Previous Section

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.

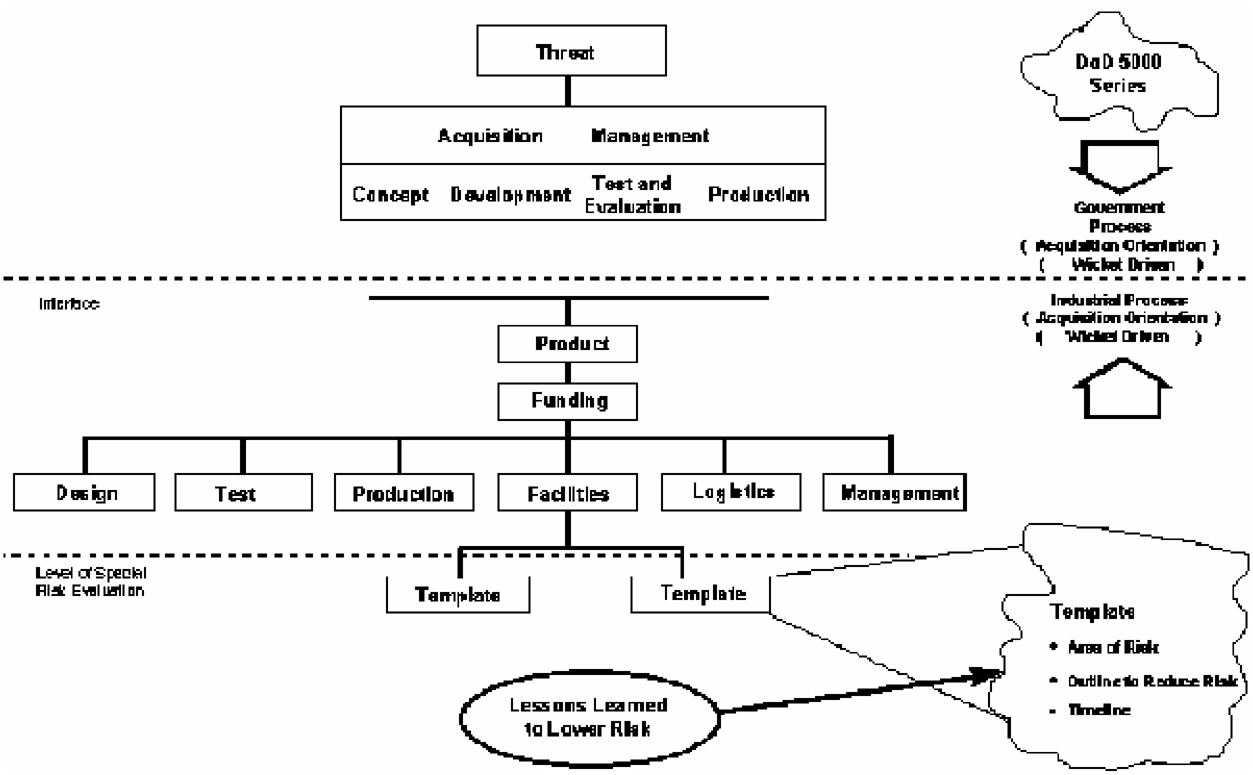


Figure 1-1. -- Transition Problem Perspective and Action to Lower Production Transition Risk

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.

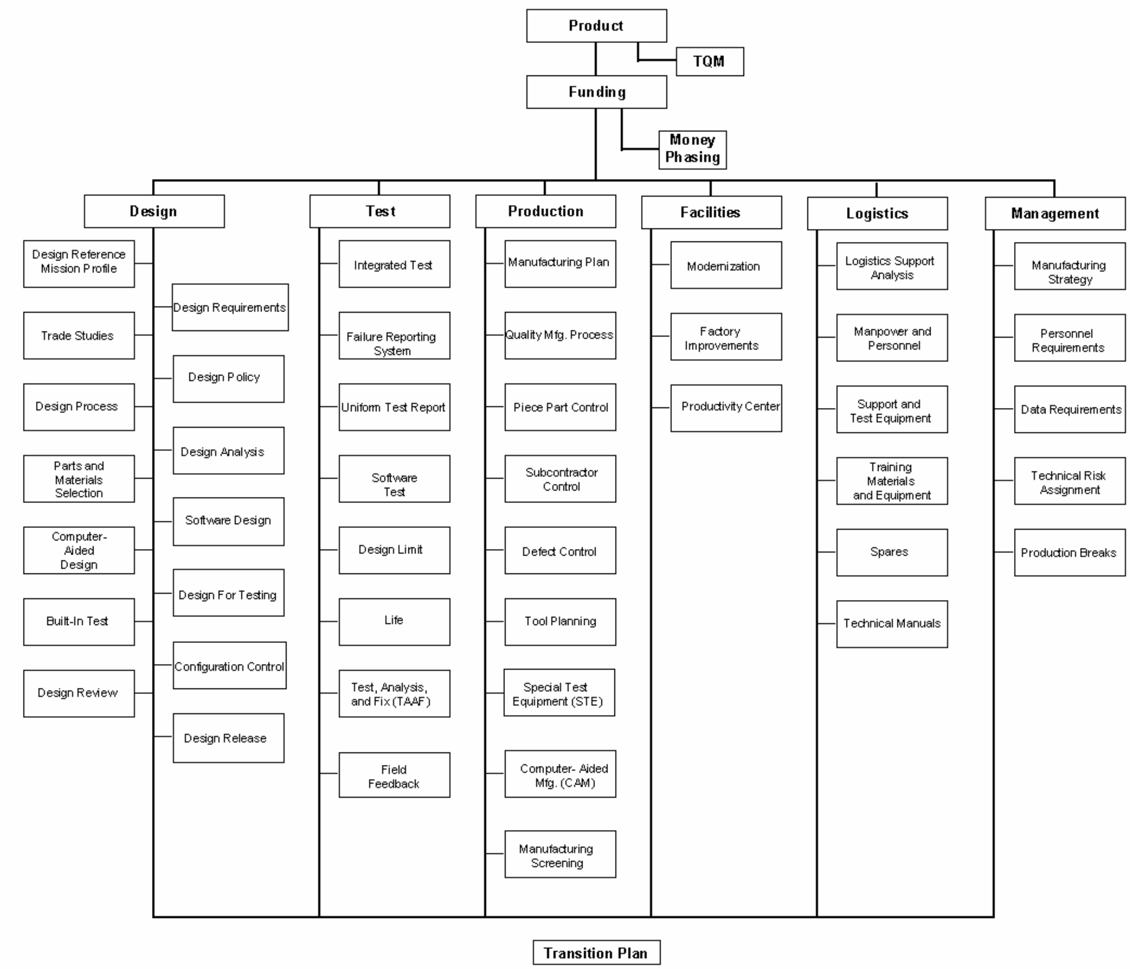


Figure 1-2. -- Critical Path Templates

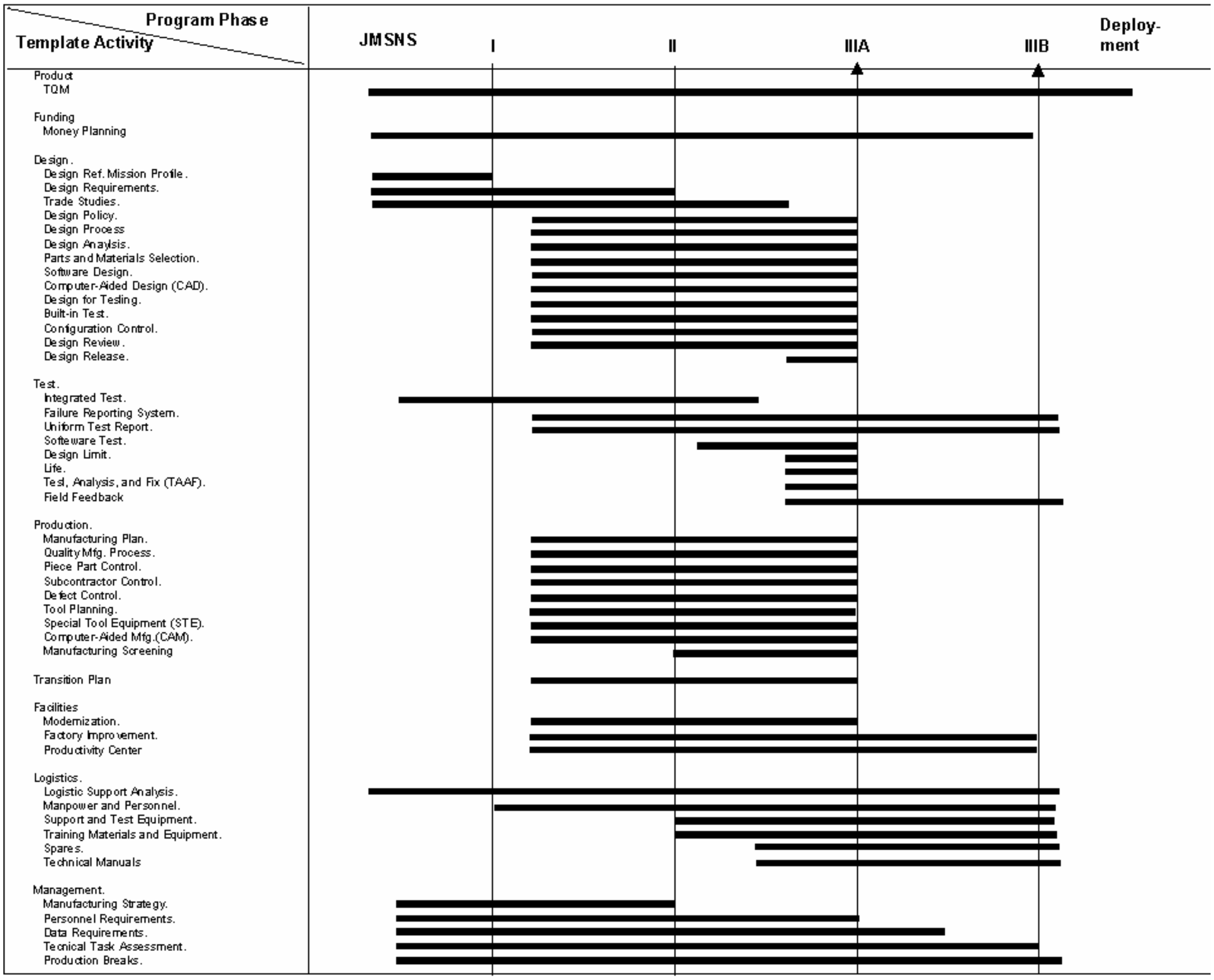
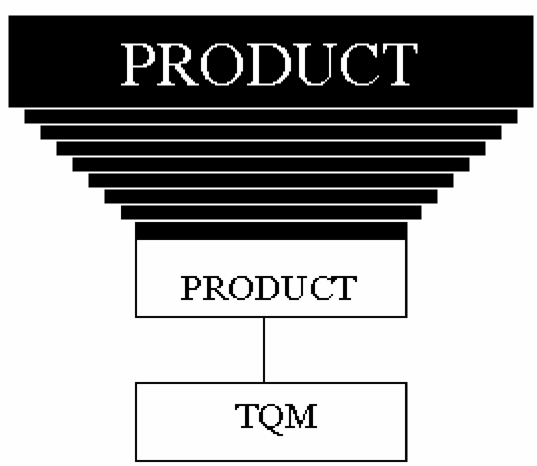


Figure 1-3. -- Template Timelines



A. -- Introduction for TQM Critical Path Template

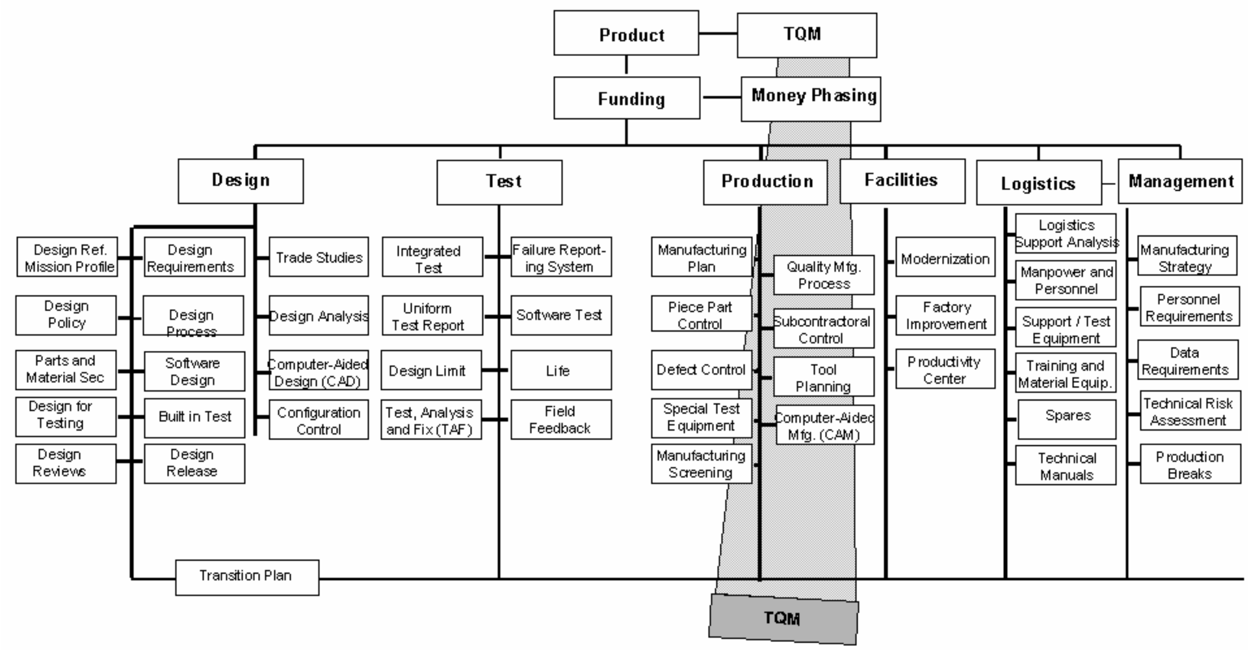
Since publication of this Manual in September 1985, a major New DoD initiative has. . been instituted called TQM. Change 1 to this Manual provides additional guidance to implement the philosophy and managerial approach involved with TQM and consists of a new template inserted in chapter 1. The new template 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.

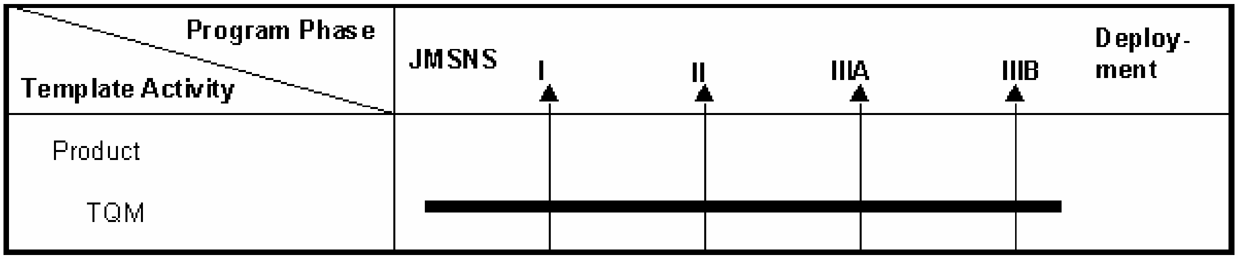
• TQM effort begun in the conceptual phase of the acquisition cycle is vitally concerned with establishing a rapport between the producer and the user or customer and a' recognition of the latter's stated performance requirements, mission profiles, system characteristics, and environmental factors. Those 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/

Next Section