to apply the Integrated Product and Process Development (IPPD) concept of using IPTs throughout the acquisition process. That direction has been captured in the draft revisions to the DoDD 5000.1 and the DoDI 5000.2. This guide clarifies the instructions contained in those directives for Overarching IPTs (OIPTs) and Working-Level IPTs (WIPTs). Program IPTs are described in the draft "Guide to Implementation and Management of IPPD in DoD Acquisition." This guide is intended to facilitate organizing and leading effective and efficient Integrated Product Teams (IPTs) that will serve the Acquisition Community and ultimately enhance our capability to provide systems that satisfy the Warfighter's needs.

The guidance in the extracts from draft DoDI 5000.2 will be mandatory. The other guidelines are not mandatory, but they represent sound business practices and will be included in the discretionary section of the Acquisition Deskbook. This guide describes the IPT process for ACAT ID and IAM acquisition programs, but the concepts should be considered for all programs.

These guidelines are not intended in any way to detract from the responsibility and authority of the Program Manager (PM). The IPT activities discussed on the following pages are designed to assist the PM by engaging OSD and Service staff in early and continuous support and by identifying and resolving issues as early and as quickly as possible. The staff's mission is to ensure the PM's success.

This is a "living" document. The draft DoDD 5000.1 and draft DoDI 5000.2 are still under revision; this guide will change in parallel with those documents. Your comments, questions, and recommendations to improve this document are encouraged. Please address them to Mr. John Smith, Acquisition Program Integration, at (703) 614-5420 or e-mail "smithje@am@zeus" or Dr. Margaret Myers, C3I Acquisition Oversight, at (703) 681-4986 or e-mail "margaret.myers@osd.mil".

I. N. Blickstein Director (Acquisition Program Integration)	Colleen A. Preston DUSD (Acquisition Reform)	Anthony M. Valletta DASD (C3I Acquisition)

INTRODUCTION

References

(a) "Reengineering the Acquisition Oversight and Review Process," USD(A&T), April 28, 1995
(b) "Use of Integrated Product and Process Development and Integrated Product Teams in DoD Acquisition," Secretary of Defense, May 10, 1995
(c) Draft DoD Directive 5000.1 and draft DoD Instruction 5000.2, October 14, 1995
(d) "Guide to Implementation and Management of Integrated Product and Process Development in DoD Acquisition" (draft)

Purpose of IPTs

As Secretary Perry stated in his May 10, 1995 memorandum, the IPT concept for oversight and review is intended to replace the current sequential process that produces a product at the program office level which frequently, when reviewed at higher levels, is modified substantially or even rejected. Such a sequential review and approval process takes considerably longer than an IPT approach that simultaneously takes advantage of all members' expertise and produces an acceptable product the first time. The purpose of IPTs is to facilitate decision-making by making recommendations based on timely input from the entire team.

Figure 1 shows the focus and responsibilities of three types of IPTs.

Organization	Teams	Focus	Participant Responsibilities
OSD and Components	OIPT*	• Strategic Guidance • Tailoring • Program Assessment • Resolve Issues Elevated by WIPTs	• Program Success • Functional Area Leadership • Independent Assessment • Issue Resolution
	WIPTs*	• Planning for Program Success • Opportunities for Acquisition Reform (e.g., innovation, streamlining) • Identify/Resolve Program Issues • Program Status	• Functional Knowledge & Experience • Empowered Contribution • Recommendations for Program Success • Communicate Status & Unresolved Issues
Program Teams & System Contractors	Program IPTs**	• Program Execution • Identify & Implement Acquisition Reform	• Manage Complete Scope of Program, Resources & Risk • Integrate Government & Contractor Efforts for Program Success • Report Program Status & Issues

* Covered by this guide
** See the "Guide to Implementation and Management of IPPD in DoD Acquisition"

Figure 1. DoD IPT Types, Focus and Responsibilities

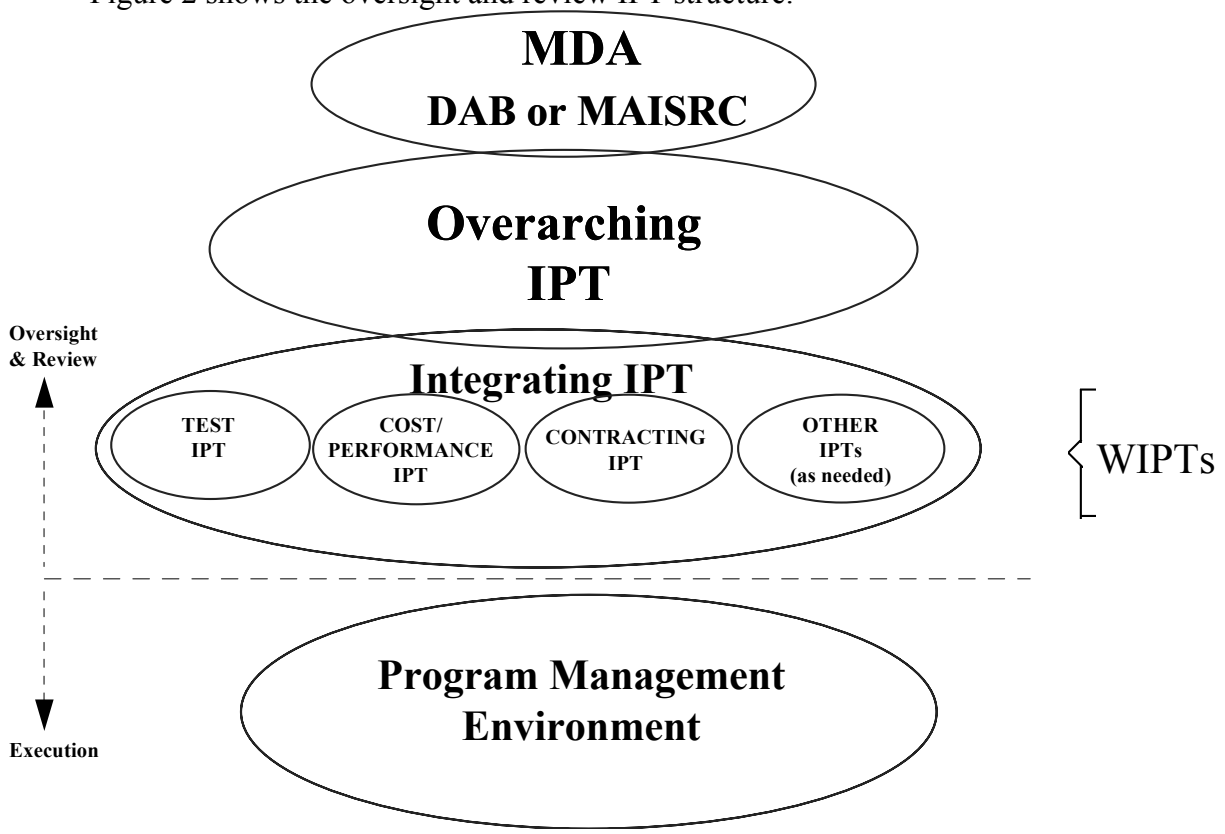
INTEGRATED PRODUCT TEAMS IN THE OVERSIGHT AND REVIEW PROCESS

For ACAT ID and IAM programs, mandatory guidance for OIPTs and WIPTs is provided in Part 5.4 of the new draft DoDI 5000.2 as extracted below. (Mandatory guidance for program IPTs is provided in Part 4.2 of the draft DoDI 5000.2.)

IPTs are an integral part of the defense acquisition oversight and review process. The Secretary of Defense has directed that the Department perform as many acquisition functions as possible, including oversight and review, using IPTs. These IPTs shall function in a spirit of teamwork with participants empowered and authorized, to the maximum extent possible, to make commitments for the organization or the functional area they represent. IPTs are composed of representatives from all appropriate functional disciplines working together to build successful programs and enabling decision-makers to make the right decisions at the right time. IPTs operate under the following broad principles:

1. Open discussions with no secrets
2. Qualified, empowered team members
3. Consistent, success-oriented, proactive participation
4. Continuous "up-the-line" communications
5. Reasoned disagreement
6. Issues raised and resolved early

Figure 2 shows the oversight and review IPT structure.



For each program, there will be an OIPT and at least one WIPT. WIPTs will focus on a particular topic, such as test, cost/performance, contracting, etc. An Integrating IPT will coordinate WIPT efforts and cover all topics not otherwise assigned to another IPT.

Figure 2. IPT Structure

WORKING-LEVEL IPTs PROCEDURES, ROLES, AND RESPONSIBILITIES
(Extracted from Draft DoDI 5000.2, Part 5.4.2)

The PM, or designee, shall form and lead an Integrating IPT (IIPT) to support the development of strategies for acquisition and contracts, cost estimates, evaluation of alternatives, logistics management, cost-performance trade-offs, etc. The IIPT will assist the PM in the development of a WIPT structure to propose to the OIPT. The IIPT will also coordinate the activities of the remaining WIPTs and ensure that issues not formally addressed by other WIPTs are reviewed. WIPTs shall meet as required to help the PM plan program structure and documentation and resolve issues. While there is no one-size-fits-all WIPT approach, there are three basic tenets to which any approach shall adhere:

1. The PM is in charge of the program.
2. IPTs are advisory bodies to the PM.
3. Direct communication between the program office and all levels in the acquisition oversight and review process is expected as a means of exchanging information and building trust.

The Leader of each IPT will usually be the PM or the PM's representative. The OSD action officer may co-chair the IPT meetings, at the invitation of the PM. The following roles and responsibilities apply to all WIPTs:

1. Assist the PM in developing strategies and in program planning, as requested by the PM
2. Establish IPT plan of action and milestones
3. Propose tailored document and milestone requirements
4. Review and provide early input to documents
5. Coordinate WIPT activities with the OIPT members
6. Resolve or elevate issues in a timely manner
7. Assume responsibility to obtain principals' concurrences on issues, as well as with applicable documents or portions of documents

Examples of WIPTs

The following examples of WIPTs are offered as illustrations:

Test Strategy IPT
(Extracted from Secretary Perry's May 10, 1995 memo)

The purpose of the IPT is to assist in outlining the Test and Evaluation Master Plan (TEMP) for a major program. The objective of such an IPT is to reach agreement on the strategy and plan by identifying and resolving issues early, understanding the issues and the rationale for the approach, and, finally, documenting a quality TEMP that is acceptable to all organizational levels the first time.

Cost-Performance IPT
(Extracted from Draft DoDI 5000.2, Part 3.3.1)

The purpose of the CPIPT shall be to facilitate cost-performance trades and to assist in establishing program cost-range objectives. Cost objectives shall be used as a management tool. They should be communicated to industry and used, in part, for source selection and to incentivize contracts. The nature of the cost-performance trades and the composition of the CPIPT shall change as the program matures from concept to design. As the program matures, the role of the PM in the CPIPT increases. The CPIPT (normally led by the PM or the PM's representative and including, at a minimum, the user or user's representative) shall recommend to the PM performance or engineering and design changes as long as the threshold values in the Operational Requirements Document (ORD) and Acquisition Program Baseline (APB) can be achieved. If the changes require ORD/APB threshold value changes, the leader of the CPIPT shall notify the PM and the OIPT leader. The PM shall ensure that the changes are brought before the ORD and/or APB approval authorities for decision.

OVERARCHING IPT PROCEDURES AND ASSESSMENTS
(Extracted from Draft DoDI 5000.2, Part 5.4.1)

In support of all ACAT ID and IAM programs, an Overarching Integrated Product Team (OIPT) shall be formed for each program to provide assistance, oversight and review as that program proceeds through its acquisition life-cycle. The OIPT for ACAT ID programs shall be led by the appropriate Office of the Secretary of Defense (OSD) official (typically the Director of Strategic and Tactical Systems, the Assistant Deputy Under Secretary of Defense (Space and Acquisition Management), or the Deputy Assistant Secretary of Defense (C3I Acquisition), depending on the program in question). The DASD (C3I Acquisition) will designate the OIPT Leader for each ACAT IAM program. OIPTs shall be composed of the PM, Program Executive Officer (PEO), Component Staff, Joint Staff, USD(A&T) staff, and the OSD staff principals or their representatives, involved in oversight and review of a particular ACAT ID or IAM program.

The OIPT shall first form upon learning that a program is intended to be initiated to consider the recommendations proposed by the IIPT; the extent of WIPT support needed for the potential program; who shall participate on the WIPTs; the appropriate milestone for program initiation; and, the minimum information needed for the program initiation review. OIPTs shall meet as necessary over the life of a program. The OIPT Leader shall take action to resolve issues when requested by any member of the OIPT, or when directed by the Milestone Decision Authority (MDA). The goal is to resolve as many issues and concerns at the lowest level possible, and to expeditiously escalate issues that need resolution at a higher level, bringing only the highest level issues to the MDA for decision.

In support of a planned milestone review by the Defense Acquisition Board (DAB) or Major Automated Information System Review Council (MAISRC), the OIPT shall normally convene two weeks in advance of the anticipated review to assess information and recommendations being provided to the MDA. Additionally, at that meeting, the PM shall propose the WIPT structure, documentation, and strategy for the next acquisition phase, for approval by the MDA. The OIPT Leader, in coordination with the appropriate Component Acquisition Executive (CAE), shall recommend to the MDA whether the anticipated review should go forward as planned.

The OIPT leader for ACAT ID or IAM programs shall provide an independent assessment to the DAB or MAISRC chairs, principals, and advisors at major program reviews and milestone decision reviews using information gathered through the IPT process. The leader's independent assessment shall focus on core acquisition management issues and shall take account of assessments prepared by OIPT members. Assessments will normally be provided by the OIPT members. There should be no surprises at this point, because all team members are already working the issues in real time, and they should be knowledgeable of their OIPT leader's independent assessment.

GROUND RULES FOR IMPLEMENTING IPTs

Open Discussions with No Secrets

Cooperation is essential. Teams must have full and open discussions with no secrets. All facts must be on the table for each team member to understand and assess. Each member brings unique expertise to the team that needs to be recognized by all. Because of that expertise, each person's views are important in developing a successful program, and these views need to be heard. Full and open discussion does not mean that each view must be acted on by the team.

A sense of ownership on the part of the IPT members is key to the success of the IPT process. However, a sense of ownership is not possible if the members of the IPT are expected to merely rubber stamp a decision or document prepared in a different setting. Ownership is a collective concept. All IPT members must feel that their contributions were important to the process and were well considered.

Qualified, Empowered Team Members

Empowerment is critical to making and keeping the agreements essential to effective IPTs. All representatives assigned to IPTs at all levels must be empowered by their leadership. They must be able to speak for their superiors, the "principals," in the decision-making process. IPT members cannot be expected to have the breadth of knowledge and experience of their leadership in all cases. However, they are expected to be in frequent communication with their leadership, and thus ensure that their advice to the PM is sound and will not be changed later, barring unforeseen circumstances or new information. One of the key responsibilities of our leadership is to train and educate their staff so they will have the required knowledge and skills to represent their organization.

IPT members must make team members aware of any limits to their ability to speak for their principals. IPT agreements cannot be binding if they exceed the limits of a member's empowerment. Staff representatives must seek direction from their superiors on the limits of their authority and make recommendations only within those limits. Leaders will enhance staff effectiveness by granting the greatest possible authority.

It is important for the IPT leader to stress at the outset that, in general, agreements reached in the IPT must be binding. An exception to this general rule would be the rare case where new information comes to light after agreements have been reached, and that new information is significant enough to warrant a review of prior agreements.

Consistent, Success-Oriented, Proactive Participation

IPTs should be organized to allow all stakeholders to participate. There should be no attempt to limit membership. OIPTs will typically draw their membership from the organizations shown in Figure 3. Other organizations may be added based on the needs of the program. WIPTs will include action officers from the program office (or agency staff if the program is pre-Milestone I) and from the staff organizations represented on the OIPT. When possible, each WIPT member should have an alternate to ensure continuity. Contractor participation shall be in accordance with guidance in draft DoDI 5000.2, Part 4.2.1.

OIPT LEADERS	
DAB	**MAISRC**
• **DASD (C3I Acquisition)** • **Director, Strategic & Tactical Systems** • **ADUSD (Space)**	**Director, Acquisition Oversight, ODASD (C3IA)**
OIPT MEMBER OFFICES	
Component Acquisition Executives	Assistant Secretary of Defense (Reserve Affairs) *
Component Representatives * • PEO • PM • Operators • Senior Information Management Official **	Deputy Under Secretary of Defense (Acquisition Reform) *
User *	Deputy Under Secretary of Defense (Advanced Technology) *
Vice Chairman, Joint Chiefs of Staff	Deputy Under Secretary of Defense (Environmental Security) *
Under Secretary of Defense (Comptroller)	Deputy Under Secretary of Defense (Logistics) *
Assistant Secretary of Defense (C3I)	Deputy General Counsel (Acquisition and Logistics) *
Director, Defense Procurement	Deputy Director, Defense Research & Engineering *
Director, Operational Test and Evaluation	Assistant Secretary of Defense (Economic Security) *
Director, Program Analysis and Evaluation	Assistant Secretary of Defense (Health Affairs) *
Director, Acquisition Program Integration	Director, Ballistic Missile Defense Organization *
Director, Test, Systems Engineering & Evaluation	Director, Defense Intelligence Agency *
Chairman, OSD Cost Analysis Improvement Group (DAB only)	Director, Defense Information Systems Agency **
Director, Counterintelligence & Defense Security Programs, OASD(C3I) (DAB only)	Director, National Reconnaissance Office *
Under Secretary of Defense (Personnel & Readiness) *	DASD(C3) *
Under Secretary of Defense (Policy) *	DASD (Information Management) (MAISRC only) *
Assistant to the Secretary of Defense (Atomic Energy) *	Director, Continuous Acquisition and Life Cycle Support (CALS) *
	Director, Central Imagery Office *
	Director, Special Programs *

* As required
** Always required for ACAT IAM

Figure 3. OIPT Membership

Continuous, "up-the-line" Communications

WIPT members are expected to ensure that their leadership is in agreement with what the IPT is doing. When issues arise that exceed the limits of empowerment, the PM or IPT leader must allow members adequate time to coordinate issues and positions with their principals. There should be no surprises later when the principals are asked to coordinate or review a final draft document or decision.

Reasoned Disagreement
(Extracted from Secretary Perry's May 10, 1995 memo)

The team is not searching for "lowest common denominator" consensus. There can be disagreement on how to approach a particular issue, but that disagreement must be reasoned disagreement based on an alternative plan of action rather than unyielding opposition. Issues that cannot be resolved by the team must be identified early so that resolution can be achieved as quickly as possible at the appropriate level.

Issues Raised and Resolved Early

The agreements essential to IPT success will be founded on the early identification and resolution of issues. When an issue cannot be resolved by a WIPT, the PM should raise the issue as quickly as possible to a decision-making level where resolution can be achieved.

Figure 4 illustrates decision making steps proceeding from the PM up to the MDA. The objective is to achieve agreement and resolve issues rapidly at the lowest executive level, without hindering program progress.

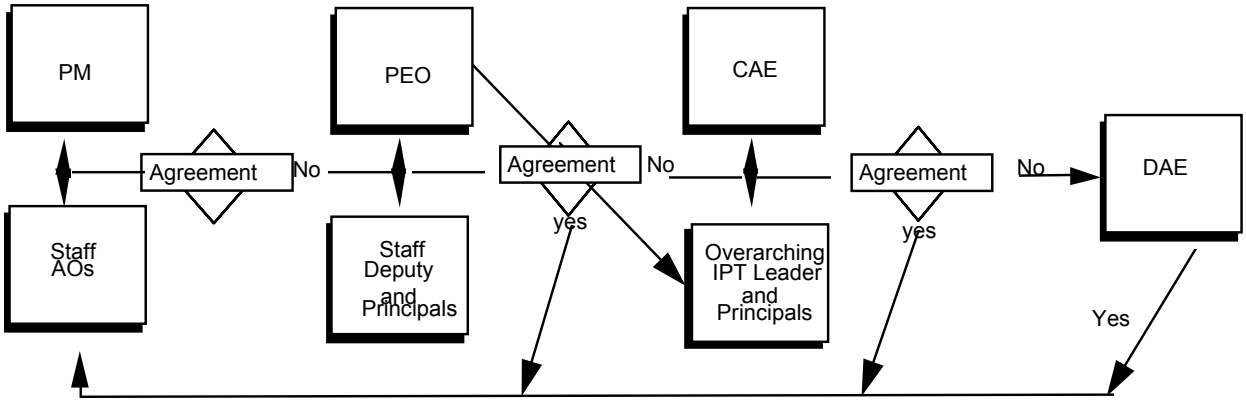


Figure 4. Issue Resolution Process

GUIDELINES FOR MEETING MANAGEMENT

Focus. An IPT must have a clear focus or reason for being. The OIPT Leader or PM, as appropriate, must clearly articulate the IPT's focus at the outset of the process. Examples of a specific focus may be to prepare for a decision milestone, to develop and reach agreement on a proposed acquisition strategy, or to resolve a specific issue or set of issues.

Orienting the Team Members. To ensure that all WIPT members have a common understanding of the program, the PM should provide a program overview briefing at the first meeting. Before the first IPT meeting, the PM and his or her staff will develop a proposed program strategy, documentation requirements and WIPT structure. These proposals will be refined by the IIPT and proposed to the OIPT. The PM will proceed based on the OIPT's agreement. Any disagreements will follow the issue resolution process in Figure 4. The IPT members will discuss and agree to a meeting management approach, to include the items listed below.

Agendas. To ensure productive meetings, detailed agendas with timelines for topics and supporting material must be distributed at least three business days before IPT meeting — NOT during the meeting. Every effort should be made to use electronic media for distribution. It may prove useful for the PM and the OIPT leader's representative to jointly prepare the agenda to ensure all concerns are addressed.

Frequency of Meetings. Once established, IPTs may meet as often as necessary to understand and build program strategies and to resolve issues or to produce a specified product. With that focus, the IPT will only meet for a particular purpose at a scheduled time. It should not meet regularly or continuously in an "update" or oversight role. Advance notice of a meeting should be provided as soon as the date is known, but *at least* two weeks before the initial or kick-off meeting and *at least* three business days before a meeting of an ongoing IPT. Subsequent meetings should be scheduled in association with product completion dates and the resolution of action items from an earlier meeting.

Meeting Summaries. Good meeting summaries will be brief and will preclude revisiting previous agreements and wasting the time and resources of the team members. Meeting summaries should:

- Record attendance
- Document any decisions or agreements reached by the IPT
- Document action items and suspenses
- Set the agenda for the next meeting
- Frame issues for higher-level resolution

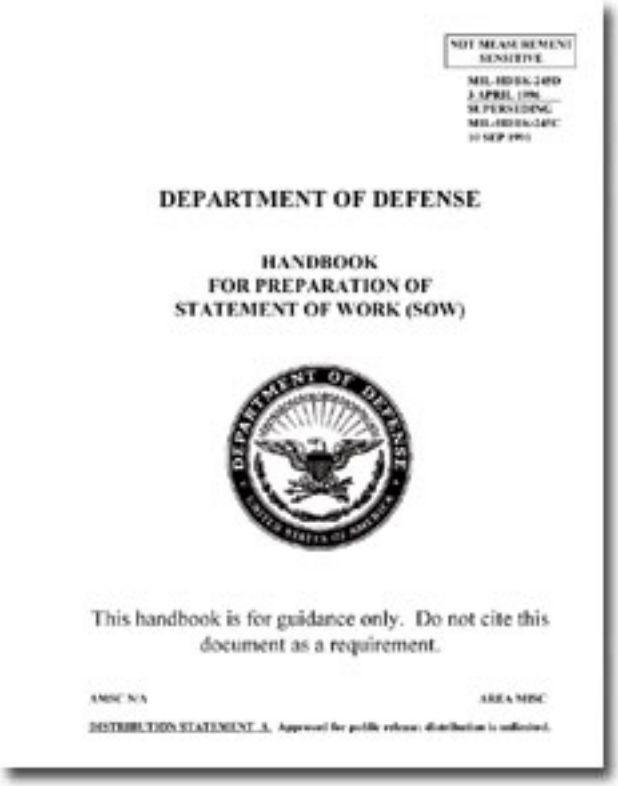
Draft meeting summaries should be provided to IPT members within one working day of a meeting. The final summary should be provided to all members within two working days after the deadline for the receipt of comments.

CONCLUSION

I need your personal involvement and commitment to ensure that the concepts of IPPD and IPTs are effectively implemented. By using the best practices from both the public and private sectors, we can enhance our ability to provide what the warfighter needs, when needed and at a cost that the Department can afford.

William J. Perry
Secretary of Defense

[28] MIL-HDBK 245D DOD Handbook for the Preparation of Statement of Work



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MIL-HDBK-245D
3 APRIL 1996
SUPERSEDING
MIL-HDBK-245C
10 SEP 1991

DEPARTMENT OF DEFENSE

HANDBOOK
FOR PREPARATION OF
STATEMENT OF WORK (SOW)

This handbook is for guidance only. Do not cite this document as a requirement.

AMSC N/A AREA MISC

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MIL-HDBK-245D
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AMSC N/A AREA MISC

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

FOREWORD

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense.

2. This handbook is for guidance only and cannot be cited as a requirement in any DoD contract. Contractors may, at their option, utilize this document for guidance in preparing responses to Government requests for proposals.

3. This handbook provides guidance to enable personnel to create a completed contract Statement Of Work (SOW) applicable to any material acquisition life-cycle phase. It also covers the SOW preparation for non-personal services contracts.

4. Modern weapon systems have traditionally contained many more specifications and greater detailed SOWs than those of the past. Contrast the Army Signal Corps SOW for the Wright Brothers' heavier-than-air flying machine in 1908 to the Air Force SOW for the Advanced Tactical Fighter in 1986. Requirements in the 1908 SOW (e.g., be easily taken apart for transport in Army wagons and be capable of being reassembled for operation in an hour, carry 350 pounds for 125 miles, and maintain 40 miles per hours in still air) and other contract conditions were specified on one page. The requirements section in the 1986 SOW for the Air Force Advanced Tactical Fighter is 85 pages long with 300 paragraphs of requirements. Today's SOWs are much more complex requiring greater attention to detail.

5. The handbook is organized so that the SOW writer after reviewing Section 3, General Description, can proceed to that portion of Section 4, Detailed Requirements, that pertains to the type of SOW required. Each portion of Section 4 has detailed instructions on the specific requirements for each type of SOW tailored to specific needs. The specific instructions provide techniques for defining task elements, and a method for organizing these elements into a comprehensive SOW. Sample outlines and significant DO's and DONT's are provided.

6. The tendency of SOW writers is to include requirements which belong in other parts of a government contract. Contract requirements should be specified in Sections A - M and should not be restated in other parts of the contract. Quantitative technical requirements should be specified in the specification and not be restated in other parts of the contract. Work requirements should be specified in the SOW, and all data requirements for delivery, format, and content should be in the Contract Data Requirements List (CDRL) in conjunction with the appropriate Data Item Description (DID) respectively, with none of the requirements restated in other parts of the contract. Redundancy invites conflict.

7. This handbook provides guidance, following DoD direction, that will enable SOW writers to rely on commercial contracting practices. The new SOW will specify what tasks need to be accomplished but leave “how to” accomplish those tasks up to the contractor.

8. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Space and Naval Warfare Systems Command, Attn.: SPAWAR 05L1, 2451 Crystal Drive, Arlington, VA

22245-5200 by using the Standardization Document Improvement Proposal (DoD Form 1426) appearing at the end of this Handbook.

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1 SCOPE

1.1 Background. This handbook applies to the preparation of Statements of Work (SOWs) for projects and programs that have deliverables and/or services performed. It is written to implement the acquisition policies established in DoDD 5000.1. It covers the preparation of SOWs which correlate to the acquisition life cycle phases identified in Department of Defense (DoD) Acquisition Instructions such as DoDI 5000.2. This handbook is for SOWs in DoD solicitations and contracts and covers work requirements, in conjunction with applicable performance/design requirements contained in specifications, but also data deliverables contained in Contract Data Requirements Lists (CDRLs). The Federal Acquisition Regulations (FAR) and Defense Federal Acquisition Regulation Supplements (DFARS) discuss the essentiality of the SOW for sound contracting. An offeror submits a proposal based on his perception of the Government's needs as defined in the RFP. Precisely stated requirements will enable the offeror and the Government to negotiate a fair price for the deliverables and/or services to be provided. This handbook has been developed as a framework to assist the responsible manager in providing a consistent, orderly, and complete description of work required.

1.2 Importance of SOW. The majority of government contracts include a SOW which forms the basis for successful performance by the contractor and effective administration of the contract by the government. A well-written SOW enhances the opportunity for all potential offerors to compete equally for Government contracts and serves as the standard for determining if the contractor meets the stated performance requirements.

1.3 Introduction of Statement of Objectives (SOO). This document introduces a new concept called the SOO which shifts the responsibility for preparing the SOW from the government to the solicitation respondents. Following recent DoD direction to lower Government costs by encouraging innovative contract options and flexible design solutions, the SOO captures the top level objectives of a solicitation and allows the offerors complete freedom in the structure and definition of SOW tasks as they apply to the proposed approach. However, the requirement, content and purpose of the SOW in the contract remain unchanged. The SOO concept is explained in detail in Section 5.

2 APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are the ones that are needed in order to fully understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the latest issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-881	Work Breakdown Structures for Defense Material Items
MIL-STD-961	Department of Defense Standard Practice for Defense Specifications

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-248	Acquisition Streamlining

2.3 Other Government Documents, Drawings and Publications. The following Government documents, drawings, and publications form a part of this handbook to the extent specified herein:

REGULATION

FEDERAL ACQUISITION REGULATION

FAR 52.215-33	Order of Precedence

DEFENSE FEDERAL ACQUISITION REGULATION SUPPLEMENTS

DFARS 211	Describing Agency Needs
DFARS 212	Acquisition of Commercial Items - General
DFARS 227.71	Rights in Technical Data
DFARS 237.104	Personal Services Contracts
DFARS 252.211-7000	Acquisition Streamlining

MANUALS

DEPARTMENT OF DEFENSE

DoD 5010.12-L	Acquisition Management System and Data Requirements Control List (AMSDL)
DoD 5010.12-M	Procedures for the Acquisition and Management of Technical Data

DIRECTIVES

DEPARTMENT OF DEFENSE

DoDD 5000.1	Defense Acquisition
DoDI 5000.2	Defense Acquisition Management Policies and Procedures

FORMS

DEPARTMENT OF DEFENSE

DD Form 1423	Contract Data Requirements List (CDRL)
DD Form 1664	Data Item Description (DID)

(Unless otherwise indicated, copies of the above specifications, standards, handbooks, or publications are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Any documents required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

3 GENERAL DESCRIPTION

3.1 Purpose. The SOW should specify in clear, understandable terms the work to be done in developing or producing the goods to be delivered or services to be performed by a contractor. Preparation of an effective SOW requires both an understanding of the goods or services that are needed to satisfy a particular requirement and an ability to define what is required in specific, performance-based, quantitative terms. A SOW prepared in explicit terms will enable offerors to clearly understand the government's needs. This facilitates the preparation of responsive proposals and delivery of the required goods or services. A well-written SOW also aids the Government in conduct of the source selection and contract administration after award. A Data Requirements Review Board (DRRB) may review each SOW to ensure compliance with the policy, guidance and procedures contained in this handbook (see DoD 5010.12-M for requirements for conducting the DRRB). The SOW is aligned with the acquisition milestones and phases discussed in detail in Section 4.

3.2 Relationship between Statement Of Work and Specification. The SOW defines (either directly or by reference to other documents) all work (non-specification) performance requirements for contractor effort. Qualitative and quantitative design and performance requirements are contained in specifications developed according to MIL-STD-961. Such specifications are typically referenced in the SOW, but the specific qualitative or quantitative technical requirements should not be spelled out in the SOW. For example, the referenced specification may cite reliability and maintainability requirements in terms of quantifiable mean-time-between failures (MTBF) and mean-time-to-repair (MTTR); the SOW should task the contractor to establish, implement and control a reliability and maintainability program.

3.3 Relationship Between the SOW and Contract. The SOW should be compatible with these provisions:

Requirements that are mandated by law, established DoD policy or necessary for effective management of its acquisition, operation, or support.

At the outset of development, system-level requirements should be specified in terms of mission-performance, operational effectiveness, and operational suitability.

During all acquisition phases, solicitations and contracts, the SOW should state management requirements in terms of results needed rather than "how to manage" procedures for achieving those results.

DFAR 252.211-7000, Acquisition Streamlining, is required in all solicitations and contracts for systems acquisition programs. This enables a contractor to effectively evaluate and recommend the tailored application of management systems and specifications and standards for use in the appropriate phase of the program life cycle.

3.4 SOW and Contractor Performance. After contractor selection and contract award, the contract SOW becomes a standard for measuring contractor performance. Consequently, the SOW writer must consider the contractual and legal implications of the SOW during its

preparation. As the contracted effort progresses, the government and the contractor will refer to the SOW to determine their respective rights and obligations. In this respect, the SOW defines the contract and is subject to the interpretations of contract law. The SOW must clearly define the work to be performed, since the language detailing the contractor's effort may be pertinent to legal questions concerning the scope of work. In a dispute concerning performance, rights, or obligations, clearly defined requirements will enhance the legal enforceability of a SOW, which has a high level of precedence in the solicitation document and contract as stated in FAR 52.215-33.

3.5 Relationship of Contract Sections. The government Request for Proposal (RFP) or solicitation defines the government's requirements and constitutes the cornerstone of the program, as it ultimately shapes the resultant contract. Therefore, the SOW must be consistent with all sections of the RFP. The SOW preparer should work closely with the overall RFP drafter and all contract section authors to achieve consistency. If acceptance and inspection of supplies or services is required to satisfy the contract, RFP Section E should address the acceptance criteria. Data deliverables are identified in Contract Data Requirements List (CDRL) exhibits to the contract. Section F (Deliveries or Performance) requires delivery of data listed in these exhibits. Clauses required by law, regulation, or any other clauses that may apply to a resulting contract are cited in Section I (Contract Clauses). Section J is a listing of all exhibits and attachments to the contract. Sections K, L, and M apply only to RFP's. They are contained at the end so that when the contract is awarded, they can be removed. Section K includes provisions that require representations, certifications, or the submission of other information by offerors. Section L includes provisions and other information or instructions to guide bidders/offerors in preparing their offers or bids in a manner that is responsive to the government’s RFP. Section M identifies the factors that will be considered in awarding the contract. It contains the evaluation criteria listed in order of importance and other factors for award. The SOW and Work Breakdown Structure (WBS) are utilized in preparing the corresponding CDRL, Section L, Section M, and other parts of the RFP/contract. The relationship of RFP/contract sections to the SOW is illustrated on Figure 1. Figure 1 is provided for general guidance and shows that the SOW and SOO may, at the preference of the procuring activity, be placed in one of several different locations in the solicitation. Because of the complex interrelationships among RFP/contract documents, use of a cross-reference matrix may be helpful (see Figure 2).

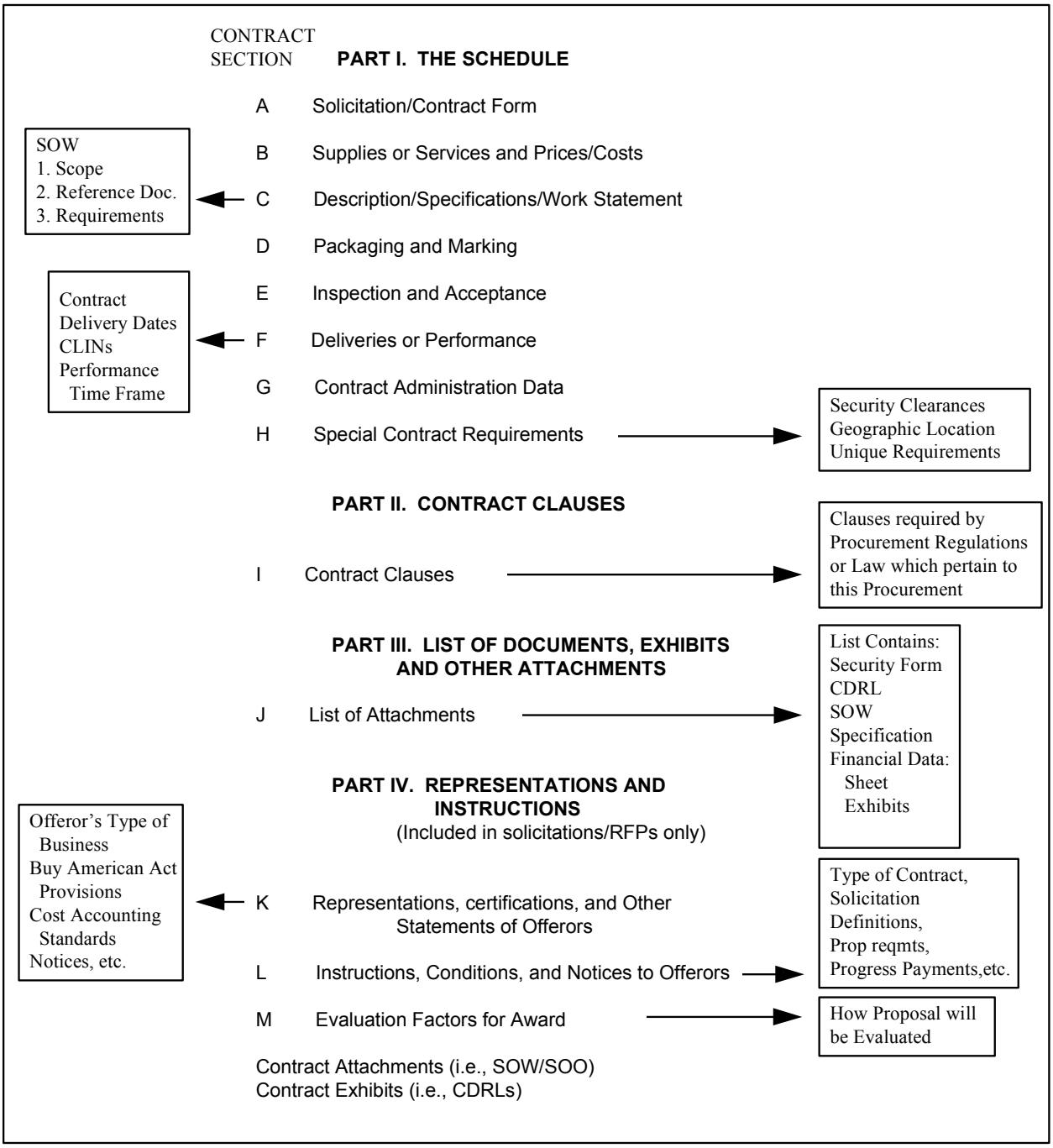


FIGURE 1. Relationship of Government solicitation/contract sections to SOW/SOO.

The following matrix is intended to reduce internal RFP inconsistencies and aid in proposal preparation. It is provided as a reference tool for information only. In the event of conflict between this matrix and any other section of the RFP, the other section shall take precedence.

WORK DESCR	WBS ELEM	SOW PARA	CLIN	CDRL	INSTR TO OFFERORS (SEC L)	EVAL FACTORS (SEC M)	PROP LOC
Design B	2.2	3.2.2	0001	N/A	3.B.1	Tech 1.A	V1-p.64
Build A	2.3	3.2.3	0002	A001	3.B.2	Tech 1.B	V1-p.75

FIGURE 2. Cross reference matrix.

3.6 Standard Format. The standard format for the SOW is as follows (subject to variations specified in Section 4 for specific types of SOWs):

SOW Section	Title
1	SCOPE
2	APPLICABLE DOCUMENTS
3	REQUIREMENTS

Deviations from the standard format may be made by the writer when necessary to accommodate overriding program needs.

3.6.1 SOW Section 1 - Scope. This Section includes a brief statement of what the SOW should cover. The scope paragraph defines the breadth and limitations of the work to be done. In some cases, the use of an introduction, background, or both, is preferred. Separate indentures under this Section are used in SOWs to accommodate complex acquisitions requiring lengthy background information. Background information should be limited to only that information needed to acquaint the proposer with the basic acquisition requirement. The items listed below should not be included in the "Scope" Section.

a. Directions to the contractor to perform work tasks.
b. Specification of data requirements.
c. Description of deliverable products.

3.6.2 SOW Section 2 - Applicable Documents. Military handbooks, government instructions, service regulations, technical orders, and policy letters, as a type, are not written in language suitable for contract application. In the event requirements of these documents must be included in a SOW, excerpts only should be used and should be made into either a clear task statement or a clear reference statement for guidance only, and not for contract compliance. Any documents called out in Section 2 of the SOW should have the specific version referenced, i.e. by date or by revision letter.

The SOW writer should refer to DFARS 252.211-7000 with respect to referenced documents and begin with a zero base situation. The requirement for any specification and standard should be justified before being placed in Section 2 of the SOW. Therefore, Section 2 should not be prepared until the draft of the requirements Section, Section 3, is complete. Sections 2 and 3 are reciprocal. Documents invoked by specific reference in Section 3 of the SOW must be identified and listed in Section 2. When invoked in Section 3 of the SOW, the application should be tailored to invoke only those minimum requirements from the document which are absolutely necessary for program success as described in MIL-HDBK-248. The applicability of each document listed in Section 2 of the SOW should be specified in Section 3 and identify only that portion needed to perform the work. Improper document referencing (e.g., blanket imposition) was often a major cost driver since total compliance with a document listed in Section 2 of the SOW was implied unless Section 3 specified otherwise.

3.6.3 SOW Section 3 - Requirements. Specific work tasks are called for in SOW Section 3 (see Appendix D). These tasks, developed to satisfy program needs, are essentially the contractor work requirements. Although the Source Selection Evaluation Board (SSEB) is responsible for the examination of SOW requirements in order to eliminate nonessential requirements, such examinations may be accomplished by the functional technical groups during development of the SOW. A well-written SOW has the following attributes:

a. Specifies requirements clearly to permit the government and offerors to estimate the probable cost and the offeror to determine the levels of expertise, manpower, and other resources needed to accomplish the task.

b. States the specific duties of the contractor in such a way that the contractor knows what is required and can complete all tasks to the satisfaction of the contract administration office.

c. Written so specifically that there is no question of whether the contractor is obligated to perform specific tasks.

d. References only the absolute minimum applicable specifications and standards needed. Selectively invokes documents only to the extent required to satisfy the existing requirements. (The tailoring of reference document requirements should result in a reduction to the overall costs otherwise incurred if all requirements stated in a document are invoked).

e. Separates general information from direction so that background information and suggested procedures are clearly distinguishable from contractor responsibilities.

f. Avoids directing how tasks are to be performed and states only what results are required.

3.6.4 SOW Do's and Don'ts.

a. Do's:

· Select a competent team with an experienced team leader.

· Exclude "how to" requirements since the offeror should be tasked to provide the deliverables under the contract in the most cost effective manner.

· Use the program Work Breakdown Structure (WBS), as discussed in paragraph 3.8.1 in this handbook to outline the required work effort.

· Set SOW objectives in support of the Acquisition Plan (AP), if applicable.

· Explicitly define the tailored limitations of all standards and specifications cited.

· Exclude design control or hardware performance parameters because these requirements should be covered in a specification.

· Educate personnel with respect to acquisition streamlining. (DFARS 211.002-70 Contract Clause).

· Give priority to commercial items over specification items when the former satisfies military requirements.

· Give priority to commercial practices as a means of acquisition (DFARS 212 Acquisition of Commercial Items - General).

b. Don'ts:

· Order, describe, or discuss Contract Data Requirements List (CDRL) data.

· Invoke, cite, or discuss a Data Item Description (DID). Although the text of the SOW should not include the data format and content preparation instructions and/or data delivery requirements, a data item description number listed on the CDRL may be cross-referenced in the SOW.

· Specify technical proposal criteria or evaluation factors.

· Establish a delivery schedule. (May include significant milestones for clarity.)

· Specify design control parameters or the performance of hardware because these items should be covered in a specification.

· Impose on the contractor a Government format when a contractor format is acceptable.

· Overspecify. Specify only what is required and let the contractor establish the best method to fulfill the requirement.

· Invoke in-house management instructions.

· Use the SOW to establish or amend a specification.

· Invoke handbooks, service regulations, technical orders, or any other document not specifically written according to DoD standards. (Non-government documents excluded.)

3.6.5 Title Page and Table of Contents. All SOWs should have a title page or cover that shows the SOW title, preparation date, procurement request number or contract number, revision number, date, and identity of the preparing organization (see Figure 3). A table of contents should be used when the SOW exceeds five pages (see Figure 4).

3.6.6 Paragraph Numbering and Identification. Each paragraph and subparagraph should be numbered consecutively within each SOW Section using a period to separate the number representing each sublevel. Paragraph numbering should be limited to the third sublevel, if possible, as shown in the following example for SOW Section 3:

Requirement	3
1st Sublevel	3.1
2nd Sublevel	3.1.1
3rd Sublevel	3.1.1.1

Paragraph breakdowns should be kept to that level necessary to clearly define required contractor tasks. Only one task should be provided in a numbered paragraph or sub paragraph to facilitate costing, referencing and tailoring of tasks. Each paragraph and sub-paragraph should be titled.

13 NOV 1995

STATEMENT OF WORK

FOR

RAPID DEPLOYABLE COMMUNICATIONS SYSTEM

Prepared by

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

FIGURE 3. Sample Title Page.

CONTENTS

Section/Para Page

1 Scope

2 Applicable documents

2.1 Department of Defense specifications

2.2 Department of Defense standards

2.3 Other publications

3 Requirements

3.1 General Requirements

3.2 Technical Objectives and Goals

3.3 Specific Requirements

3.3.1 Contractor Services

3.3.2 Integrated Logistics Support

3.3.3 Management Systems Requirements

3.3.4 Production Planning for Phase II

3.3.5 Reliability Program

3.3.6 Maintainability Program

FIGURE 4. Sample Table of Contents.

3.6.7 Language Style. SOW requirements should be written in language understandable to all potential program participants. Requirements should be stated explicitly in a topical, logical,

chronological, or similarly structured order, avoiding words which allow for multiple interpretations. Use technical language sparingly with simple wording predominating in concise sentences. Use "shall" whenever a provision is mandatory. “Will” expresses a declaration of purpose or intent; for example, "The Government will review all recommendations and provide direction within thirty calendar days". Use active rather than passive voice; for example, "The contractor shall establish a program", not "A program shall be established by the contractor.”

Spell out acronyms and abbreviations the first time and put the abbreviated version in parentheses after the spelled-out phrases. This will define them for each subsequent use. Acronyms and abbreviations may be defined in a glossary. Many of the common acronyms used are found in Appendix A.

Use verbs that identify work and performance task requirements (See Appendix B) and answer the explicit question: "What are the work requirements?" When selecting the appropriate work word which properly expresses the degree of contractor involvement, the SOW writer must explicitly define the total nature of the work requirement.

Avoid using “Any,” “Either,” “And/Or,” as these words imply that the contractor can make a choice which may not support the intent of the SOW. Do not use pronouns. Repeat the noun to avoid any misinterpretation. Terminology should be consistent throughout the SOW. When referring to a specific item, use the same phrase or word, particularly when referring to technical terms and items. Where words can be spelled in several different ways, employ the most common spelling. Make every effort to avoid ambiguity. A list of ambiguous phrases is provided in Appendix C.

3.7 Data Management. As the contractor performs and completes the SOW tasks, data may be developed. Submissions of this data are generally expensive. Proper tailoring and scheduling of data submission items requires particular attention by the SOW preparers. Data costs can be minimized by selectively eliminating unnecessary reports and requiring appropriately phased submissions. A review of anticipated data requirements should therefore include definition of a time line defined for data submission. The contractor's format may be the acceptable form for submission of data products. The SOW preparer should make every effort to ensure that the CDRLs and DIDs reflect the anticipated need for data and to ascertain whether the specific data required will in fact be generated and available prior to the proposed delivery date stated on the proposed CDRL.

3.7.1 Use of Contract Data Requirements List (CDRL) Data. The ordering and delivery of data which the Government requires are specified and scheduled through the use of the Contract Data Requirements List (CDRL), DD Form 1423, in conjunction with the appropriate Data Item Description (DID), DD Form 1664. The CDRL is used to order the data required and tailor the DID. The DID’s use is to describe the data’s format and content requirements. The SOW task(s) that will produce data requirements should be referenced in Block 5 of the CDRL. The SOW author should exercise considerable care and attention to the data delivery implications of the SOW. While data may be inherently generated by a work task, recording and delivering the data in a specific format are cost drivers that must be considered when preparing the SOW and CDRLs. The CDRL should specify that the contractor's format is acceptable, wherever possible.

3.7.2 Data Item Description (DID). After the need for recording and delivery of data resulting from a work task has been determined, appropriate DIDs should be selected from DoD 5010.12-L, Acquisition Management System and Data Requirements Control List (AMSDL). If certain elements of data are not needed, the DID should be tailored downward noting deletions in CDRL Block 16. When the contractor format for a data product will meet the Government's needs, it should be specified in block 16 of the CDRL if the DID does not already state contractor format is acceptable. The CDRL should only require data specifically generated in a SOW work task. The SOW, and not the DID, must task the contractor to perform work. At the end of each SOW task paragraph, the DIDs that are associated with the effort described in the task may be identified in parentheses.

To understand the relationship of a SOW to the CDRL and DID (see Figure 5), consider the example where the SOW establishes a requirement that, "the contractor shall establish, implement and control a Configuration Management (CM) program". The associated CDRL would order a CM data item and identify due date, distribution and other such parameters while the DID would provide the format and content requirements for that particular CM item, with non-essential references tailored out of the DID.

3.8 SOW Development. Section 4 of this handbook describes how the SOW content may change depending on which acquisition phase it supports. The following paragraphs will describe a general planning and development approach that is applicable to all SOWs regardless of which acquisition phase is to be supported.

3.8.1 Work Breakdown Structure (WBS). A WBS should be used in developing the SOW. MIL-STD-881 may be used for guidance. A WBS provides the framework for a disciplined approach of structuring and defining the total project or program. It is a product-oriented family tree composed of equipment, services, and other items which make up the project or program, and provides the basis for progress reporting, performance and engineering evaluations, and financial data reporting. When preparing the SOW a complete application of a WBS may not be necessary in all programs, however, the underlying philosophy and structured approach can and should be applied. The Contract Line Item Number (CLIN) and the SOW should be constructed to correlate with the WBS. Use of a WBS during SOW development facilitates a logical arrangement of the SOW elements and provides a convenient check-list to trace all necessary elements of the program and ensure that they are addressed in the SOW. The WBS will evolve into greater detail as the system definition and acquisition phases advance. For each phase, the WBS must be in sufficient detail to cover all the required work in that phase, as well as to produce the technical information needed for the next phase. The WBS may be tailored to the minimum level required to manage program risk.

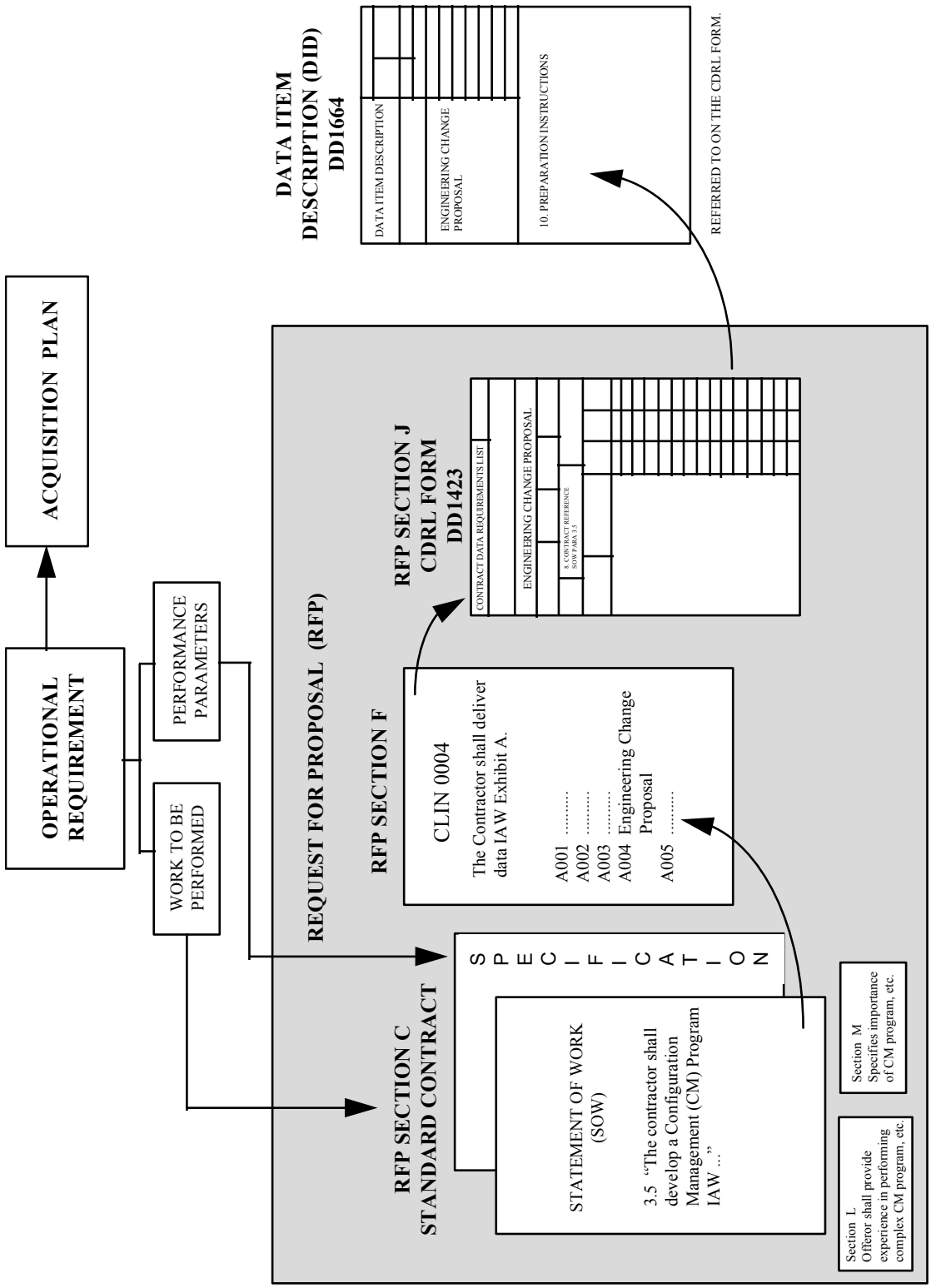


FIGURE 5. SPEC-SOW-CDRL-DID Relationship.

3.8.2 Development Approach. A systematic process is essential for SOW development. Select a competent team (expert in managerial, technical and contractual fields) with a team leader who is experienced in systems acquisition and SOW development. The SOW preparer and all contract section authors must first understand all program requirements to be supported. Following the systematic process shown on figure 6, the team should:

a. Ensure that only those tasks which add value to the product, whether a management system or technical requirement, are included in the SOW. (See DFAR 211.002 policy.)

b. Conduct market research to determine whether commercial items or nondevelopmental items are available to meet program requirements.

c. Review the requirements documents which authorize the program and define its basic objectives.

d. Review the various DoD/Services/Joint Services requirements documents for program management, acquisition and control impact.

e. Prepare a bibliography citing the specific portions of all applicable governing instructions, directives, specifications, and standards with which the program must comply. Keep these requirements to the absolute minimum and do not include citings that direct "how" work is to be performed.

f. Categorize the work described by the program WBS into that which will be done in-house and that which needs to be contracted.

g. Compile all work that needs to be contracted into an Acquisition Plan (if applicable) which will identify the various RFPs/contracts required, type of contract, the time-phasing, estimated cost, method of contractor selection/award, and period of performance among other things. For each RFP/contract so identified, a SOW must be prepared covering all of the WBS work elements included in that RFP/contract.

h. Identify all organizations and persons who will participate in preparing the SOW, and determine the participants' areas of responsibility.

i. Prepare the SOW following the guidelines of this handbook. For each WBS work element, identify tasks that define the scope of the work effort to satisfy the minimal needs of the program and identify required data deliverables.

j. Ensure that the specifications are consistent with the SOW. Ensure technical performance requirements are properly contained in the system specification and not in the SOW.

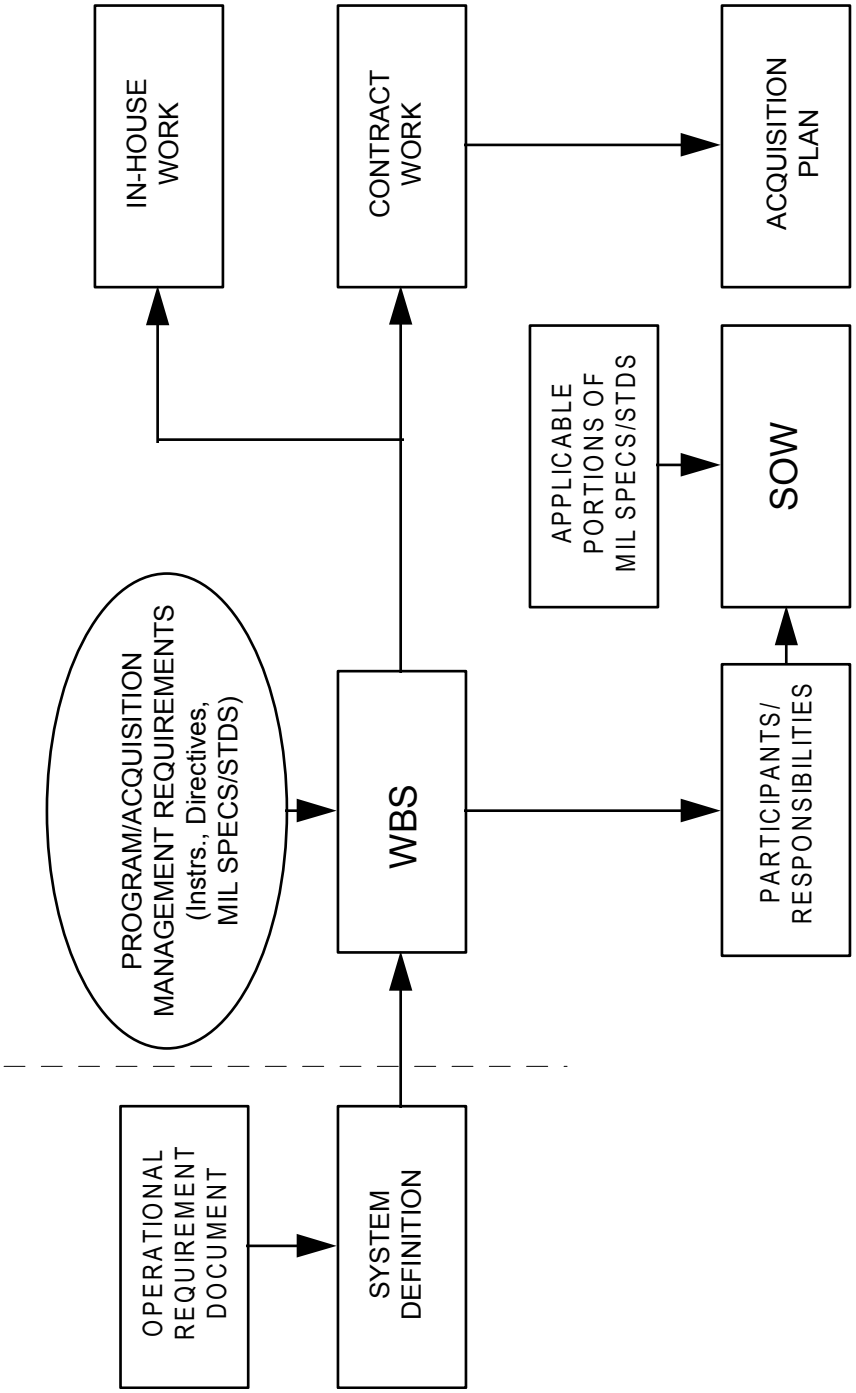


FIGURE 6. Systematic approach to SOW preparation.

k. Utilize the SOW and WBS in preparing the corresponding CDRL, Section L Instructions to Offerors, Section M Evaluation Factors for Award, and other parts of the RFP/contract following DFARS.

3.8.3 Non-Complex SOW Development. It is essential to establish a SOW outline for non-complex acquisitions which do not lend themselves to utilization of a WBS.

a. Define end items (line items) to be acquired, such as hardware, software, engineering analysis, software validation or simulation, etc.

b. Establish the requirements which apply to each end item and, as a minimum, develop a bibliography as described in 3.8.2.e above.

c. Determine what services or data will be needed to support each end item after delivery to the Government.

d. Identify all participants (see 3.8.2.h)

e. Prepare the SOW following the guidelines of this handbook.

4 DETAIL REQUIREMENTS

4.1 SOW Phasing and Results. All programs, including highly classified programs, should accomplish certain core activities. These activities must be tailored to satisfy an identified need using common sense and sound business practices. The acquisition process is structured in logical phases separated by major decision points called milestones. Each milestone is an opportunity for a review to determine if the program should continue. The decision to enter the next phase or not is based on results obtained in the acquisition phase preceding that milestone. SOW requirements are tailored to support the acquisition of information, hardware, software, technical data and the logistic support required during any particular life cycle phase.

4.1.1 Determining Mission Needs and Identifying Deficiencies. All acquisition programs are based on identified, documented, and validated mission needs. Mission needs result from assessments of current and projected capability requirements. Mission needs may establish a new operational capability, improve an existing capability, or exploit an opportunity to reduce costs or enhance performance. If the potential solution results in a new program, an appropriate level review should be held to document its validity and joint potential, and confirm that the requirements have been met or considered.

4.1.1.1 Elements of Information. Where preliminary studies involving systems analyses, preliminary cost effectiveness, or trade-off studies are to be contracted, there are certain distinctive elements of information to be included in the SOW. These can be included in either the introduction or background descriptions of the Scope in Section 1.

These areas are as follows:

a. *Statement of the problem(s).* A brief description and background of the problem(s) to be solved, and a succinct discussion of the need giving rise to this requirement.

b. *System description.* A short functional description of the overall system. If practicable, a pictorial representation that will quickly orient the reader to the desired system and the proposed use should be considered for inclusion in this Section of the SOW.

c. *Major milestones. A* graphic display of major program milestones should be included in the background information.

4.1.1.2 Requirements. The Section 3 paragraphs will establish what the contractor shall do, and may properly contain discussions of the following requirements and conditions:

a. *Component and subsystem relationships. A* functional flow diagram, explaining what is visualized as possible or practical at this time and showing the system and each associated subsystem (or major component).

b. *Alternative courses of development.* A summation of the alternatives for development as they are visualized at this time, pointing out the possible differences in operational

effectiveness in terms of performance, reliability, maintainability and operability. The SOW should clearly indicate the basis of comparison, e.g., previous experience or extrapolations.

c. *Phasing.* Where the studies to be accomplished are divisible into time phases or into other separable areas of work. The SOW should spell out these requirements.

4.1.2 Phase O: Concept Exploration - Examining Alternative Concepts to Meet Deficiencies. Phase objective is to define and evaluate alternative system design concepts which fulfill mission needs and program objectives. During this phase, technological advances, concept feasibility, schedules and costs are evaluated by the program manager in order to identify a viable solution to a military requirement. Because of the evolving nature of the desired product, the SOW used during this phase must be limited to an expression of the mission need objectives and goals. The precision with which operational goals or technical objectives can be defined during this phase will impact the Government's and the contractor's ability to estimate cost and risk. In the majority of early stage research programs, including preliminary explorations and studies, the work to be performed cannot be described precisely. When preliminary exploration and studies have indicated a high probability that the development is feasible a more definitive SOW can be drawn. Based on program needs, the contractor in this phase may develop a Type A system or system/segment specification for use by the Government in the solicitation for the next phase.

4.1.2.1 Detailed Requirements. The Concept Exploration Phase SOW instructs the contractor to assess the merits of the concepts and define the most promising concepts in broad terms of objectives for cost, schedule, performance and overall acquisition strategy. Initial measures of effectiveness and performance are also identified in this phase.

4.1.3 Phase I: Program Definition and Risk Reduction. During this Phase, the program becomes defined as one or more concepts, designs, and/or technologies are investigated. Early development models, demonstrations, and operational assessments are conducted as required to reduce risks prior entering the program's next phase. Cost, schedule and performance trade-offs are conducted. Key activities include: strategy review, identification of program specific accomplishments for the next phase, initial manpower estimates, and the identification of potential environmental impacts.

4.1.3.1 Detailed Requirements. The Program Definition phase SOW should contain enough detail to enable the successful bidders to translate program requirements into an effective development program. It should delineate specific tasks for evolving the system requirements into system type specifications or system segment specifications.

4.1.4 Phase II: Engineering and Manufacturing Development - Detailed Design, Integration Testing, and Establishing a Manufacturing Capability. The objectives of this phase are: to translate the selected design into a stable, producible, supportable, and cost effective design; to validate the manufacturing or production process; and to demonstrate system capabilities through testing.

4.1.4.1 Detailed Requirements. The Engineering and Manufacturing Development phase SOW efforts include verification that adequate resources have been programmed to support

production, deployment, and logistics support of the operational system; verification of the system's software design, coding, integration and tests.

4.1.5 Phase III: Production, Deployment, and Operational Support. In the Production, Deployment, and Operational Support Phase, the system developed in the previous phases is produced and installed and any support required for operational use is provided. All tasks which were deferred until the Production Phase are addressed and action is initiated for their completion. These include efforts deferred in support areas such as, supply support (provisioning), technical publications and training. Systems engineering management will ensure on a continuing basis that the design is feasible and sound. Additionally, they will initiate, evaluate and integrate engineering changes throughout the Production Phase to provide the capability for continued support after the system is deployed. The evaluation of system Engineering Change Proposals (ECPs) and value engineering changes, and the preparation for turnover of system operation to the using service are important tasks to be accomplished during this phase. The need for continued system effectiveness and product assurance work as well as CM work will be based on the impact of engineering changes. Operation and Maintenance manuals, and supply support documents, are updated during this Phase and the finished system is tested and approved for DoD use.

4.1.5.1 Product Specifications. The product specification is the primary procurement control document used during the production phase to determine the product baseline, control design, and establish system performance. The content of the specifications is limited to requirements intended to control design and establish performance requirement of the purchased product. The SOW should not conflict with the product specification. Typical SOW requirements which should be tailored to the minimal Production Phase needs are: ILS, CM, technical manuals and publications, training, quality program requirements, calibration and instrumentation, reliability, maintainability, human factors, safety, Planned Maintenance Subsystem (PMS) and other contractor provided services needed in conjunction with the production buy. Many of these areas have already been addressed during the development phases and should now be well defined and documented. Some SOW tasks are no longer required, while others require continued effort or the introduction of new tasks compatible with the Production Phase.

4.1.6 Examples. Figure 7 provides a standard SOW format, and Appendix D illustrates an example of SOWs for both products and services. The example SOWs are intentionally incomplete in the interest of brevity.

4.2 Services (Non-personal). The product of a non-personal services SOW (Appendix D2) is the result of some work task being performed. The requirements that establish the work must be defined in terms of work words and not product words. The need for non-personal services may occur at any time. If the work to be performed is painting a building, the task

STATEMENT OF WORK FORMAT

1 Scope. Include a statement about what this SOW covers. Some background information may be helpful to clarify the needs of the procurement.

1.1 Background. Do not discuss work tasks in Section 1.

2 Applicable Documents. All documents invoked in the requirements section of the SOW must be listed in this section by document number and title. These documents may include Standards, Specifications and other reference documents needed to identify and clarify the work task or deliverable product. However, DoD and Departmental Instructions are provided to control in-house work effort and should not be used in the SOW to control contractor effort. Also, any document listed in this section must be invoked and selectively tailored to meet minimal needs of the planned procurement in the requirements section. The exact version of any document cited in the SOW should be specified in this section.

2.1 Department of Defense specifications.

2.2 Department of Defense standards.

2.3 Other Government documents.

2.4 Industry documents.

3 Requirements. The arrangement of technical tasks and subtasks within the Requirements section will be dictated by program requirements. If a WBS is being used in the program, tasks should be arranged in accordance with that WBS. It may be helpful to have a general task to orient the planning and use of the subsequent subtasks. The following outline is a generalization. Care should be exercised to scope the program tasks to meet only the minimal needs for the phase SOW or requirements.

3.1 General.

3.2 Detail tasks.

3.2.1 System engineering.

a. Technical studies - including life cycle costs.

b. System effectiveness planning, for example, reliability, maintainability, and human factors.

FIGURE 7. SOW format.

must define what is to be painted and to what standards. The product of such a contract is obviously a building painted and completed by a certain time. If the SOW is prepared properly, contractor monitoring can be kept to a minimum as long as the task is completed on time and within cost. This would be a proper non-personal services contract. The Government is then left with the requirement to inspect the product and either accept or reject it based on the contractor's conformance to the prescribed work requirement. The wide variety of non-personal services requirements cause this type of contract to take on many forms. However, in all applications, two factors are important to ensure that the services purchased are indeed non-personal. These factors are: (a) the SOW must establish explicitly what work is to be done and require the delivery of a product or result other than periodic progress reports and (b) the contractor's employees must not be supervised or controlled by the Government during the execution of the work and production of the product or result. In this regard, the SOW must be explicit, inclusive and comprehensive in prescribing the work requirements. For a more complete discussion of a personal versus a non-personal services contract, refer to DFARS 237.104.

4.2.1 Product Definition. As the product or service becomes more involved and technical in nature, defining in adequate detail what is needed to enable a contractor to produce the product independently becomes more difficult. If the job is an analysis, the task must say precisely what is to be analyzed and the criteria for performing the analysis, including any particular elements to be considered. If some conclusion is to be drawn as a result of the analysis, be precise about what the DoD needs to obtain as a result of this analytic work. If it is important how or in what sequence the analysis is to be conducted, spell it out. Specify explicit needs, leaving nothing to the contractor's imagination.

4.2.2 Terminology. A frequent problem encountered in defining the tasks in an SOW is the use of non-specific words and phrases such as: “any”, “assist”, “as required”, “as applicable/as necessary” and “as directed”. Do not use any of these words. The following rationale for precluding their use is provided:

a. *Any.* "Any" is an ambiguous word. Writers may intend it to denote "plurality" and readers may interpret it to denote "oneness”. Also, when "any" is used to describe the selection of items from a list, it's the reader who does the selecting, not the writer. Which items, and how many the reader selects are beyond the control of the writer.

b. *Assist.* “Assist” connotes personal services. It infers working side-by-side, being subject to supervision. The word is totally undefined in terms of identifying the work and its range and depth. Spell out explicitly what the contractor must do.

c. *As required.* The result of this approach is an undefined work condition. It has no expressed limitations. It places the Government in a position of not expressing its minimal needs. It could lead to a debatable condition concerning the contractor's compliance with the contract or order. The SOW must be declarative as to its minimal needs.

d. *As applicable/As necessary.* If the Government does not know what is necessary or applicable, it must not leave to the contractor the responsibility for determining the minimal

needs of the contract. The SOW should forthrightly state the requirements so that the contractor can comply with the requirement using his best efforts and expertise to accomplish the tasks.

e. As *directed.* This condition, as a part of a work task in a SOW, connotes a personal services situation in which the contractor is placed under direct supervision. "When directed" may be used in conjunction with a task order contract to indicate that specific tasks may be initiated at various times during the period of contracted performance.

f. *Including but not limited to.* This term is generally inserted when the drafter is unsure of requirement or criteria. However, it creates an unspecific requirement which creates ambiguity. Only list known requirements.

g. *Etc.* This word also introduces potentially more unidentified ambiguous requirements.

4.2.3 Word Usage. Another area of concern in establishing the SOW for non-personal services is the overuse of the words and phrases "support" and "engineering and technical services".

a. Support is an ambiguous term. Specify the specific type of support needed.

b. The terms "engineering and technical services" encompass a broad area of expertise. The SOW must state the minimal needs, even if it means broadening the work limitations to cover anticipated work tasks. For clarification, the SOW may include some examples of typical work to be done.

c. Perhaps one of the most vexing problems in contracting is the problem of loopholes. Contractors and inspectors go by the letter of the contract SOW. In one instance, an engineer intended to have a damaged roof edge repaired and repainted. He wrote "match existing," but did not specify "repaint." The contractors who did the work matched the existing metal flashing strip but refused to paint the new flashing. The inspector could only agree with the contractor, since the engineer had not adequately described what was intended. The writer and reviewers at all levels of review have a responsibility to ensure that loopholes do not exist in the final SOW.

5 STATEMENT OF OBJECTIVES (SOO) METHOD

5.1 SOO Introduction. The SOO is a Government prepared document incorporated into the RFP that states the overall solicitation objectives. It can be used in those solicitations where the intent is to provide the maximum flexibility to each offeror to propose an innovative development approach. Offerors use the RFP, product performance requirements, and SOO as a basis for preparing their proposals including a SOW and CDRL. Note: The SOO is not retained as a contract compliance item.

5.1.1 SOO Purpose. The program SOO should provide the basic, top level objectives of the acquisition and is provided in the RFP in lieu of a Government written SOW. This approach provides potential offerors the flexibility to develop cost effective solutions and the opportunity to propose innovative alternatives meeting the stated objectives. It also presents the Government with an opportunity to assess the offeror's understanding of all aspects of the effort to be performed, by eliminating the 'how to' instructions to accomplish the required effort normally contained in the SOW the Government provides to prospective offerors.

5.2 SOO Content. The Government may include a SOO as part of the RFP, listed in Section J, attached at the end of the RFP, or referenced in Section L and/or M, defining the top level program objectives. Alternatively, the SOO may be placed in Section L of the RFP (e.g., as an annex). Figure 8 provides a notional SOO format. It is developed to be compatible with the mission need statement (MNS); operational requirements document (ORD), technical requirements from the system requirements document (SRD)/systems specification; and the draft work breakdown structure (WBS)/dictionary. The SOO should address product oriented goals rather than performance requirements. SOOs are normally in the 2-4 page range. The SOO is not a one for one replacement of the SOW. Sections L and M should logically follow with instructions to the offerors asking for proposal information supporting the objectives and evaluation criteria that clearly identify how the offerors' responses will be evaluated. Each portion of the RFP must support one another. The key is to keep the SOO clear and concise and to provide potential offerors with enough information and detail to structure a sound program, designed to be executable and satisfy government objectives. The SOO is used, along with other information and instructions in the RFP, by offerors, to develop the contract work breakdown structure, statement of work, and other documents supporting and defining the offerors proposed effort. SOO content depends both on the type of program and on the program phase. It is possible that a 'mature' program, such as one which has been fielded for some time, could require slightly more detail in the SOO to properly integrate with other, ongoing parts of the program. The SOO is replaced at contract award in the contract by the proposed SOW.

1.0 Program Objectives

(a) multi-phased program
(b) one program, multi-contractor
(c) one phase contract

2.0 Contract Objectives (WBS 00000)

(a) Objectives in paragraph 2.0 are traceable to Level 0 WBS
(b) For multi-phase programs, describe objectives for each phase in a format similar to an indentured list (clearly indicate which phases are part of the anticipated contract and any phases that will involve separate contracts).

Note: The SOO should not address each WBS element, but each WBS element should be traceable to something in the SOO. For example, a SOO may instruct the bidder to address his engineering approach. That is not a particular WBS element, but several WBS elements might be created to breakout the engineering tasks. Generally, a broad and sweeping objective statement will trace to more WBS elements than would be the case for a very narrowly focused objective statement.

FIGURE 8. Notional Statement of objectives (SOO) format.

5.3 SOO Development Approach. A systematic process is essential for SOO development. The following steps are an integral part of that process:

a. Conduct market research to determine whether commercial items or nondevelopmental items are available to meet program requirements.

b. Review the requirement documents which authorize the program and define its basic objectives. Complete a risk assessment and expound the basic objectives of the program to incorporate the major technical and programmatic risks.

c. Review the various DoD/services/joint services requirements documents for program management, acquisition and control impact.

d. Prepare a bibliography citing the specific portions of all applicable governing instructions, directives, specifications and standards with which the program must comply. Keep these requirements to the absolute minimum.

e. Categorize the work described by the program WBS into that which will be done in-house and the objectives of that work which needs to be contracted.

f. For each RFP/contract defined, prepare a SOO from the objectives identified.

5.4 SOO-RFP Relationships.

a. Section L: Section L of the RFP must include instructions to the offeror that require using the SOO to construct and submit a SOW and CDRL. An example of such wording follows:

"The Statement of Objectives (SOO), included as (cite location of SOO in the RFP), provides the Government's overall objectives for this solicitation. Offerors shall use the SOO, together with other applicable portions of this RFP, as the basis for preparing their proposal, including the CWBS, SOW and CDRL. The offeror shall ensure all aspects of the SOO are addressed. The SOW should specify in clear, understandable terms the work to be done in developing or producing the goods to be delivered or services to be performed by the contractor. Preparation of an effective SOW requires both an understanding of the goods or services that are needed to satisfy a particular requirement and an ability to define what is required in specific, performance based, quantitative terms. The offerors understanding of both required goods/services, and work effort required to accomplish should be fully demonstrated in the offeror's proposed CWBS, SOW, and CDRL. For complex interrelationships among RFP/contract documents, use of a cross-reference matrix may be helpful (see figure 2 in Section 3 of this handbook).

The offeror shall use his proposed SOW to prepare a CDRL including appropriately tailored data item description references. The requirements listed below (if any) are known minimum Government data requirements. The offeror may include additional data requirements. All data requirements shall be traceable to specific tasks defined in the SOW. Each specific data requirement shall be selected from DoD 5010.12-L and specified on DD Form 1423.

(1) (cite minimum data requirements here if any)
(2) . . .
(3) . . ."

(End of Section L example wording.)

b. Section M: Evaluation Factors for Award should include sufficient criteria to:

(1) Evaluate the offeror's ability to successfully achieve the SOO objectives,
(2) Ensure a sound approach is proposed, and
(3) Verify that all requirements can be met.

The Government's intention to evaluate the proposed SOW should be stressed in both Section L and Section M. The offeror's proposed CWBS, SOW, and CDRL's will be evaluated

as critical elements in assessing the offerors understanding of both required goods/services, and work effort required to accomplish them.

6 NOTES

6.1 Subject term (key word) listing.

Acquisition Plan (AP)
Contract Data Requirements List (CDRL)
Contract Line Item Number (CLIN)
Commercial off-the-shelf (COTS)
Data Item Description (DID)
Non-Developmental Item (NDI)
Operational Requirement Document (ORD)
Request for Proposal (RFP)
Statement of Objectives (SOO)
Statement of Work (SOW)
Work Breakdown Structure (WBS)
Work Breakdown Structure, Contract (CWBS)

6.2 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

APPENDIX A

ACRONYMS

ADM	Advanced Development Model
AMSDL	Acquisition Management Systems and Data Requirements Control List
AP	Acquisition Plan
ASP	Acquisition Strategy Panel
CDRL	Contract Data Requirements List
CLIN	Contract Line Item Number
CM	Configuration Management
COTS	Commercial off-the-shelf
CWBS	Contract Work Breakdown Structure
D&V	Demonstration and Validation
DAB	Defense Acquisition Board
DFARS	Defense Federal Acquisition Regulation Supplement
DID	Data Item Description
DoD	Department of Defense
ECP	Engineering Change Proposal
EDM	Engineering Development Model
EMC	Electromagnetic Compatibility
FAR	Federal Acquisition Regulation
FMS	Foreign Military Sales
ILS	Integrated Logistics Support
IPS	Integrated Program Summary
LSA	Logistic Support Analysis
LSAR	Logistics Support Analysis Records
MILDEP	Military Department
MNS	Mission Needs Statement
MTBF	Mean-Time-Between-Failure
MTTR	Mean-Time-To-Repair
NDI	Non-Developmental Item
ORD	Operational Requirement Document
PMS	Planned Maintenance Subsystem
R&D	Research and Development
RDT&E	Research, Development, Test, and Evaluation
RFP	Request for Proposal
SOO	Statement of Objectives
SOW	Statement of Work
SPEC	Specification
SRD	System Requirements Document
STD	Standard
T&E	Test and Evaluation
WBS	Work Breakdown Structure

APPENDIX B

WORK WORDS/PRODUCT WORDS

B.1 Select the key word that properly expresses the degree of contractor involvement. Specify what is to be done and the total nature of the work requirement. The word list provided in this Appendix is not complete but is provided to stimulate the thinking of the SOW writer by pointing out the critical differences in the meaning of work words versus the product words identified in connection with deliverable data.

B.2 Work words. When selecting the key work word that properly expresses contractor's involvement, the SOW writer must define explicitly the total nature of the work requirement in terms of what is to be done. In some cases, the "why" or the application of the results of the performed work may be stated if it clarifies the requirement. The following sample list contains words which have the inherent value of work. This list is offered as a reminder of the various shades of meaning conveyed by choice of words.

analyze	(solve by analysis)
annotate	(provide with comments)
ascertain	(find out with certainty)
attend	(be present at)
audit	(officially examine)
build	(make by putting together)
calculate	(find out by computation)
consider	(think about, to decide)
construct	(put together; build)
control	(direct; regulate)
contribute	(give along with others)
compare	(find out likeness or differences)
create	(cause to be; make)
determine	(resolve; settle; decide)
differentiate	(make a distinction between)
develop	(bring into being or activity)
define	(make clear; settle the limits)
design	(perform an original act)
evolve	(develop gradually, work out)
examine	(look at closely; test quality of)
explore	(examine for discovery)
extract	(take out; deduce, select)
erect	(put together; set upright)
establish	(set up; settle; prove beyond dispute)
estimate	(approximate an opinion of)
evaluate	(find or fix the value of)
fabricate	(build; manufacture, invent)
form	(give shape to; establish)

formulate	(to put together add express)
generate	(produce, cause to be)
identify	(to show or to find)
implement	(to carry out, put into practice)
install	(place; put into position)
inspect	(examine carefully or officially)
institute	(set up; establish, begin)
interpret	(explain the meaning of)
inquire	(ask, make a search of)
integrate	(to add parts to make whole)
investigate	(search into; examine closely)
judge	(decide; form an estimate of)
make	(cause to come into being)
maintain	(to keep in an existing state, to continue in, carry on)
manufacture	(fabricate from raw materials)
modify	(to change, alter)
monitor	(to watch or observe)
notice	(comment upon, review)
observe	(inspect, watch)
originate	(initiate, to give rise to)
organize	(integrate, arrange in a coherent unit)
perform	(do, carry out, accomplish)
plan	(devise a scheme for doing, making, arranging activities to achieve objectives)
probe	(investigate thoroughly)
produce	(give birth or rise to)
pursue	(seek, obtain or accomplish)
reason	(think, influence another's actions)
resolve	(reduce by analysis, clear up)
record	(set down in writing or act of electronic reproduction of communications)
recommend	(advise, attract favor of)
review	(inspection, examination or evaluation)
revise	(to correct, improve)
study	(careful examination or analysis)
seek	(try to discover; make an attempt)
search	(examine to find something)
scan	(look through hastily, examine intently)
screen	(to separate, present, or shield)
solve	(find an answer)
test	(evaluate, examine)
trace	(to copy or find by searching)
track	(observe or plot the path of)
update	(modernize, make current)

APPENDIX B

B.3 PRODUCT WORD LIST. Although Non-personal Services contracts may not result

in data as a deliverable product, a large portion do. This list of product words is provided to assist in identifying those products.

agenda
audio visual aids
books
cards
certificates
charts
decks
disc-magnetic
documentation
drafts
drawings
drums-magnetic
equipment
files
findings
forms
guides
graphics
handbooks
illustrations
lists
ledgers
logs
manuals
manuscript
materials
minutes
outlines
proposals
pamphlets
plans
procedures
publications
recommendations
records
recordings
reproducible
reports
requests
sheets
specifications
standards
systems
tapes
transparencies

APPENDIX C

PHRASES HAVING MULTIPLE MEANINGS

C.1 This list of phrases having multiple meanings is provided as an example of those to be avoided.

To the satisfaction of the contracting officer,

As determined by the contracting officer,

In accordance with instructions of the contracting officer,

As directed by the contracting officer,

In the opinion of the contracting officer,

In the judgment of the contracting officer,

Unless otherwise directed by the contracting officer,

To furnish if requested by the contracting officer,

All reasonable requests of the contracting officer shall be compiled with,

Photographs shall be taken when and where directed by the contracting officer.

In strict accordance with,

In accordance with best commercial practice,

In accordance with best modern standard practice,

In accordance with the best engineering practice,

Workmanship shall be of the highest quality,

Workmanship shall be of the highest grade,

Accurate workmanship,

Securely mounted,

Installed in a neat and workmanlike manner,

Skillfully fitted,

Properly connected,

Properly assembled,

Good working order,

Good materials,

In accordance with applicable published specifications,

Products of a recognized reputable manufacturer,

Tests will be made unless waived,

Materials shall be of the highest grade, free from defects or imperfections, and of grades approved by the contracting officer.

Kinks and bends may be cause for rejection,

Carefully performed,

Neatly finished,

Metal parts shall be cleaned before painting,

Suitably housed,

Smooth surfaces,

Pleasing lines,

Of an approved type,

Of standard type,

Any phrases referring to "The Government inspector".

APPENDIX D - STATEMENT OF WORK EXAMPLES

APPENDIX D1: EXAMPLE SOW FOR PRODUCTS

APPENDIX D2: EXAMPLE SOW FOR SERVICES

APPENDIX D1

EXAMPLE SOW FOR PRODUCTS

1 SCOPE. This Statement of Work (SOW) defines the effort required for the design, engineering development, fabrication, and test of an Advanced Development Model (ADM) of the _____ System for the Program Definition and Risk Reduction Phase. It includes the associated program management, human engineering, and logistic support planning requirements.

1.1 Background. The _____ program has been initiated to design, develop, produce, and deploy an _____improved system that will fulfill the_____ requirements as specified in Operational Requirement No._____. The _____ System will replace the XYZ System, and will significantly improve _____ capabilities. The _____ System specification for the ADM was developed during the Concept Exploration Phase conducted over the past two years. Upon successful testing and acceptance of the ADM developed during this Program Definition and Risk Reduction Phase, it is intended to obtain Department of Defense approval to competitively procure Engineering Development Models (EDMs) using performance specifications and program plans developed under this SOW.

2 APPLICABLE DOCUMENTS. The following documents are applicable to this Statement of Work and attached appendices to the extent specified herein.

2.1 Department of Defense Specifications.
(List documents as appropriate.)

2.2 Department of Defense Standards
(List documents as appropriate.)

2.3 Availability of DoD Documents. Unless otherwise indicated, copies of specifications, standards and handbooks listed above are available from the Standardization Document Order Desk, 700 Robbins Ave, Bldg 4D, Philadelphia PA 19111-5094

2.4 Non-Government standards and other publications.
(List documents as appropriate.)

2.5 Availability of Non-Government standards and other publications. Application for copies should be addressed to the (name and address of the source).

3 REQUIREMENTS.

3.1 General. The work required by this contract shall be performed in accordance with _____ System Specification (#) and this Statement of Work (SOW).

APPENDIX D1

The contractor shall design, develop, fabricate, and test an Advanced Development Model as listed in Section C of this contract to meet the performance criteria specified by _____ System Specification (#) and in accordance with the detailed requirements in paragraph 3.2.1 below.

The contractor shall provide program management, human engineering management, and logistic support planning in accordance with the detail requirements of 3.2.2 below.

3.2 Detail Tasks.

3.2.1 Design, Engineering, Fabrication and Test.

3.2.1.1 Design and Engineering. The contractor shall design and develop an ADM of the _____ System to meet the specification and criteria of _____ System Specification (#) utilizing engineering trade-offs between performance, reliability, maintainability, supportability, producibility, and life cycle costs. The _____ System design shall include the equipment performance and physical characteristics, subsystem component location, materials, the software program design elements of a top-down design, basic module description, and interface design.

3.2.1.2 Design Analysis. The contractor shall conduct a detail design analysis of the selected design. Detailed physical and performance design characteristics shall be specifically identified including the engineering decision process for using one methodology over another. Design documentation shall include discussion of alternatives and the ramifications thereof, risk assessments, and trade-offs made.

3.2.1.3 Preliminary Design Review (PDR) and Design Formalization. The contractor shall conduct a Preliminary Design Review. Informal design reviews may be held at times agreed to by the Government and the Contractor.

As a result of the design analysis conducted in paragraph 3.2.1.2 and the PDR in 3.2.1.3, the contractor shall finalize and formalize the design for fabrication. Written procuring activity approval of the design is required before the contractor is authorized to proceed with ADM fabrication.

3.2.1.4 Fabrication. The contractor shall correct and document any design characteristics that are found to inhibit or make fabrication unnecessarily costly but that do not otherwise alter performance or system effectiveness characteristics.3.2.1.5 Test and Evaluation. The contractor shall conduct and evaluate the results of environmental and performance tests on the ADMs to demonstrate full compliance of all equipment and software with _____ System Specification (#). The tests shall be conducted in accordance with the developmental test plan developed by the contractor and approved by the Government. The tests may be conducted at the contractor's facilities or at an independent laboratory or commercial testing facility.

3.2.1.6 Critical Design Review (CDR). The contractor shall conduct a Critical Design Review. At the CDR, the contractor shall formally report the results of the developmental tests, address design changes made during the fabrication process, and recommend design changes as a result of the developmental tests including trade-off impacts. The contractor shall incorporate all design changes approved during the CDR.

3.2.2 Program Planning

3.2.2.1 Program Management. The contractor shall establish and maintain management operations that shall include the following areas:

(a) Program Planning and Control
(b) Subcontractor Control
(c) Financial Management
(d) Data Management
(e) Management and Accountability for Government Furnished Equipment, Material or Information.
(f) Risk Management

The contractor shall develop and implement a Management Program that clearly defines how the _____ Program Definition and Risk Reduction Project will be managed and controlled. A task matrix keyed to the Work Breakdown Structure (WBS) shall be developed in sufficient detail to identify Contractor and subcontractor responsibilities. The Contractor shall develop and implement a management program that clearly defines how the _____ Program Definition and Risk Reduction Project will be managed and controlled.

The contractor shall establish and implement a program management office function to manage all technical performance, including reliability, maintainability, ILS, cost, schedule, and data delivery requirements of the contract.

3.2.2.2 Human Engineering Program. The contractor shall develop and implement a Human Engineering Program (HEP) to ensure that appropriate studies are performed and that human engineering criteria are applied to subsystem hardware and computer software design.

3.2.2.3 Logistic Support Planning. The contractor shall implement an ILS program to ensure that supportability design criteria and characteristics are considered and incorporated into the design consistent with the trade-off studies and that meet the operational availability requirements of _____ System Specification (_#_). The ILS program shall use a Logistic Support Analysis (LSA) as the principal analytic effort within the design process.

APPENDIX D2

EXAMPLE SOW FOR SERVICES

1 SCOPE. This SOW covers systems engineering, technical and management support services to the _____ Program Office This support encompasses engineering analysis and recommendations for technical logistical and life cycle support for _____ system.

2 APPLICABLE DOCUMENTS.

3 REQUIREMENTS.

3.1 Production Support.

3.1.1 Conduct independent review of _____ production programs to identify requirements consistent with directives governing the acquisition of system and equipment.

3.1.2 Using acquisition plans, existing hardware contracts and inherent lead-time items, construct schedules for inclusion in documentation for weapon system and equipment acquisitions.

3.1.3 Based on production program schedules as well as weapon system configurations, formulate technical documentation for these programs itemizing all supplies, data and services to be obtained.

3.1.4 Provide impact statements when deviations or changes occur and alternative recommendations when required to maintain individual program production integrity.

3.1.5 Identify, compile, and utilize available information, update and input data for manual or automated production scheduling information systems, prepare government production reports germane to maintaining weapons system production status and inventory.

3.1.6 Prepare production documentation for input into the applicable Management Information System (MIS).

3.1.7 Prepare recommendation for identifying project data to be entered into existing Automatic Data Processing (ADP) programs. When data system deficiencies are discovered, provide recommendations for solutions.

3.2 Foreign Military Sales (FMS) Support.

3.2.1 Compare actual deliveries with contract schedules for Military Departments (MILDEP) and FMS.

3.2.2 Track components and deliverable end items, and compile monthly acceptance reports and quarterly production reports. Consolidate delivery schedules by fiscal year, weapons, components, support equipment and manufacturer.

3.2.3 Compare schedule with industrial capacities and weapon station buildup capabilities and identify shortcomings and problem areas in meeting these requirements.

3.2.4 Correlate consignment instructions, acceptance reports and production/weapon build-up capabilities.

3.2.5 Maintain and track material inspection receiving reports status reports of system components and support equipment.

3.3 MILDEP Support.

3.3.1 Identify unique MILDEP requirements for the system, its components and associated equipment, based on MILDEP production planning and production support requirements.

3.3.2 Compare current MILDEP acquisition plans and project directive with MILDEP delivery and performance requirements to identify firm and provisioned requirements by component and associated support equipment.

3.3.3 Determine the compatibility of requirements, military specifications and engineering documentation with MILDEP standard and specifications.

3.3.4 Provide recommendations to incorporate MILDEP stated requirements into the overall program schedules. Correlate and maintain the status of MILDEP monthly status reports thereof.

APPENDIX E

EXAMPLE SOO

E.1 Refer to Figure 8 in the body of this document for a general example. For specific examples of SOOs, contact Air Force Custodian - Code 10 (see DoD Standardization Directory (SD-1), which has all Preparing Activity codes, addresses, and telephone numbers).

Custodians:
Army - CR
Navy - EC
Air Force - 10

Review activities:
Army - AT
Navy - SH, AS, MC
Air Force - 11, 13

User Activities:
Army - SC
Navy - YD

Preparing activity:
Navy - EC
(Project Number MISC-0214)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-HDBK-245D	2. DOCUMENT DATE (*YYMMDD*) 960403

3. DOCUMENT TITLE
PREPARATION OF STATEMENT OF WORK (SOW)

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include Zip Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial (2) AUTOVON (*if applicable*)	7. DATE SUBMITTED (*YYMMDD*)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE ((Include Area Code)
COMMANDER, SPACE AND NAVAL WARFARE SYSTEMS COMMAND (SPAWAR 05L1)	(1) Commercial (703) 602-7234 (2) AUTOVON 332-7234
c. ADDRESS (Include Zip Code) 2451 CRYSTAL DRIVE ARLINGTON, VA 22245-5200	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340

Resources – Websites

ACQWeb, Office of the Under Secretary of Defense for Acquisition & Technology – **http://www.acq.osd.mil/**

AMCOM Acquisition Center – **https://wwwproc.redstone.army.mil/acquisition/**

Acquisition & Business Management (ABM) – **http://www.abm.rda.hq.navy.mil/**

Acquisition & Contracting Policy Site – **http://www.amc.army.mil/amc/rda/rda-ap/aqnsite.html**

Acquisition Initiatives – **http://www.acq.osd.mil/dpap/**

Acquisition Logistics – **http://www.almc.army.mil/AMD/Huntsville/logistics.htm**

Air Force Acquisition – **http://www.safaq.hq.af.mil/**

Army Acquisition and Procurement – **http://dasapp.saalt.army.mil/acqinfo/default.htm**

Army Single Face to Industry (ASFI) Acquisition Business Management (ABM) – **https://acquisition.army.mil**

DAU – Acquisition Glossary – **http://www.dau.mil/pubs/glossary/preface.asp**

DAU Acquisition Support Center – **http://center.dau.mil/**

DON Long Range Acquisition Estimates (LRAE) – **http://www.hq.navy.mil/RDA/RelatedLinks.asp**

Defense Acquisition Deskbook – **http://deskbook.dau.mil/jsp/default.jsp**

Defense Acquisition University – **http://www.dau.mil/**

Defense Contract Management Agency – **http://www.dcma.mil/**

Defense Procurement and Acquisition Policy – **http://www.acq.osd.mil/dpap/**

Defense Technical Information Center – **http://www.dtic.mil/**

Department of Defense Acquisition Bulletin Boards – **http://www.brooks.af.mil/HSC/PKA/sitedod.htm**

Department of the Navy Acquisition Reform Office – **http://www.ar.navy.mil/index.cfm**

Deputy Assistant Secretary of the Navy for Acquisition Management DASN(Acq) – **http://www.acquisition.navy.mil/**

FARSite (Federal Acquisition Regulation Site) One stop location for Most of the Federal Acquisition regulations and is Supplements, Including NASA, DOE, Army, Navy and, Air Force and its command sups – **http://farsite.hill.af.mil/**

Federal Acquisition Regulation – **http://www.arnet.gov/far/**

Federal Acquisition Virtual Library– **http://www.arnet.gov/Library/**

GSA Federal Acquisition Institute (FAI) – **http://www.gsa.gov/**

HOV-LANE Virtual Library for Acquisition News & Electronic Information – **http://www.dtic.mil/hovlane/**

NAVAIR Acquisition Guide – **http://www.ntsc.navy.mil/Resources/Library/Acqguide/Acqguide.htm**

Paperless Acquisition Office of the Navy – **http://www.peoarbs.navy.mil/**

US Army Acquisition Support Center – **http://asc.rdaisa.army.mil/**

[29] 5000 Summary Briefing

Defense Acquisition University

A premier corporate university serving DoD Acquisition, Technology, and Logistics

New Acquisition Policy

Signed 12 May 2003

DoDD 5000.1

DoDI 5000.2

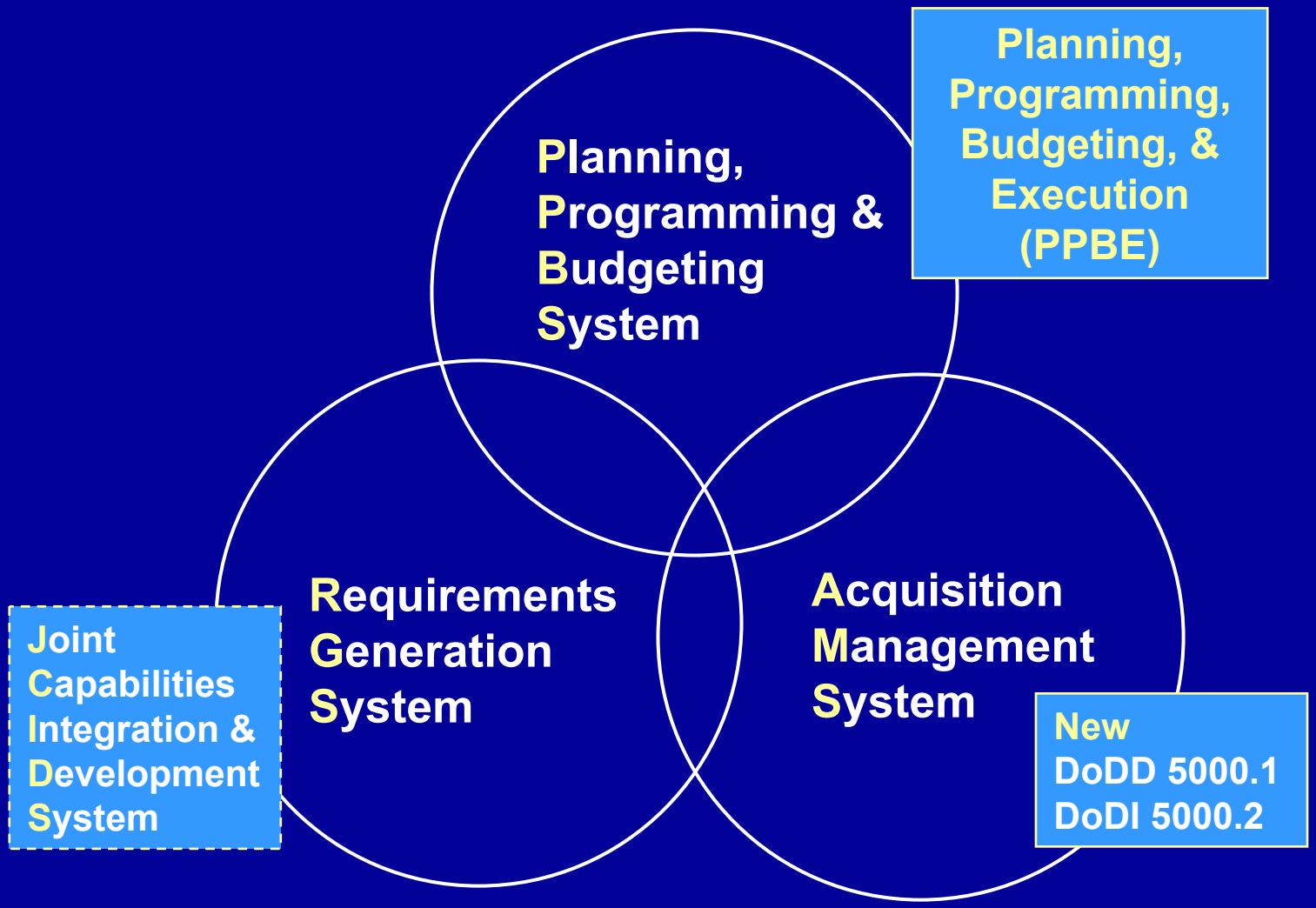
Center for Program Management
Defense Acquisition University

10 June 2003

Briefing Intent

- Provide an abbreviated overview of resvised 5000
- Introduce Evolutionary Acquisition Concept
- Introduce impact of 5000 changes on the Systems Engineer
- Provide information on AT&L Knowledge Sharing System (AKSS)

Decision Support Systems



DEPSECDEF Direction

30 October 2002

- Determined that current acquisition policies require revision
- Cancelled DoDD 5000.1, DoDI 5000.2 and DoD 5000.2-R
- Issued interim guidance
- Directed that revised documents be prepared in 120 days

USA

THE DEPUTY SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-1000

OCT 30 2002

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
DIRECTOR DEFENSE RESEARCH AND ENGINEERING
ASSISTANT SECRETARIES OF DEFENSE
GENERAL COUNSEL, DEPARTMENT OF DEFENSE
INSPECTOR GENERAL, DEPARTMENT OF DEFENSE
DIRECTOR, OPERATIONAL TEST AND EVALUATION
ASSISTANTS TO THE SECRETARY OF DEFENSE
DIRECTOR, ADMINISTRATION AND MANAGEMENT
DIRECTOR, NET ASSESSMENT
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF DOD FIELD ACTIVITIES

SUBJECT: Defense Acquisition

I have determined that the current DoD Directive 5000.1, "The Defense Acquisition System," DoD Instruction 5000.2, "The Operation of the Defense Acquisition System," and DoD 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," require revision to create an acquisition policy environment that fosters efficiency, flexibility, creativity, and innovation. Therefore, by separate memorandum, I have cancelled those documents effective immediately.

By this memorandum, I am issuing the attached interim guidance in place of the cancelled documents. The intent of the guidance is to rapidly deliver affordable, sustainable capability to the warfighter that meets the warfighter's needs. Additional, supporting discretionary, best practices, lessons learned, and expectations have been posted to the DoD 5000 Resource Center at http://dod5000.dau.mil.

I am directing the Under Secretary of Defense for Acquisition, Technology, and Logistics, with the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) and the Director, Operational Test and Evaluation, to jointly prepare revised documents within 120 days.

Paul Wolfowitz

Attachments:
As stated

U16167-02

DoD Leadership's Intent
For DoD 5000 Revision

"….create an acquisition policy environment that fosters efficiency, flexibility, creativity, and innovation."

DEPSECDEF Wolfowitz, 30 Oct 2002

Revised Policy Objectives

- Encourage innovation and flexibility
- Permit greater judgement in the employment of acquisition principles
- Focus on outcomes vice process
- Empower PM's to use the system vice being hampered by over-regulation

New Acquisition Policy Construct

- ***DoD Directive 5000.1***

  Principles retained; innovation/flexibility emphasized

- ***DoD Instruction 5000.2***

  Focused on required outcomes and statutory requirements and less on regulatory requirements

- ***DoD Regulation 5000.2-R***
  - **Cancelled; becomes "guide" not a regulation**
  - **Provides expectations (TEMP, C4ISP, etc..), best practices and lessons learned**

New Acquisition Policy

Oct 2000 - April 2002

- DoD Directive 5000.1
- DoD Instruction 5000.2
- DoD Regulation 5000.2-R

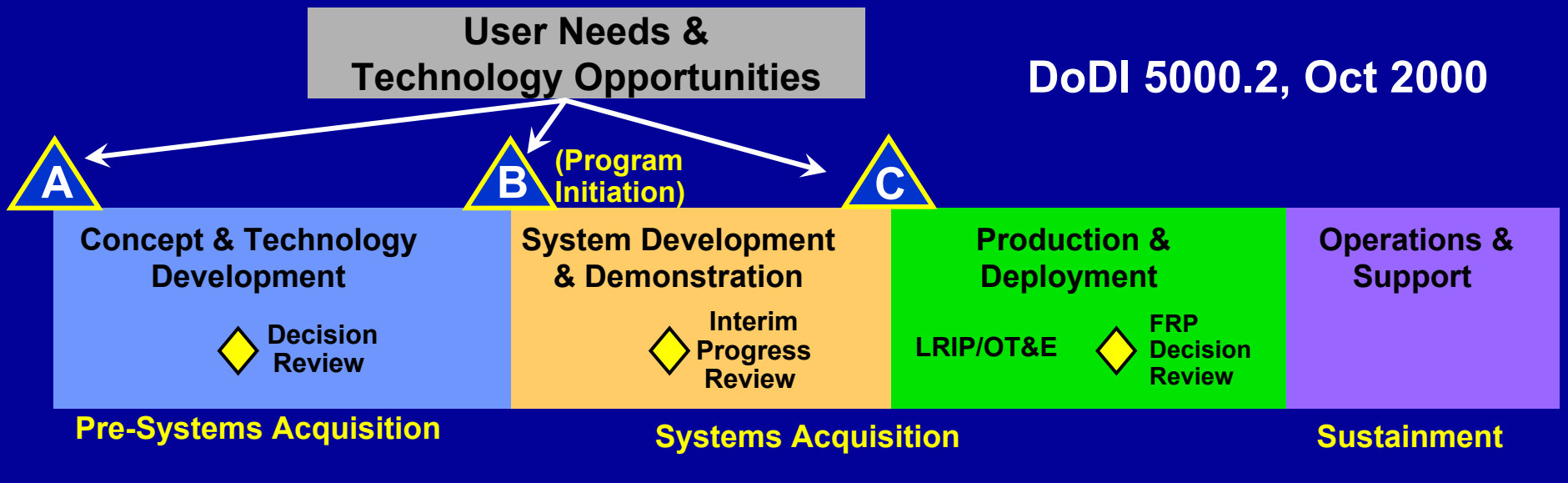
October 2002

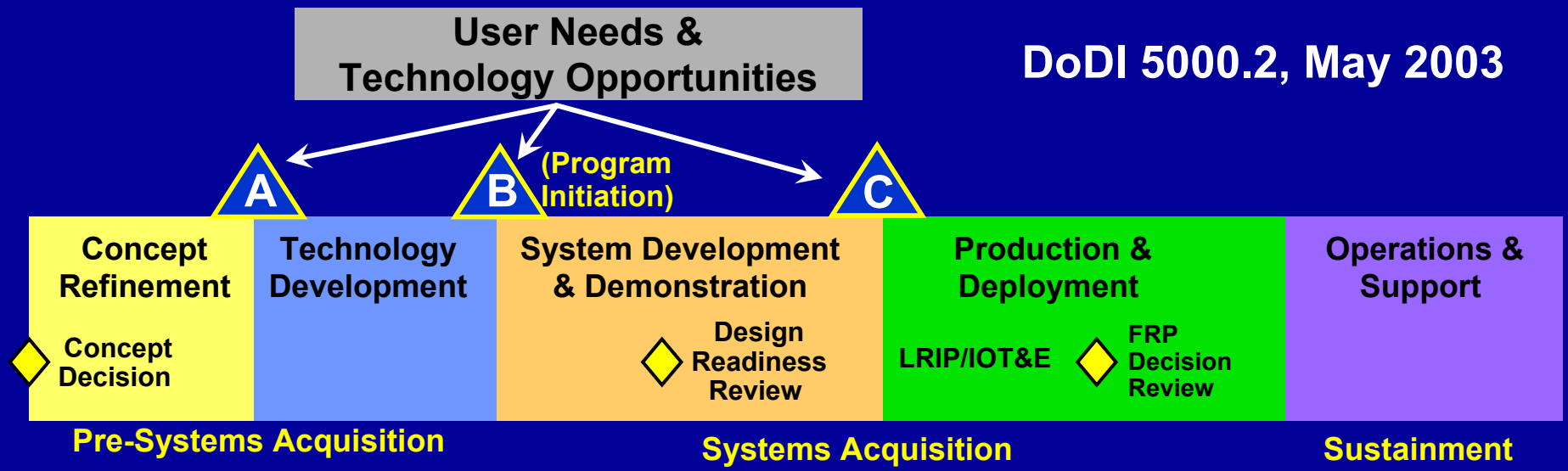
- Interim Guidance:
  - The Defense Acquisition System
  - Operation of the Defense Acquisition System
  - Interim Defense Acquisition Guidebook

May 2003

- DoD Directive 5000.1
- DoD Instruction 5000.2
- Interim Defense Acquisition Guidebook

The Defense Acquisition Management Framework





New 5000 Model
Milestones & Phases

2000. OLD: 4 Phases
Six potential decision points

- ➔ **Milestone A**, Decision to enter Concept & Technology Development Phase. May enter at:
  - Concept Exploration (CE), or
  - Component Advanced Development (CAD)
  - ➔ *entry at CE may require decision review for CAD*
- ➔ **Milestone B**, Program Initiation, and Decision to enter System Development & Demonstration Phase. May enter at:
  - Systems Integration (SI), or
  - Systems Demonstration (SD)
  - ➔ *entry at SI may require IPR for SD*
- ➔ **Milestone C**, Decision to enter the Production & Deployment Phase
  - LRIP (ACAT I/II), or production/ procurement (ACAT III)
  - ➔ Full-Rate Production Decision Review
  - Operations & Support Phase overlaps Production and Deployment
    - Sustainment
    - Disposal

2003. NEW: 5 Phases
Six potential decision points;

- ➔ **Concept Decision** to enter Concept Refinement Phase.
- ➔ **Milestone A**, Decision to enter Technology Development Phase
- ➔ **Milestone B**, Program Initiation and Decision to enter System Development & Demonstration Phase. May enter at
  - System Integration (SI) or
  - System Demonstration (SD)
  - ➔ *entrance into SD requires DRR*
- ➔ **Milestone C**, Decision to enter Production & Deployment Phase
  - LRIP (ACAT I/II), or production/ procurement (ACAT III)
  - ➔ Full-Rate Production Decision Review
  - Operations & Support Phase overlaps Production and Deployment
    - Sustainment
    - Disposal

The Defense Acquisition Management Framework

DoDI 5000.2, May 2003

- *Process entry at Milestones A, B, or C*
- *Entrance criteria met before entering phase*
- *Evolutionary Acquisition or Single Step to Full Capability*

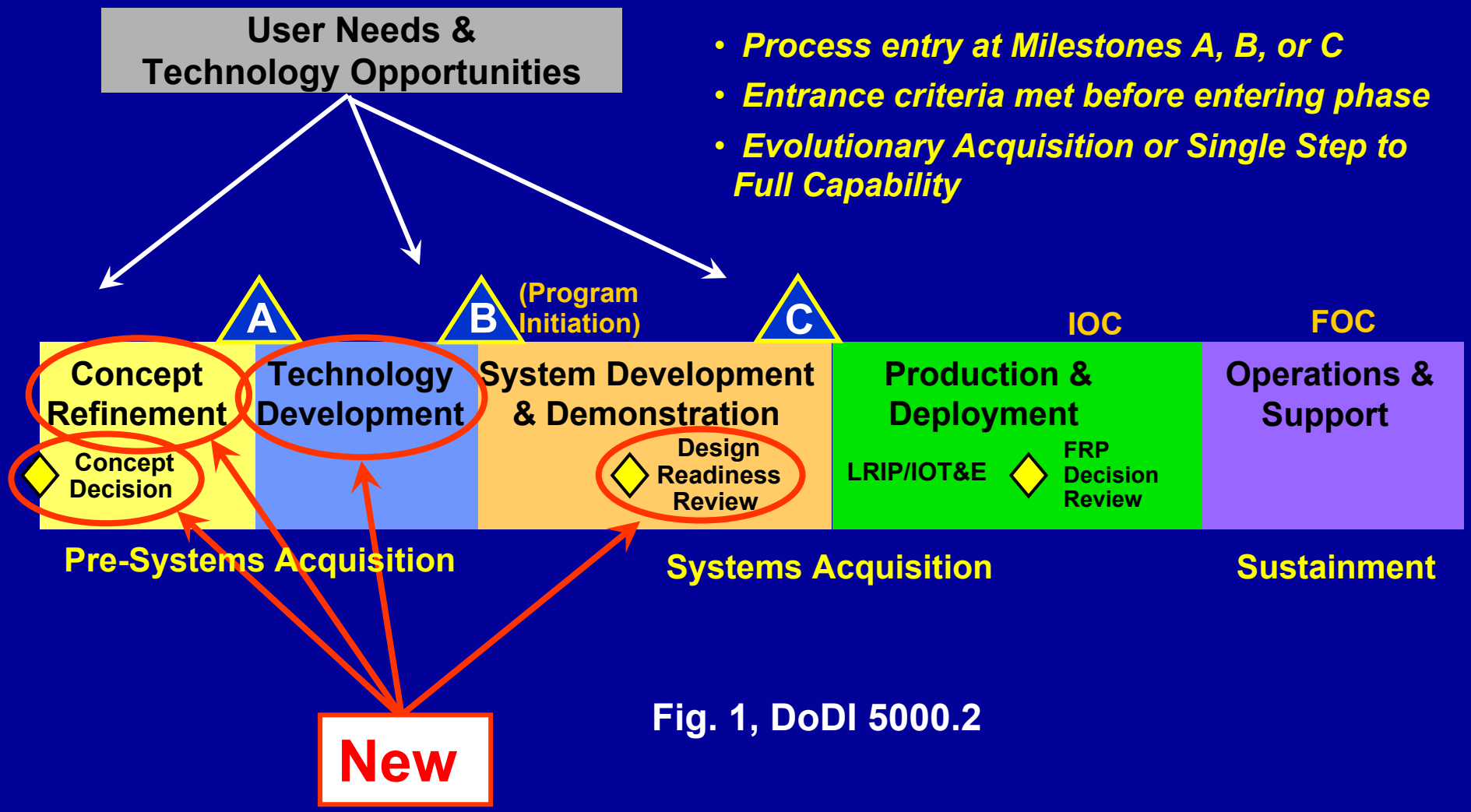
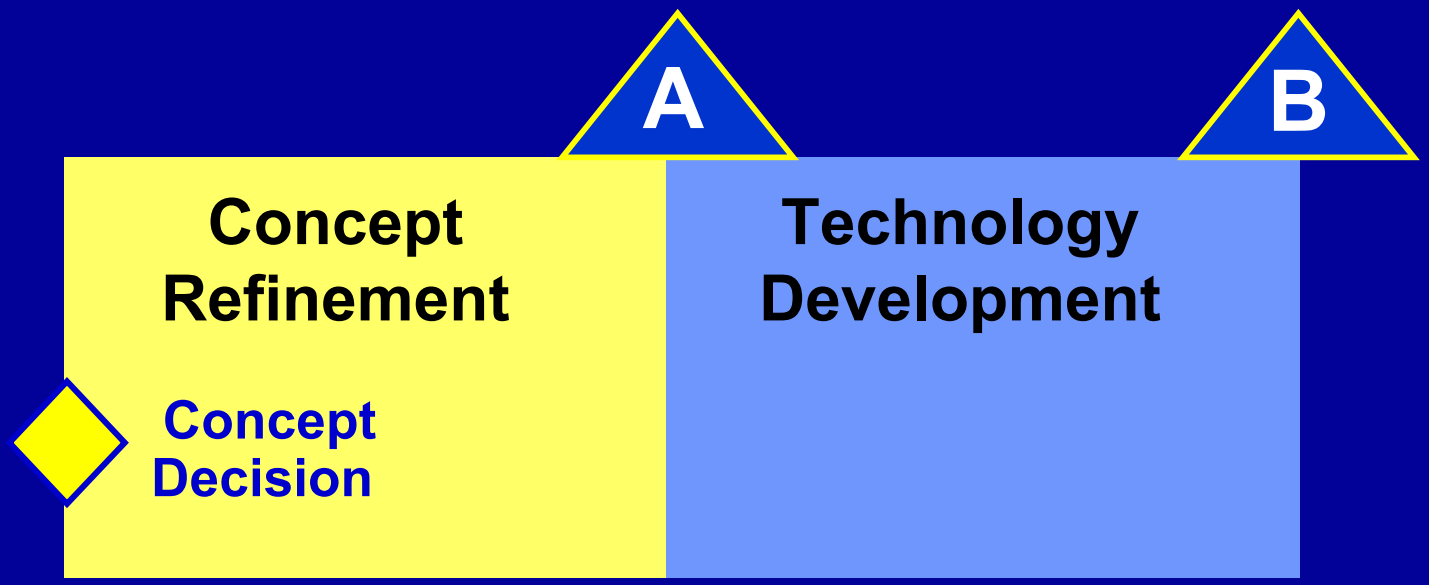


Fig. 1, DoDI 5000.2

The Defense Acquisition Management Framework

DoDI 5000.2, May 2003

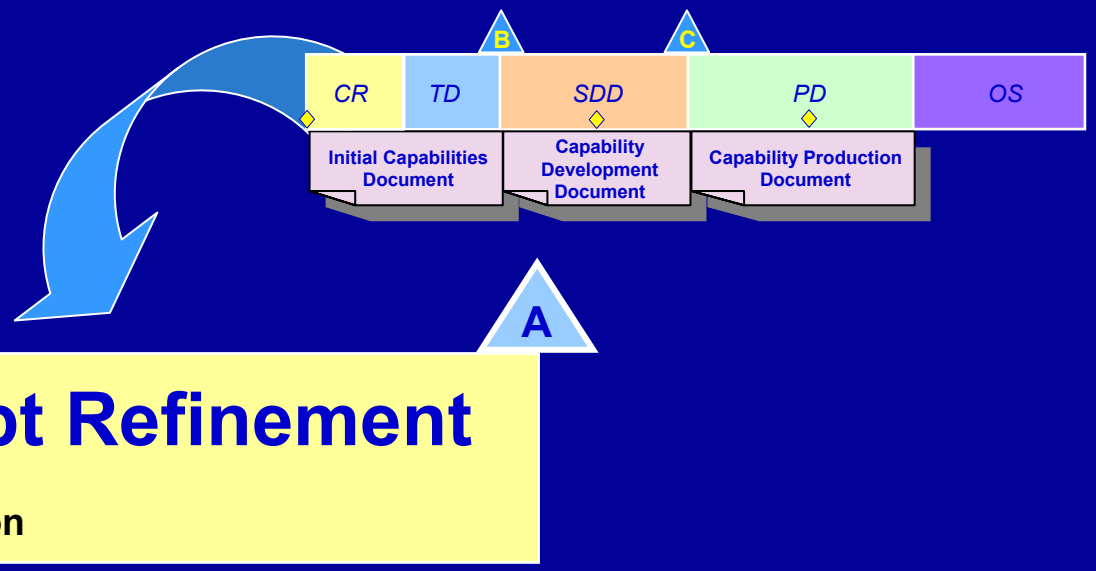


Pre-Systems Acquisition

Highest impact –

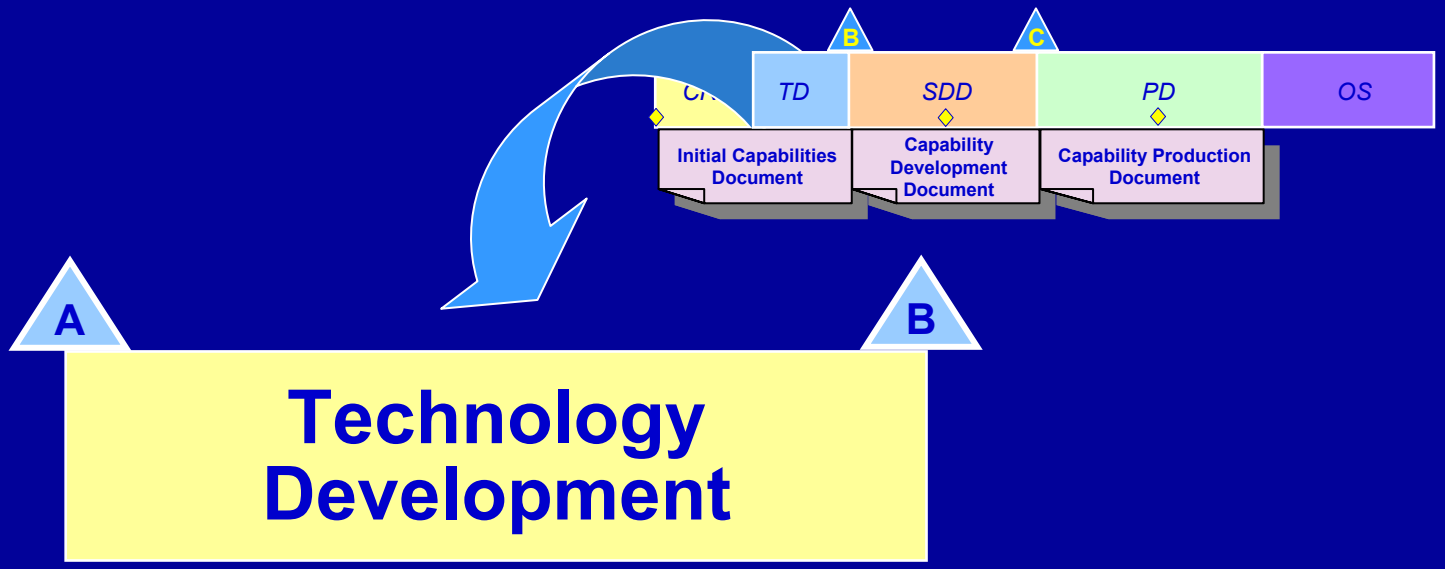
- Concept & Technology Development now two distinct phases
- Concept Decision new decision point driven by Joint Staff requirements for "capabilities analysis"
- Analysis of Alternatives results due at Milestone A

Concept Refinement



- **Purpose**. Refine the initial concept and develop a Technology Development Strategy (TDS)
- **Entrance Criteria**. Approved Initial Capabilities Document (ICD); approved plan for conducting an analysis of alternatives (AoA); phase funding
- **Exit**. MDA-approved preferred solution and TDS

Technology Development



- <u>Purpose</u>. Reduce technology risk; determine the appropriate technologies to be integrated into a full system
- <u>Entrance criteria</u>. MDA - approved Technology Development Strategy TDS; phase funding
- <u>Exit</u>. Affordable increment of militarily – useful capability with technology demonstrated in a relevant environment, and a system that can be developed for production within a short timeframe.

Current Requirements & Acquisition Process
(Joint Staff briefing, 25 Sep 02)

Why change from a "requirements & acquisition process" to a "capabilities & acquisition process"?

The Requirements Generation System frequently produces stovepiped system solutions that are not necessarily based on the future capabilities required by the joint warfighter. Acquisition decisions are typically made from a single system perspective, without the benefit of considering impact to interrelated systems.

New Requirements Documents

Common element is CAPABILITIES

- **Initial Capabilities Document (ICD) replaces MNS at Milestone A**

  Describes desired capability. Evaluates multiple materiel approaches. Recommends a materiel approach.

- **Capability Development Document (CDD) replaces ORD at Milestone B**

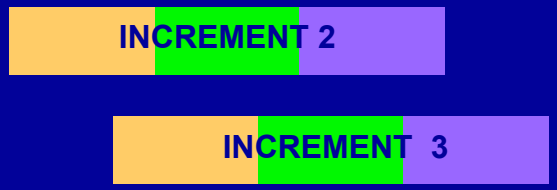
  Describes the SDD effort and provides KPPs for the increment. Describes program to get to complete solution.

- **Capability Production Document (CPD) replaces ORD at Milestone C**

  Describes the SDD effort to produce materiel solution for the increment and provides KPPs for the production increment.

Details will be implemented by CJCSI 3170.01C & CJCSM 3170.01

Evolutionary Acquisition



OR ***Single Step to Full Capability ?***

Key Considerations

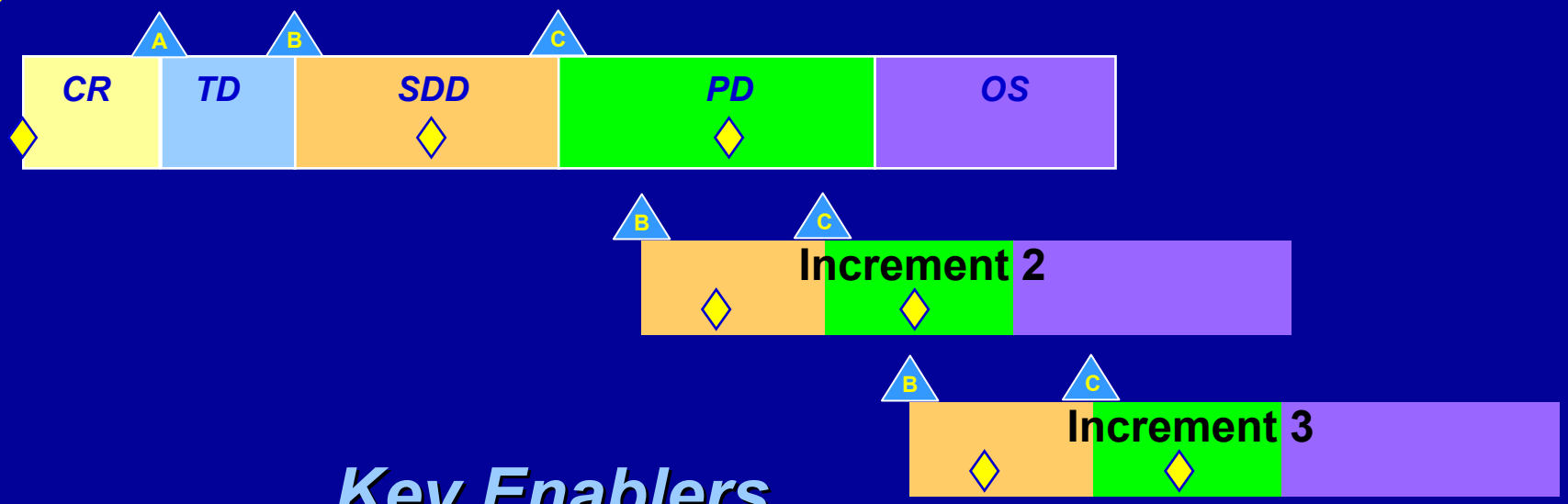
- **Urgency of Requirement**
- **Maturity of Key Technologies**
- **Interoperability, Supportability, and Affordability of Alternative Acquisition Approaches**
- **Cost/Benefit of Evolutionary vs. Single Step Approach**

DoD Instruction 5000.2
Operation of the Defense Acquisition System

Evolutionary Acquisition

- **Two development processes to implement Evolutionary Acquisition Strategy**
  - ***Incremental Development*: End-state requirement is known, and requirement will be met over time in several increments**
  - ***Spiral Development*: Desired capability is identified, but end-state requirements are not known at Program Initiation. Requirements for future increments dependent upon technology maturation and user feedback from initial increments**
- **Evolutionary acquisition strategies shall be preferred approach to satisfying operational needs.**
- **Spiral development shall be the preferred process.**

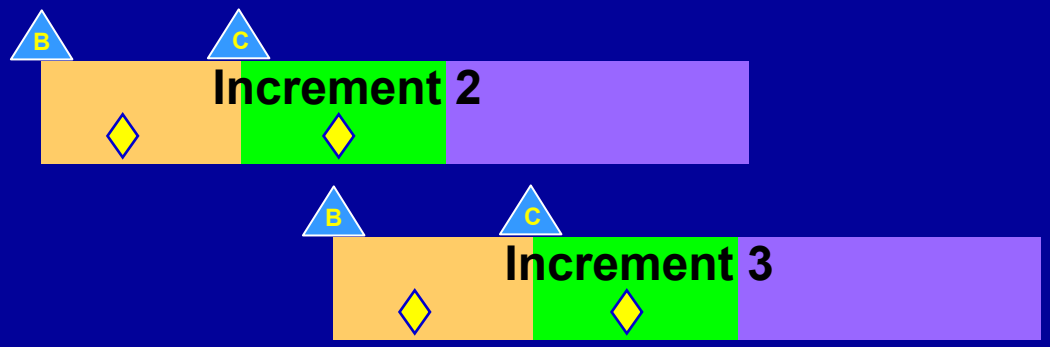
Evolutionary Approach



Key Enablers

- Time-Phased Requirements
- A Modular Open Systems Approach to facilitate Technology Insertion
- Evolutionary Sustainment Strategies
- T&E Consistent with Evolutionary Approach
- Full Funding

Each Increment Must Have…



- Approved Operational Requirements
  - Interoperability Key Performance Parameter
- Performance, Cost and Schedule Goals (Acquisition Program Baseline)
- Operational and Live Fire Testing (If Required)
- Compliance with Acquisition Oversight Requirements
- An Acquisition Strategy that reflects consideration of Logistics Planning; Manpower, Personnel and Training; Environmental and Security Factors; Protection of Critical Program Information; and Spectrum Management
- Other information tailored to the conditions of the program

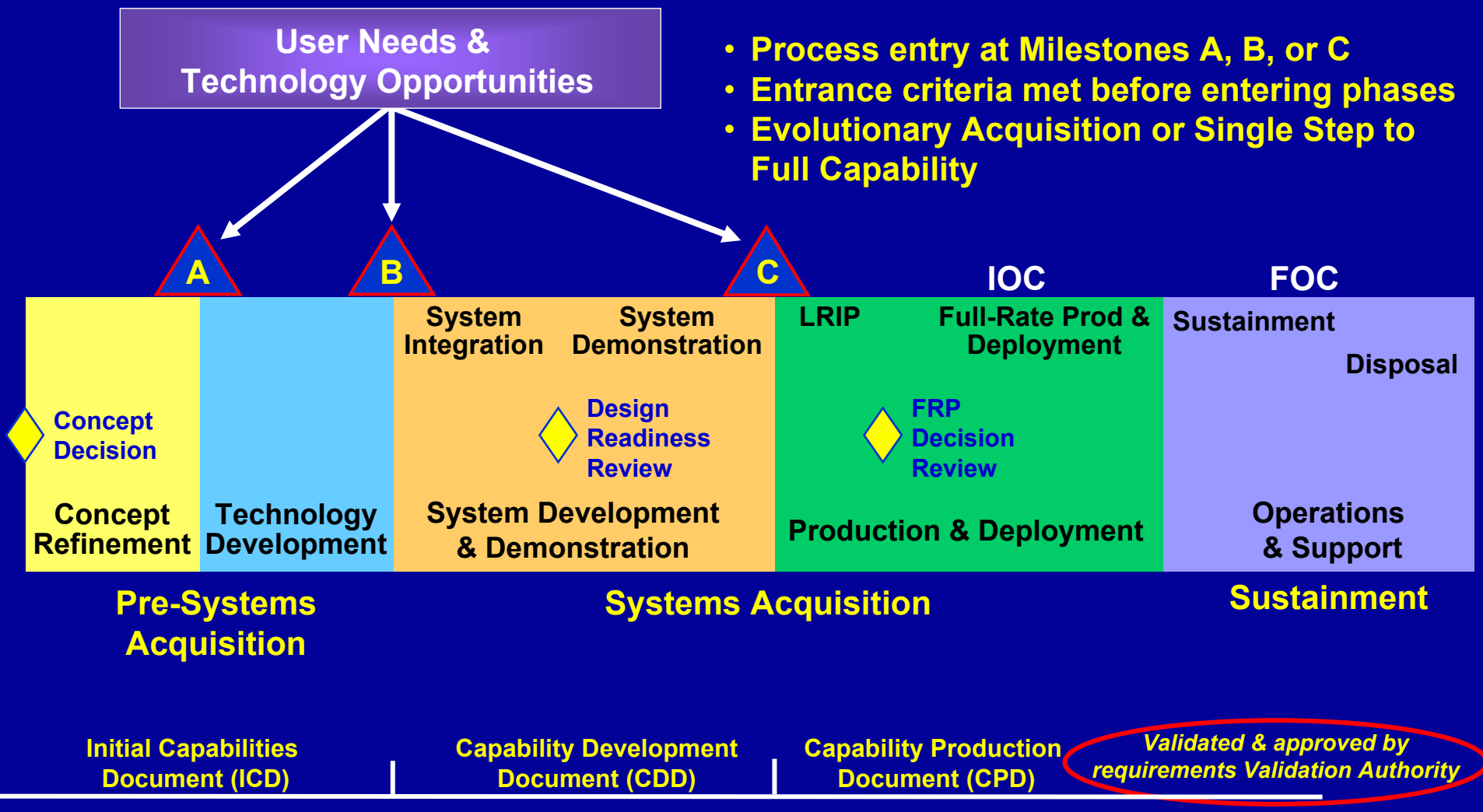
Each Increment is Managed as a Unique Acquisition

DoD Instruction 5000.2
Operation of the Defense Acquisition System

Sustainment

- PM ensures that a flexible, performance oriented sustainment strategy is developed and executed (Total Life Cycle Systems Management)
- PM documents support requirements in performance agreements (PBL emphasis)
- Sustainment strategies evolve during increments of an evolutionary strategy
- For business area capabilities (IT), the PM employs commercial available frameworks and solutions (Enterprise Integration)
  - Best practices toolkit at http://deskbook/dau.mil

The Defense Acquisition Management Framework



- Process entry at Milestones A, B, or C
- Entrance criteria met before entering phases
- Evolutionary Acquisition or Single Step to Full Capability

Relationship to Joint Capabilities Integration & Development System

Defense Acquisition Deskbook Transition to AT&L Knowledge Sharing System (AKSS)

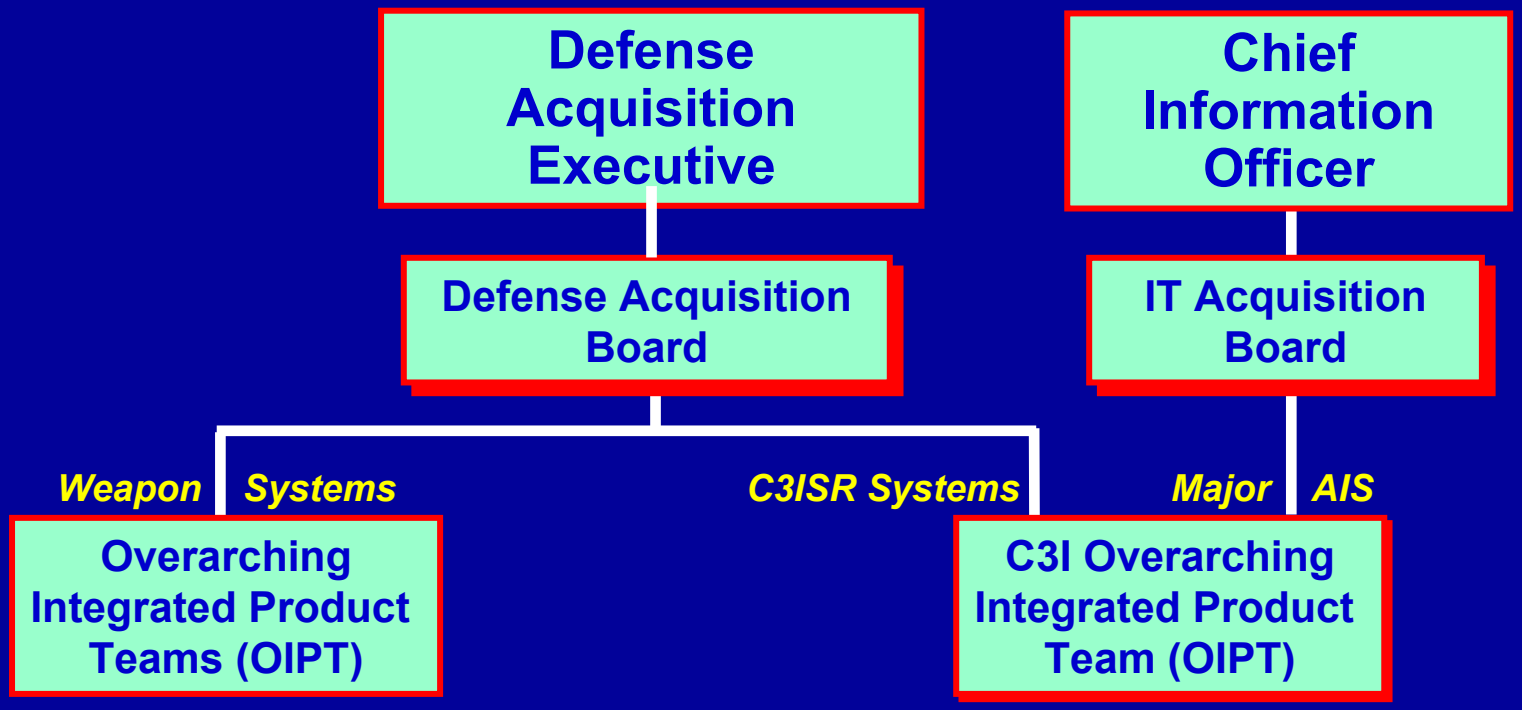
- WHERE DO YOU GO FOR MORE INFORMATION?
  - AT&L Knowledge Sharing System (AKSS)

- Original Deskbook created in 1996 as a resource for mandatory policy, discretionary practices, optional formats and Lessons Learned.
- Was available at first on CD and now on-line.
- AKSS is the next evolution of the on-line Deskbook – the source for all acquisition knowledge.
- AKSS was launched on 1 October 2002. Ver. 2.0 was posted on 15 January 2003.
- AKSS is located at http://deskbook.dau.mil

www.dau.mil

http://deskbook.dau.mil

Oversight & Review
ACAT ID/IAM Programs*



*Note: Space Programs have been delegated to the Air Force and most missile defense programs to the Missile Defense Agency

Defense Acquisition Management Framework
A Short Tutorial

The following charts provide a summary of the acquisition framework based on the new DoD Directive 5000.1 and DoD Instruction 5000.2, dated 12 May 2003.

Defense Acquisition University

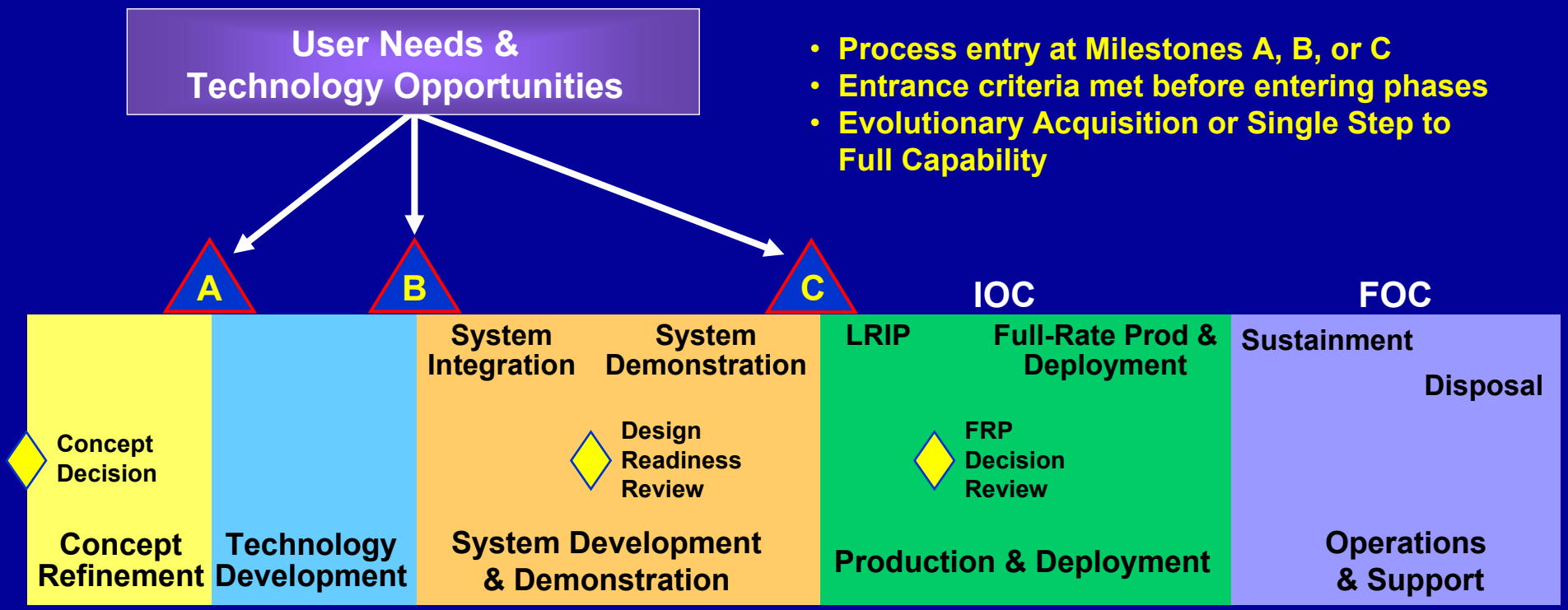
A premier corporate university serving DoD Acquisition, Technology, and Logistics

Defense Acquisition Management

Framework

A Tutorial

The Defense Acquisition Management Framework



- Process entry at Milestones A, B, or C
- Entrance criteria met before entering phases
- Evolutionary Acquisition or Single Step to Full Capability

IOC: Initial Operational Capability
FOC: Full Operational Capability

Initial Capabilities Document (ICD) | Capability Development Document (CDD) | Capability Production Document (CPD)

Validated & approved by requirements Validation Authority

Relationship to Joint Capabilities Integration & Development System

Pre-Systems Acquisition

User Needs & Technology Opportunities
Work Content

User Need

Documents

- Initial Capabilities Document (ICD) *

Technology Opportunities

Activities

- Science & Technology (S&T) activities
  - ATDs
  - ACTDs
  - Joint Warfighting Experiments

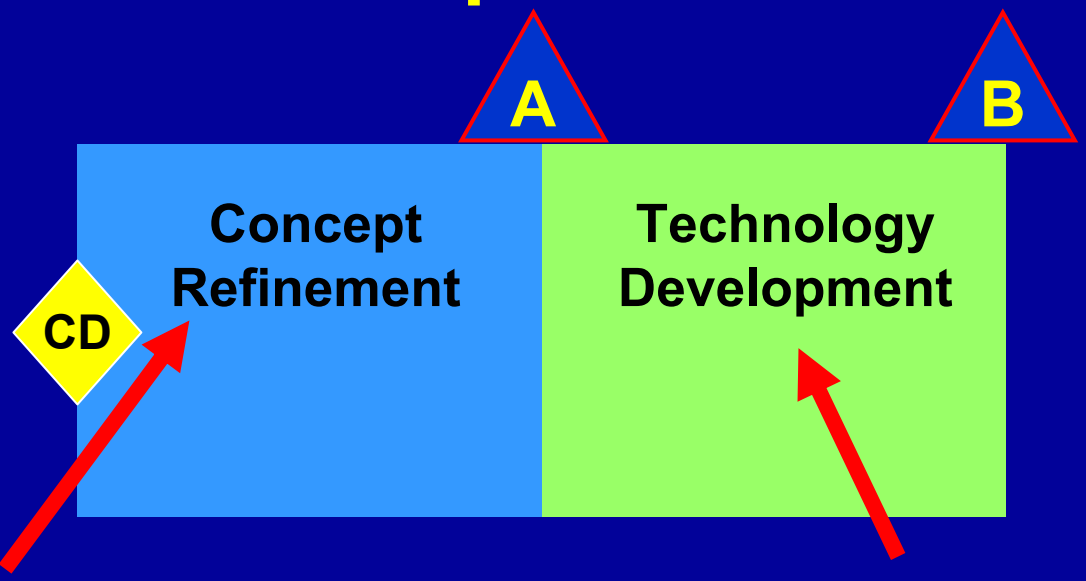
* MNS was cancelled by Joint Staff Memo on 4 Oct 02. Guidance on ICD will be in revised CJCSI 3170.01 expected in mid 2003

Hierarchy of Materiel Alternatives

The DoD Components shall work with users to define requirements that facilitate, in preferred order:

1. **Procurement/modification of commercially available products, services, and technologies, from domestic or international sources, or the development of dual-use technologies;**
2. **The additional production/modification of previously-developed U.S. and/or Allied military systems or equipment;**
3. **A cooperative development program with one or more Allied nations;**
4. **A new joint Component or Government Agency development program; or**
5. **A new DoD Component-unique development program.**

Concept Refinement & Technology Development Phases



Concept Refinement

Enter: Validated ICD and approved plan for conducting AoA.

- Activity: Refine selected concept, conduct AoA, develop Technology Development Strategy (TDS)

Exit: MDA selects preferred solution and approves TDS

Technology Development

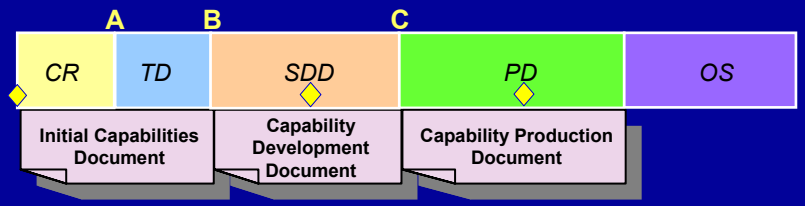
Enter: MDA approved solution and TDS

- Activity: Technology development demonstration(s)

Exit: Affordable increment of military-useful capability identified and its technology has been demonstrated in relevant environment – normally can be developed for production within 5 years

Entering the Acquisition Process at Concept Refinement

The MDA may authorize entry into the acquisition process at any point consistent with phase-specific entrance criteria and statutory requirements



Entrance Criteria

- **Validated ICD resulting from analysis of potential concepts across DoD, international systems from Allies and cooperative opportunities?**
- **An approved plan for conducting an AoA for the selected concept documented in the validated ICD?**

Concept Refinement

Concept Decision

- Approval to enter the Concept Refinement Phase
- MDA approves:
  - AoA Plan
  - Lead DoD Component
  - Date for Milestone A
  - Acquisition Decision Memorandum(ADM)
- Information Requirements:
  - Initial Capabilities Document (ICD)*

* MNS was cancelled by Joint Staff Memo on 7 Oct 02. Guidance on ICD will be in CJCSI 3170.01C and CJCSM 3170.01 expected in mid 2003

Concept Refinement Phase

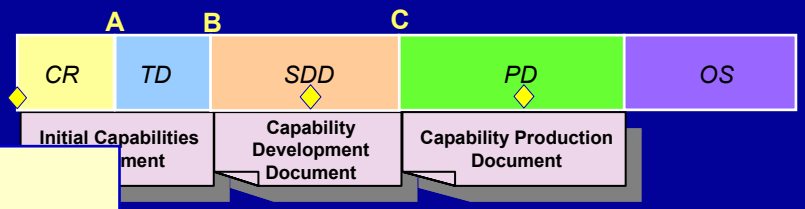
Purpose: Refine the initial concept and develop a Technology Development Strategy

Characterized by:

- Innovation and competition
- Assessment of critical technologies
- Development of rationale for either an evolutionary or a single-step-to-full-capability strategy
- Work guided by the ICD and AoA Plan

Entering the Acquisition Process at Technology Development

The MDA may authorize entry into the acquisition process at any point consistent with phase-specific entrance criteria and statutory requirements



Entrance Criteria

- **Approved Technology Development Strategy?**
- **Validated Initial Capabilities Document (ICD)?**
- **For AIS Programs: Does the acquisition**
  - **support core/priority mission functions that need to be performed by the federal government?**
  - **need to be undertaken by the DoD Component because no alternative private sector or governmental source can better support the function?**
  - **support work processes that have been simplified or otherwise redesigned to reduce costs, improve effectiveness, and make maximum use of commercial off the shelf technology?**

Milestone A

- **MDA approves:**
  - Entry into Technology Development Phase
  - Technology Development Strategy (TDS)
  - Exit criteria for next phase
  - Acquisition Decision Memorandum (ADM)
- **Information Requirements**
  - ICD
  - Consideration of technology issues
  - Clinger-Cohen Act Compliance (all IT including NSS)
  - Certification of compliance with CCA (MAIS only)
  - Certification of compliance with the FMEA (FM MAIS only)
  - Analysis of Alternatives
  - Economic Analysis (MAIS only)
  - TEMP (T&E strategy only)

Technology Development Phase

Purpose: To reduce technology risk and determine appropriate set of technologies to be inserted into a full system.

Key Activities:

- Development of a system architecture
- Demonstration(s) of technology(ies) in a relevant environment
- Risk reduction on components and subsystems
- Shipbuilding programs may be initiated at beginning of Technology Development

Technology Development Phase

Key Activities, continued..

- Form IPTs to facilitate decision-making
- Capability Development Document (CDD)* prepared by user led IPT
- Conduct cost performance trade-offs
- Develop overall acquisition & T&E strategy
- Formulate initial Acquisition Program Baseline
- Complete Test & Evaluation Master Plan
- Prepare C^4I Support Plan (if applicable)
- Prepare life-cycle / independent cost estimates (including economic analysis for AIS programs)

* ORD until CJCSI 3170.01C issued

Technology Development Phase
Key Activities, continued

- Develop draft performance specification
- Identify potential environmental consequences
- Prepare waiver from full-up Live Fire T&E (if applicable)
- Ensure full funding in FYDP prior to MS B
- Prepare contract package for next phase
- Meet exit criteria for TD Phase
- Propose exit criteria for next phase

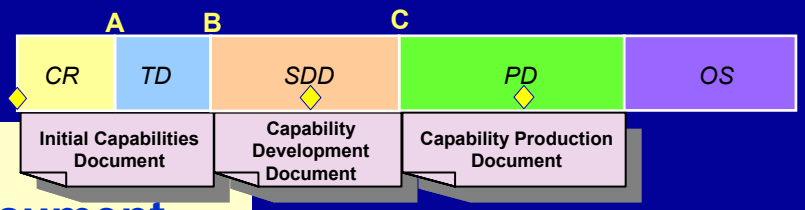
Summary, Technology Development Phase

- Maximum competition and innovation to satisfy requirements
- System can be developed for production within short timeframe (normally less than five years)
- Thorough planning critical to success

BOTTOM LINE: Is New Development Program Justified ???

Entering the Acquisition Process at Systems Development & Demonstration

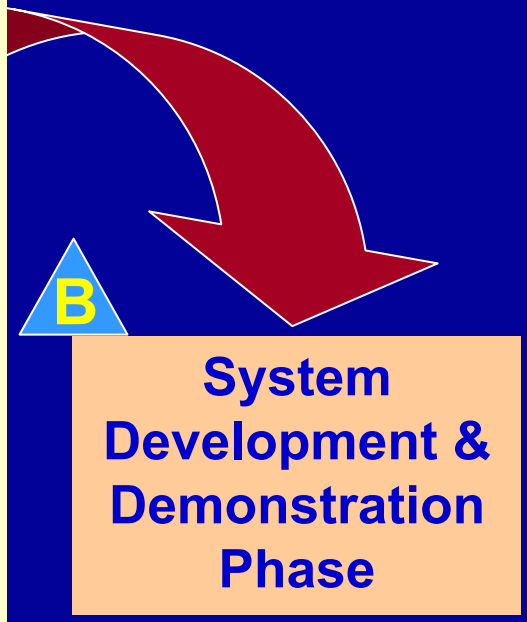
The MDA may authorize entry into the acquisition process at any point consistent with phase-specific entrance criteria and statutory requirements



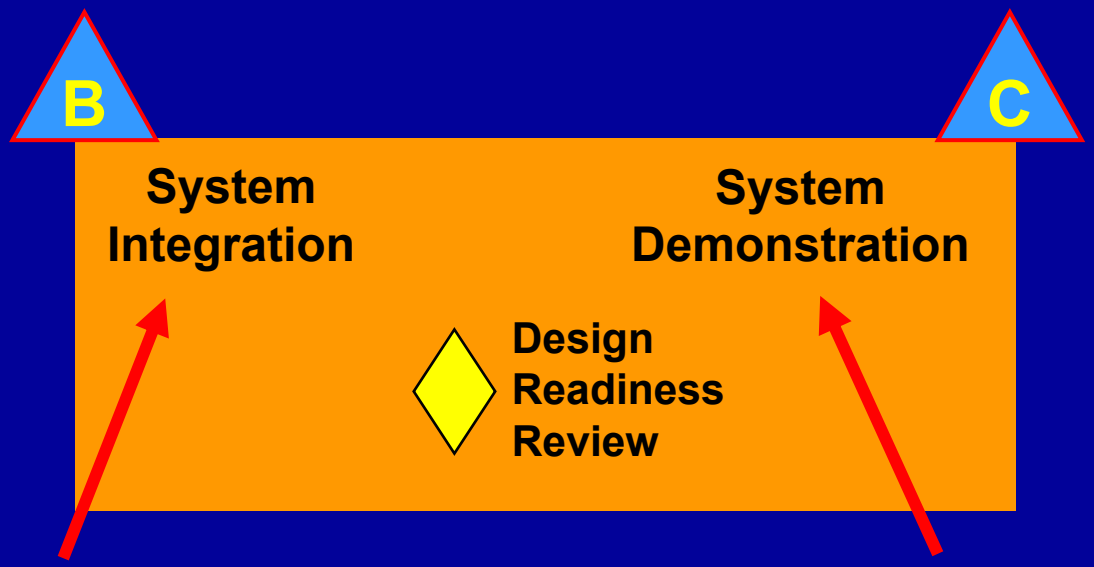
Entrance Criteria

- Have validated Capability Development Document (CDD*)?
- Answers to following questions are "yes"?
  - Does the acquisition support core/priority mission functions of the Federal Government?
  - Does the acquisition need to be undertaken by DoD because no alternative private sector or government source can better support the function?
  - Does the acquisition support work processes that have been simplified or otherwise redesigned to reduce costs, improve effectiveness, and make maximum use of commercial off-the-shelf technology?
- Technology mature?
- Have APB & minimum set of KPPs?
- Affordability determination?
- Full funding in FYDP?

* ORD until CJCSI 3170.01C issued



System Development & Demonstration Phase



System Integration

Enter: PM has technical solution but has not integrated subsystems into complete system

- Activities: System Integration of demonstrated subsystems and components. Reduction of integration risk.

Exit: Demonstration of prototypes or EDMs in relevant environment

System Demonstration

Enter: Prototypes or engineering development models (EDM) demonstrated in relevant environment

- Activities: Complete system demonstration. DT/OT/LFT&E

Exit: System demonstration in intended environment using EDMs; meets validated requirements

Milestone B

- Requires an approved Capability Development Document (CDD*)
- A PM has been assigned
- MDA approves:
  - Entry to System Development and Demonstration Phase
  - Program Initiation
  - Acquisition Strategy (AS)
  - Acquisition Program Baseline (APB)
  - LRIP Quantities
  - Exit criteria for next phase
  - Acquisition Decision Memorandum (ADM)

* ORD until CJCSI 3170.01C issued

Milestone B: Information Requirements

- Acquisition Strategy
- Acquisition Program Baseline (APB)
- Affordability Assessment
- Analysis of Alternatives
- Benefit Analysis & Determination
- Cost Analysis Requirements Description (CARD) (MDAPs & MAIS only)
- Capability Development Document (CDD) (ORD until CJCSI 3170.01 revised)
- Certification of Compliance with FMEA (FM MAIS only)
- Component Cost Analysis (MAIS; as requested by CAE for MDAP)[1]
- Competition Analysis[2]
- Consideration of Technology Issues
- C4I Support Plan (C4ISP)
- Cooperative Opportunities[2]
- Clinger-Cohen Act (CCA) compliance (all IT incl NSS)
- Certification of Compliance with CCA (MAIS only)
- Core Logistics Analysis/Source of Repair Analysis[2]
- Economic Analysis (MAIS only)
- Exit Criteria
- Initial Capabilities Document (ICD)
- Independent Cost Estimate (ICE) & Manpower Estimate (MDAPs only)
- Independent Technology Assessment (ACAT ID only – as required by DUSD(A&T))
- Industrial Capabilities Assessment[1]
- LFT&E waiver, if appropriate
- LRIP quantities (N/A for AIS)
- Market Research
- Programmatic Environmental Safety & Health Assessment (w/NEPA Schedule)
- Operational Test Agency Report of OT&E Results
- Program Protection Plan (Pgms w/CPI)
- Registration of Msn-Critical and Msn-Essential Information Systems
- Spectrum Certification Compliance
- System Threat Assessment
- Selected Acquisition Report (MDAP only)
- Test & Eval Master Plan (TEMP)
- Technology Development Strategy
- Technology Readiness Assessment

[1] For MAIS when MDA requires an Economic Analysis [2] part of acquisition strategy

System Development & Demonstration Phase

Purpose:

- To develop a system
- Reduce program risk
- Ensure operational supportability
- Ensure design for producibility
- Assure affordability
- Demonstrate system integration, interoperability, and utility

System Integration

- Purpose: Integrate subsystems – reduce systems-level risk
- Key Activities:
  - Demonstrate prototype articles
  - Conduct an Early Operational Assessment (EOA)
  - Prepare for Design Readiness Review (DDR)
  - Prepare RFP for next effort/phase

System Demonstration

- **Purpose: Demonstrate the ability of the system to operate in a useful way consistent with the validated KPPs.**
- **Key Activities:**
  - **Conduct extensive testing: developmental, operational, and survivability/lethality testing, as appropriate**
  - **Conduct technical reviews, as appropriate**
  - **Demonstrate system in its intended environment**
  - **Prepare RFP for Low Rate Initial Production**
  - **Prepare for Milestone C**
  - **Update: Information requirements**

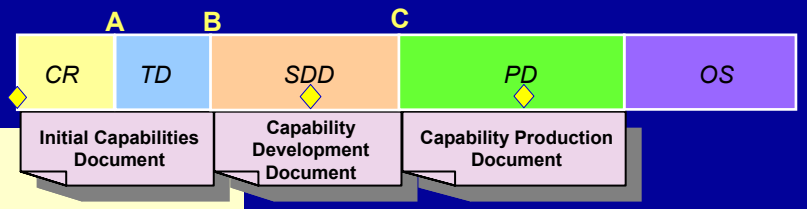
Summary: System Development & Demonstration Phase

- May consist of System Integration *and* System Demonstration depending on:
  - *technology maturity*
  - *affordability*
- System demonstrated in the intended environment; meets validated requirements; industrial capability available; meets exit criteria
- Manufacturing risk low

<u>Bottom Line</u>: System ready to begin LRIP?

Entering the Acquisition Process at Production & Deployment

The MDA may authorize entry into the acquisition process at any point consistent with phase-specific entrance criteria and statutory requirements

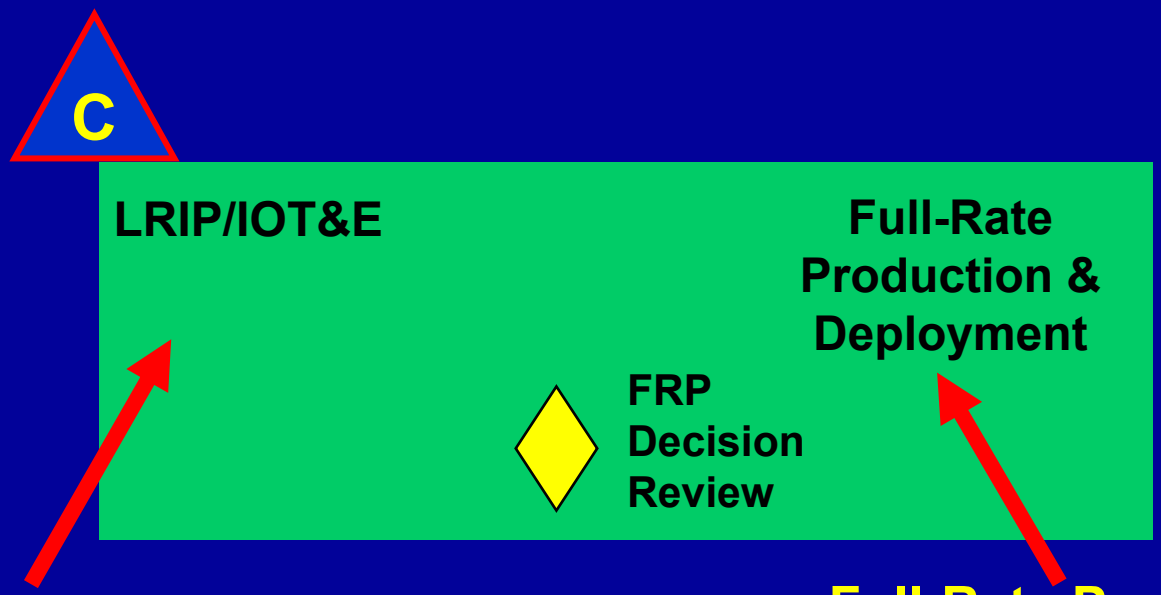


Entrance Criteria

- Acceptable performance in DT&E and Operational Assessment (OA)?
- Mature software capability?
- No significant manufacturing risks?
- Manufacturing process in control (if MS C is for full-rate production)?
- Approved Capability Production Document (CPD*)?
- Acceptable interoperability?
- Acceptable operational supportability?
- Compliance with DoD Strategic Plan?
- Affordable throughout life cycle?
- Optimally funded and properly phased for rapid acquisition?

* ORD until CJCSI 3170.01C issued

Production & Deployment Phase



LRIP

Enter: System matured for production
- Activities: Low-rate initial production. IOT&E, LFT&E of production-representative articles. Establish full manufacturing capability.

Exit: System operationally effective, suitable and ready for full rate production

Full-Rate Production & Deployment

Enter: Beyond LRIP (OSD T&E Over-sight programs) and LFT&E reports (covered systems) submitted to Congress
- Activities: Full rate production. Deploy system. Start support.

Exit: Full operational capability; deployment compete

Milestone C

- Commits the Department to Production
- MDA approves:
  - Acquisition Decision Memorandum
  - Updated Acquisition Strategy and Acquisition Program Baseline
  - Entry into LRIP for systems that require a LRIP, into production or procurement for systems that do not require LRIP, or into limited deployment for MAIS programs or software intensive systems with no production components
  - Exit criteria for LRIP if appropriate

Milestone C: Information Requirements

- Acquisition Strategy
- Acquisition Program Baseline (APB)
- Affordability Assessment
- Analysis of Alternatives (MDAPs only)
- Benefit Analysis & Determination
- Cost Analysis Requirements Description (CARD) (MDAPs & MAIS only)
- Capability Production Document (CPD) (ORD until CJCSI 3170.01 revised)
- Certification of Compliance with FMEA (FM MAIS only)
- Competition Analysis[1] (if no MS B)
- Consideration of Technology Issues
- C4I Support Plan (C4ISP)
- Cooperative Opportunities[1]
- Clinger-Cohen Act (CCA) compliance (all IT incl NSS) (if equiv to FRPDR)
- Certification of Compliance with CCA (MAIS only)
- Core Logistics Analysis/Source of Repair Analysis[1] (if no MS B)
- Economic Analysis (MAIS only)
- Exit Criteria
- Initial Capabilities Document (ICD) (if program initiation)
- Independent Cost Estimate (ICE) & Manpower Estimate (MDAPs only)
- Independent Technology Assessment (ACAT ID – as required by DUSD(A&T))
- Industrial Capabilities Assessment[1]
- Programmatic Environmental Safety & Health Assessment (w/NEPA Schedule)
- Operational Test Agency Report of OT&E Results
- Program Protection Plan
- Registration of Msn-Critical and Msn-Essential Information Systems (if program initiation or equiv to FRPDR)
- Spectrum Certification Compliance (if no MS B)
- System Threat Assessment (STA)
- Selected Acquisition Report (MDAP only)
- Test & Eval Master Plan (TEMP)
- Technology Development Strategy
- Technology Readiness Assessment

[1] part of acquisition strategy

Low Rate Initial Production (LRIP)

- **Purpose**: Complete manufacturing development; produce minimum quantities for IOT&E, to establish initial production base, and to permit orderly ramp-up to full-rate production.
- **Key Activities**:
  - Intensive testing: DT, full-up system level LFT&E and IOT&E
  - Update support and deployment plans
  - Prepare RFP for full-rate production
  - Prepare for Full-Rate Production Decision Review (FRPDR)
  - Update: all information requirements.

Full Rate Production Decision Review (FRPDR)

- Approves entry into Full Rate Production
- MDA Approves:
  - Acquisition Decision Memorandum (ADM)
  - Full-rate production
  - Updated Acquisition Strategy
  - Updated Acquisition Program Baseline
  - Exit criteria, if appropriate
  - Provisions for evaluation for post-deployment performance

FRPDR: Information Requirements

- Acquisition Strategy
- Acquisition Program Baseline (APB)
- Analysis of Alternatives (MAIS only)
- Beyond LRIP Report (DOT&E oversight programs)
- C4I Supportability Certification
- Cost Analysis Requirements Description (CARD) (MDAPs only)
- Competition Analysis (part of acquisition strategy)
- Certification of Compliance with FMEA (FM MAIS only)
- Clinger-Cohen Act (CCA) compliance (all IT incl NSS)
- Certification of Compliance with CCA (MAIS only)
- Component Cost Analysis (MDAPS only)
- Exit Criteria
- Interoperability Certification
- Independent Cost Estimate (ICE) & Manpower Estimate (MDAPs only)
- Life Fire Test & Evaluation Report (covered program only)
- Programmatic Environmental Safety & Health Assessment (w/NEPA Schedule)
- Operational Test Activity Report of OT&E Results
- Post –Deployment Performance Review
- Registration of mission-critical & mission essential information systems
- Selected Acquisition Report (MDAP only)
- Test & Eval Master Plan (TEMP)

Full Rate Production and Deployment

Purpose:

- Establish stable, efficient production and support base
- Achieve initial operational capability (IOC)
- Ensure fielded system continues to provide warfighter with required capabilities

Full Rate Production and Deployment

Key Activities:

- Monitor and update the threat
- Produce and deploy the system
- Monitor system performance and readiness of initial system deployments
- Identify and correct shortcomings/ deficiencies to improve performance and/or supportability
- Conduct Follow-On Operational Test and Evaluation (FOT&E), as appropriate

Summary: Production & Deployment Phase

- Consists of both LRIP and Full-Rate Production:
  - Not all programs have LRIP
  - Formal IOT&E and LFT&E conducted
- Monitor systems - correct shortcomings
- Continue testing

<u>Bottom Line</u>: System is produced and deployed; IOC attained

Operations & Support Phase

Sustainment

Sustainment starts immediately upon fielding or deployment.

- Activities: Maintain readiness and operational capability of deployed system(s). Execute operational support plans. Conduct modifications and upgrades to hardware and software. Measure customer confidence.

Disposal

Demilitarization & Disposal

- Activities: Demilitarize and dispose of systems IAW legal and regulatory requirements, particularly environmental considerations. Use Defense Reutilization and Marketing Office support, as appropriate.

Operations and Support Phase*

- Emphasis shifts from design/development engineering to supporting the fielded system
- Operational units established & readiness monitored
- Test and evaluation continues
- Operational/support problems identified
- Product Improvement/Service Life Extension Programs energized, if required
- System disposed of at the end of its useful life

* Overlaps Production and Deployment Phase since items are deployed prior to the end of production, and must be sustained in the field

Check Back Often For…

- Additional information on the new Joint Capabilities Integration & Development System (JCIDS) – the new CJCSI 3170.01C and CJCSM 3170.01
- More on the Future Logistics Enterprise

Information on these and other topics will be posted to this site soon as available. Also, in late summer 2003 continuous learning modules on the Acquisition Process, the Joint Capabilities Integration & Development System, and the Future Logistics Enterprise will be posted to the DAU Continuous Learning Center web site, http://dau.clc.mil