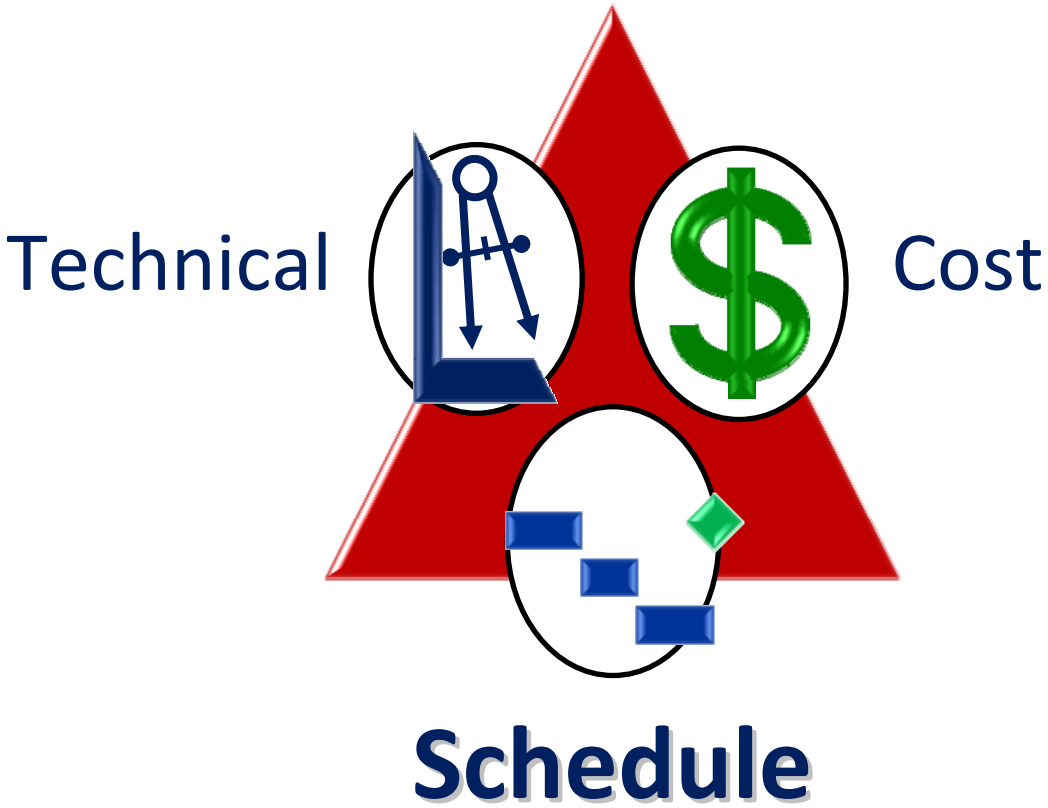
NAVAIR

Integrated Master Schedule (IMS) Guidebook



February 2010

Version 1.0

NAVAIR Public Release 09-456

Distribution: Statement A – "Approved for public release; distribution is unlimited"

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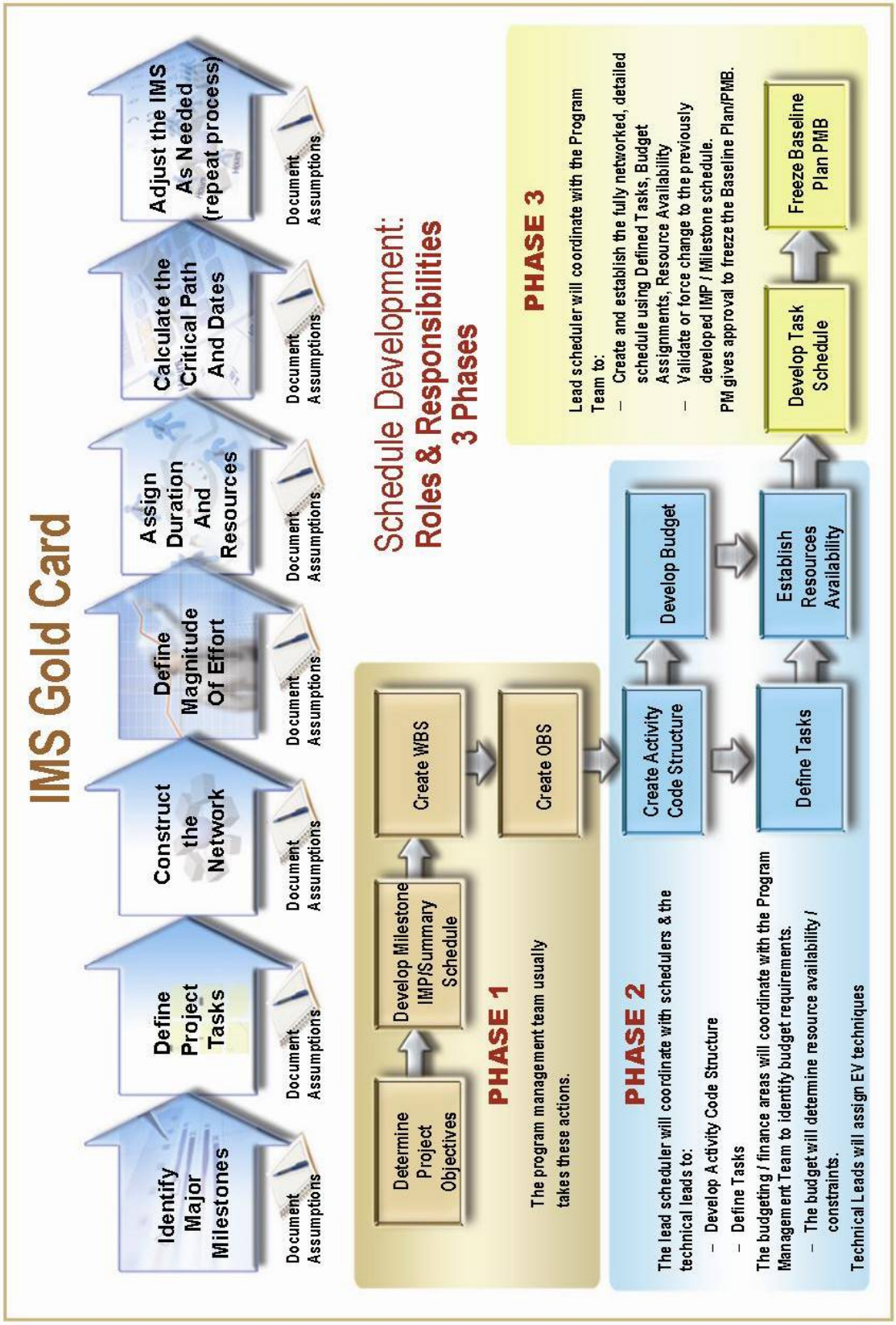
IMS Gold Card/Quick Reference (tear out)



IMS Gold Card

Questions to be asked at program reviews by PEOs/DPEOs (look for DPEOs nod on these):

1. **What has changed on each critical paths to the next three key events/milestones in the Integrated Master Schedule?**
2. **What are the risks and mitigation actions associated with these events and the next major acquisition milestone?**
3. **Describe your strategy for the development and management of the IMS.**
4. **How is subcontractor or government workload being captured and integrated into your schedule? How are you managing those interfaces? (e.g., Do you have a schedule for GFE/GFI?)**
5. **What gives you confidence you'll be able to achieve the program objectives (cost, schedule, performance)?**

Questions for PMA Level (Questions for program initiation, these questions plus PEO questions interactive basis):

1. Have you and your IPT members attended IMS 101 training?
2. Have you contacted 4.2 and got a scheduler? Is the scheduler funded?
3. Have you and all your competency IPT members reviewed and concurred with the IMS?
4. Have you established a drumbeat/business rhythm to include Government, Contractor(s), and Sub(s)?
5. How are you going to bring me the highlights from your review(s)?
6. Do you or your team have any issues related to the last AIR 4.2 11-point assessment?
7. What has changed on each critical paths to the next three key events/milestones in the Integrated Master Schedule?
8. What are the risks and mitigation actions associated with these events and the next major acquisition milestone?
9. Describe your strategy for the development and management of the IMS.
10. How is subcontractor or government workload being captured and integrated into your schedule? How are you managing those interfaces? (e.g., Do you have a schedule for GFE/GFI?)
11. What gives you confidence you'll be able to achieve the program objectives (cost, schedule, performance)?

IPT Leads and Schedule Analysts questions, (includes AIR 4.2 11 Point Schedule Assessment):

1. Does the plan reflect the work to be done? Does the plan include subcontractor and government workload; and to what level?
2. Are critical target dates identified, are they being used to plan the work?
3. Is work sequenced logically?
4. Are interdependencies planned in a logical manner?
5. Are constraints, leads, and lags justified?
6. Are duration estimates meaningful?
7. Are resource estimates reasonable; are key resources available to support the plan?
8. Does the critical path make sense; is it calculated by the scheduling software?
9. Are float times reasonable?
10. Does the schedule provide current status and forecasts of completion dates for all authorized work; are they logical?
11. Where are the highest risk areas in the schedule?
12. Can the program schedule, as displayed, be accomplished at an acceptable risk level?
13. Review the overall scheduling strategy (e.g., drumbeat, integration of Prime/Subcontrators/Government, IPT participation, scheduling tools)
14. Do the appropriate team members have access to the scheduling tool software and the schedule

About This Guidebook

Did you ever wonder why we never seem to meet our schedules? Did you ever wonder if there is anything we can do about it? From Congress through the leadership of the Navy, to Naval Air Systems Command (NAVAIR) Program Management, these very questions are being asked. This guide provides answers to some of these questions and will (re) introduce you to one of the most powerful tools in the Program Manager's toolkit, the use of the Integrated Master Schedule (IMS). However, a word of caution: this guide will NOT teach you everything you need to know about Integrated Master Schedules (IMSs) and/or scheduling. Of course, if you are a senior program manager with many years of experience, you may not learn anything new from this guidebook, as you are one of a vanishing breed. For the rest of us, this guidebook serves as a quick and easy-to-read reference. After reading this guide, you should know a lot more about creating and using Integrated Master Schedules and good scheduling practices and principles. Most importantly, you will be armed with useful insight and knowledge and will know the right questions to ask and when to ask them. And if you need additional information, this guidebook includes informative web links.

This guidebook incorporates information gathered during a nine-month effort of data collection and analysis, as a result of the 2008 Commanders Conference where VADM Venlet commissioned a study to improve the "integrity of Integrated Master Schedules inclusive of requirements flow-down." As Figure 1 shows, NAVAIR averages a 35% growth in schedule by the time we arrive at IOC.

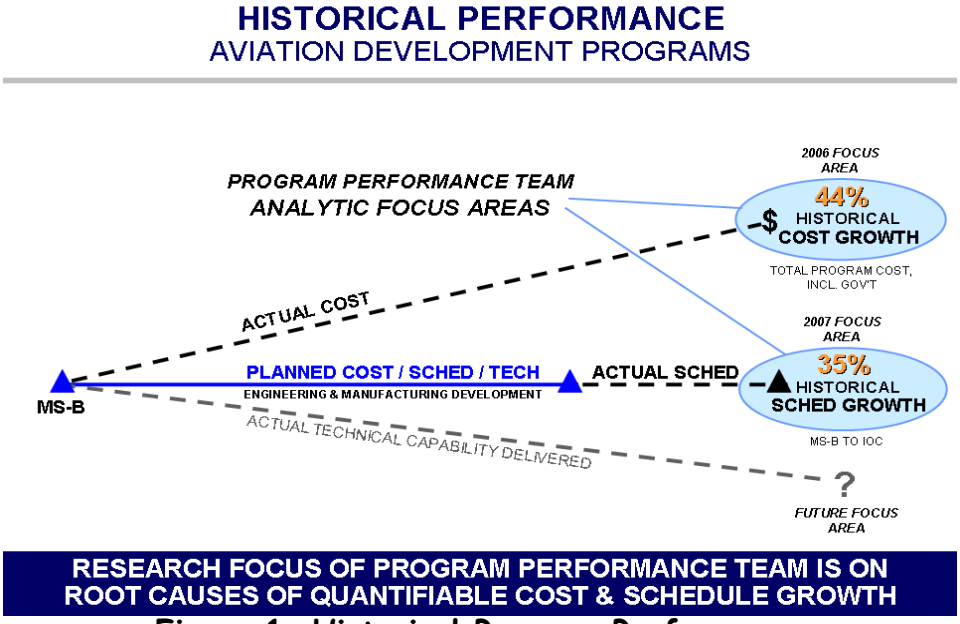


Figure 1: Historical Program Performance

The project focused on the need to instill the discipline to develop a realistic IMS (contractor, government, both combined) and use it as an effective tool to help execute programs/projects and mitigate potential schedule/cost risks. The approach was to identify root causes of poor development and use of an IMS, document best practices including how to use an IMS, and when/where to take action to mitigate cost/schedules impacts.

To identify these issues and best practices, a cross section of NAVAIR and Industry Program Managers, Technical Leads, and Schedulers were interviewed and/or surveyed. The project team also studied various IMS-related artifacts such as the draft Earned Value Management (EVM) Report of the Defense Support Team, Center for Naval Analyses memo for DASN of Management and Budget, the DOD Systems Engineering Technical Review (SETR) Process, documents from the National Defense Industrial Association (NDIA) Scheduling Sub-Group, Air Force Schedule Management and Analysis Initiative, and the AIR-4.2.3 Schedule Process Group. The issues identified herein were consistent with findings from Air Force, NDIA, and AIR-4.2 efforts.

Specific issues identified and documented were grouped as shown in Figure 2; 85% of the issues were accounted for in the top five categories.

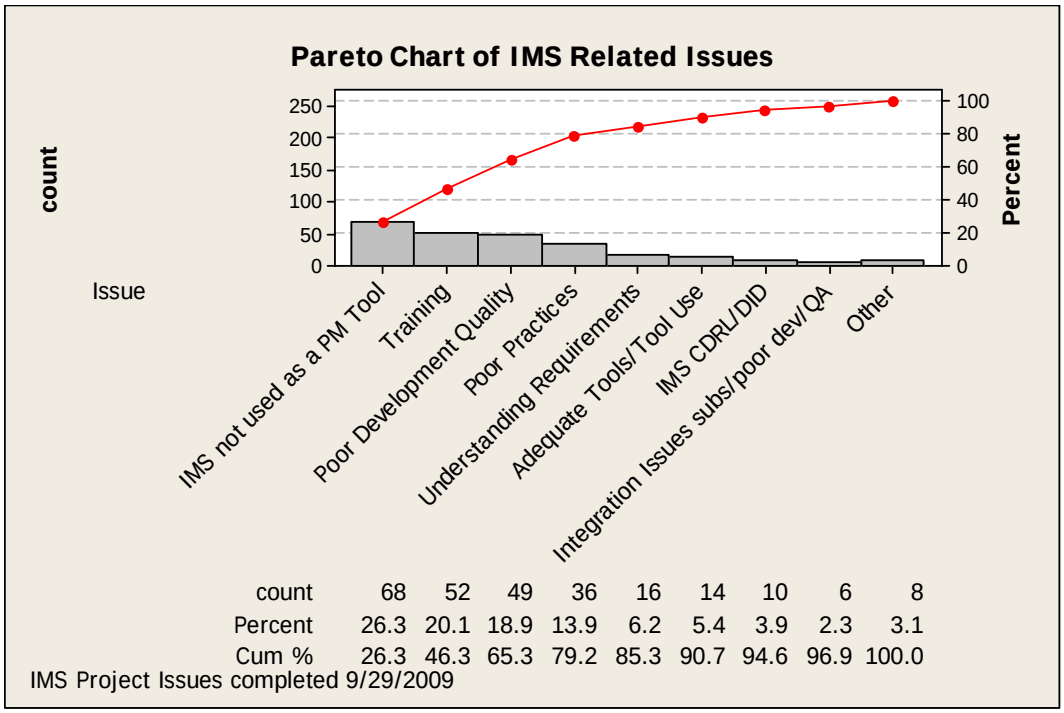


Figure 2: IMS Project Issues

Root causes for a poor IMS and/or poor use of an IMS include lack of or inadequate training, no leadership emphasis, not being a priority, thinking the IMS use and analysis was exclusive to AIR-4.2, poor communication, no clear understanding of the work, and poor requirements management. The team identified training, leadership, and priority as the top three root causes relative to the top five IMS-related issues.

As a result, this guidebook, which includes an IMS Gold Card/Quick Reference, along with existing and new training courses, was developed as a step in the right direction to help Program Managers at all levels gain discipline to develop and utilize an IMS as an effective tool for successful program/project execution.

A word of caution: while this guide addresses IMSs and scheduling, please remember the IMS is NOT the only tool that an IPT Lead needs in his or her toolkit.

Oh yeah, and one more thing….do not be offended if we used "he" or "she" in this guide; you'll know we meant "he/she" or "they" or "them" or "whoever"….okay?

Icons Used in This Book

In the margins of this guidebook, you'll find several icons to help you identify valuable information:

This is definitely worth trying!

Great Idea but not yet generally accepted practice!

Put this to use now!

Straight from the pros – this can really help!

A tool that you can put to use immediately.

Pull out your highlighter or take a note.

The Surgeon General has determined that this may be hazardous to your program . . .

Some *sweet* philosophy or detailed explanations (the faint-hearted may want to skip this section).

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I. Lay of the Land

"I saw the movie, 'Crouching Tiger, Hidden Dragon' and I was surprised because I didn't see any tigers or dragons. And then I realized why: they're crouching and hidden." - Steve Martin

So how the heck did we get here? A guide about schedules? What is this, the master of the obvious? Everyone knows you need a good schedule and most times we think we have one. But why do we derail time and time again? Not only are we asking ourselves those questions, our industry partners are as well.

To try to figure out what was going on, we surveyed over 40 of our industry partners, talked to program managers, professional scheduling groups, and to anyone who ever had to manage to a schedule.

What did we learn? The government and their prime contractors spend millions of dollars on developing IMSs and yet:

- History has shown a vast majority of programs are not completed within their original period of performance
- Primes have issues linked to subcontractors and their IMSs (or lack thereof)
- Often, there is a top down versus bottom up approach to building an IMS, backing into a solution leading to buy-in to an unrealistic IMS
- Often, no "IMS Planning" window exists to support an Integrated Baseline Review
- Program managers and IPT leads do not use their IMS to manage the program

And here at NAVAIR specifically?

- Program Teams are not managing to an IMS
- Program Teams are not accountable to use an IMS
- Program Teams are not knowledgeable in the tools available to manage to an IMS

To make matters worse, as soon as we realize the contractor's IMS is wrong, we ignore it! We do not even reject EVM Contract Deliverable Requirements List

(CDRL) submittals that tie back to said inadequate IMS. We may comment, but do not withhold approval. And, do we practice what we preach? Hardly. Our data shows that programs' use of a government IMS is nearly non-existent.

But there is hope. We did find that highly successful programs teams were:

- Managing USING their IMS
- Holding themselves and the contractor accountable
- Holding regular drum beat reviews of the IMS
- Reacting proactively

"Okay, you have me convinced there's an issue. So why an IMS? What does that do for me?"

- It provides a measureable baseline:
  - Where am I?
  - Am I ahead, on, or behind schedule?
- It is a vehicle by which accomplishments and status of progress are monitored
- It shows when things start to go south and predicts impacts of non performance on subsequent schedule tasks so you can be proactive
- And finally, it is a communication tool (however, you are still the communicator)

Here's another way of saying it: A schedule answers the four W's:

- **Who** in the organization is doing the work?
- **What** milestone is the task contributing to?
- **When** is the work starting and finishing?
- **Where** is the work being done?

"We haven't talked about the critical path, what about that?" Well, that's a great question, but you are going to need to do some more reading before we get to that. So, **keep reading** and pay attention!!

II. What is an IMS?

"How many legs does a dog have if you call the tail a leg? Four.
Calling a tail a leg doesn't make it a leg." - Abraham Lincoln

"So I have this nice, pretty schedule in PowerPoint that I use to show my boss; he likes things simple." Nothing wrong with that! It often happens as information flows up the chain, and needs to be summarized at a high level. But we are no longer in the Flintstone's era; **please do not use that nice pretty CARTOON to manage your program!** The schedule YOU should be using is a little more complex and certainly more comprehensive. Hence the term "integrated." The IMS must be the only schedule.

So, what is an IMS? At a top level, it is an integrated schedule containing the networked, detailed tasks necessary to ensure successful program execution. What makes them different from just any schedule? An IMS will:

- Capture project tasks and tasks relationships (predecessor & successor logic ties)
- Show the magnitude and how long each task will take
- Show resources, durations, and constraints for each task
- Show the critical path which is the longest path through the project network with least amount of float

If your schedule doesn't contain all this information then you are not using your IMS to manage your program!

"But wait a minute, no one told me I had to have all that stuff!" You are absolutely correct; we at NAVAIR do not require an IMS on every program. Perhaps we should after all the data we have reviewed and all the schedule problems we have experienced. Right now, IMSs are only required on cost type contracts over $20M; per DOD 5000.2 instruction.

"Can I request an IMS from the contractor even though my program is under the requirement dollar threshold?" Of course, and it doesn't need to be coupled to EVM. It will cost you, so be specific in the Statement of Work (SOW) on what you want. The $20M requirement is from the DOD 5000 series documents. It usually is put on contract in the SOW and requested via the Earned Value Management CDRL which leads many to the mistaken idea that an IMS is an AIR-4.2 EVM tool and not a

program management tool. Wrongo! Are you beginning to see where our programs are getting set adrift?

So let's get on with it – what really is an IMS? Like we talked about earlier it is an integrated schedule containing the networked, detailed tasks necessary to ensure successful program execution. An IMS is supposed to contain the milestones, accomplishments, and discrete tasks/activities (including planning packages where applicable) from program start to program completion. The detail should be sufficient to verify attainability of program objectives, to evaluate progress toward meeting program objectives, and to integrate the program schedule activities with all related components.

For IMSs that need to be linked to the cost accounting (EVM requirements) the schedule should be vertically and horizontally traceable to the cost/schedule reporting instrument. This linkage is the only way to properly address variances. All IMSs should contain contractual and program milestones and descriptions and display summary, intermediate, and detailed schedules, and periodic analysis of progress to date.

The IMS will act as a database integrating all of the management tools together; each task will have a field containing product work breakdown structure (WBS), process (statement of work (SOW) and integrated master plan (IMP)), or organizational breakdown structure (OBS), and other categories. You should be able to access information by utilizing any of those.

"OK, I'm with you, one of those IMSs came from my contractor. I even look at the CDRL delivery occasionally but it doesn't show my whole program, just the contractor piece of it. So I can't really use it to manage from, now can I?" Roger that, but don't you think it's important for the contractor to know what the government key dates are? Trying to hit a boat detachment? Or maybe availability of a test aircraft or facility? Don't you think if the contractor had that information in your IMS then everyone would be better off for it? Absolutely! Make sure all key government dates are in the program IMS.

Now, you also may have heard of an IMP and want to know what this is. An IMP is an Integrated Master Plan, which is a non-time-phased, event-based plan for a program. Actually, an IMP includes a hierarchy of contract events, associated accomplishments for each event, and associated criteria for each accomplishment. So, the IMP is a listing of high-level items. The IMS must include the IMP items in a time-phased manner, and will also include lower level items/tasks that support each

criterion. This guide does NOT go into any additional detail on IMPs. *Section XI, References* in this guide contains a link to the DOD IMP and IMS Guide should you need more information about IMPs.

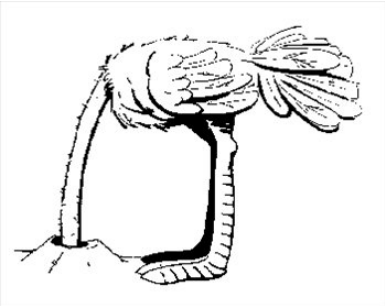
II.a. What Goes Wrong

"The definition of insanity is doing the same thing over and over and expecting different results." - Benjamin Franklin/Albert Einstein

So what is happening?
How are our schedules getting so messed up right out of the starting blocks?
The following factors were repeatedly identified during this project as causes for the lack of realism in the cost and schedule estimates:

- Lack of clear requirements definition
- Unrealistic/un-executable schedule/cost estimates generated by the Government and accepted by the prime
- Unrealistic/un-executable schedule/cost estimates generated by the prime Contractor and accepted by the Government
- Program Mangers not managing to an IMS because it is unrealistic and/or out of date.
- Lack of sufficient time to get subcontractor/supplier estimates to respond to and meet the Request for Proposal (RFP)/Request for Quote (RFQ) deadline
- Insufficient Management Reserve and/or program schedule margin to handle risk
- "Award to lowest offeror" mentality by Government

It may seem obvious, but remember, if your IMS is not realistic or does not reflect how your program is being executed, your EVM data will also be suspect. You may have your head in the sand and not even realize it!!



"In theory there is no difference between theory and practice.
In practice there is." - Yogi Berra

While this guide can't teach you everything, it will provide you insight into things to watch for, and tips and best practices to address these problems.

II.b. How Critical Is the Supply Chain to the IMS

(or I Got Hosed by the Crunch Effect!)

Before we proceed, let's take a minute and talk about the impact of the supply chain on schedules. As we have seen and heard over the last few years, our primes are subcontracting out more and more of their work. Consequently, they now have to perform more and more contracting activities after our contract award to them. "Go" on our side does not necessarily mean "go" to them.

The "Subcontractor 101" guidebook, referenced in Section XI, goes into a lot more detail on what this can do to our programs but from a scheduling perspective, let's talk about the "Crunch Effect" as demonstrated in Figure 3.

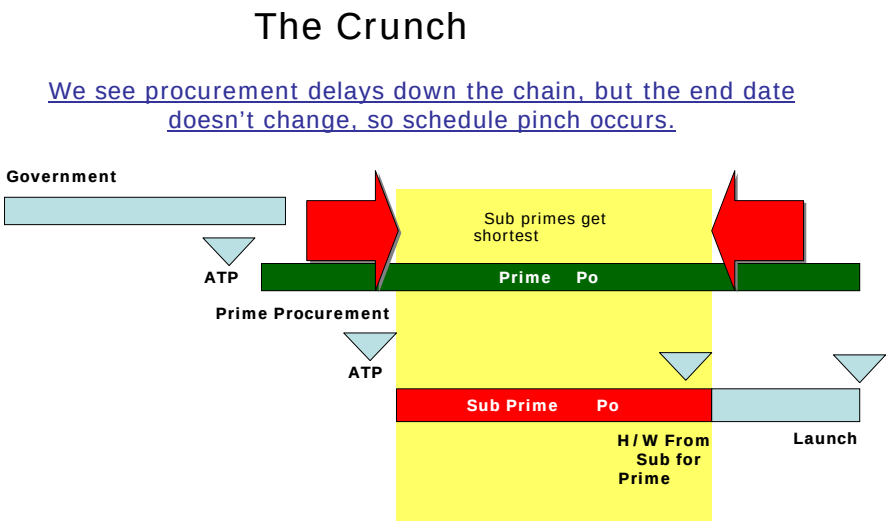


Figure 3: The "Crunch" Effect

"The Crunch Effect" - One issue that often occurs is that primes do not always place their subs on contract in a timely manner. Negotiations take time. However, to make matters worse, the "need date" for the subcontractors' deliverables is rarely allowed to slide to match the slip of the subcontract start date. So now, procurement delays and constrained end dates amplify the disconnect on program planning,

resulting in an even more unrealistic portrayal of the schedule. The consequence? We now have a tool that is unusable for management purposes.

The effect on cost is no less significant than the effect on schedule. Initial Government estimates are generated before requirements are fully stabilized. Prime contractors respond to RFPs or RFQs without full participation from critical subcontractor/suppliers providing cost estimates which are significantly disconnected from the ultimate cost to the program resulting in suboptimal program planning and execution.

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III. You Gotta Be Kidding Me! (Or How am I Supposed to Use The IMS?)

"A child of five would understand this. Send someone to fetch a child of five."
- Groucho Marks

There are many reasons we, program offices and competencies, struggle to use a contractor-built IMS: we do not understand how they built it, no one ever explained it to us, no one ever showed us what to do with it, and consequently, we leave its use to the experts in AIR-4.2. These all contribute, but let's knock through a couple of the most common excuses so we can move on.

"I can't read this thing – I don't have the right software." IMSs require specialized software that we can't always access through NMCI. This is an area we at NAVAIR need to work on. But for now some program offices use their contractor support to access programs like Primavera, or Open Plan or even Microsoft Project so that we can see exactly what is going on. Otherwise, travel to the prime is going to be a necessity.

AIR-4.2's Problem? Hardly. Yes, they are our experts in schedule development, task analysis and EVM, and you need to rely heavily on them to make sure the tasks are correctly built; the interrelationships are accurate, etc. But they are not the program manager. You, as the PM or IPT lead, have responsibility to make sure the schedule is accurate and up to date. You make the decisions, you pull it all together, you know what is in it, you react appropriately to changes, and you get to act humbly when your team wins the annual NAVAIR Program Management award!

How Was the IMS Conceived? One of the most important things you as an IPT lead need to understand is how the IMS was built. Not necessarily what program was used to build it or what the structure is (although this may be debatable), but what philosophy or approach was used to build it. Did the contractor (or you) build it to meet a certain end date? Sure, we don't do anything without an end date. But, was that the first date the contractor entered information and everything thing else was crammed in there willy-nilly? Or did the contractor lay out the tasks in an organized, logical fashion (read low risk) and then get to the end date? If the end date was too late what was done? Did he start cramming in concurrent work that couldn't be completed on schedule? Or, did he find efficiencies; did he change logic ties, reduce durations, increase resources; or, was scope reduced? Did his actions add risk to your program? Where was that risk added and was it worth it? Knowing the answers to these questions for any schedule is key

to managing to a schedule. You now know your schedule and know where the risks are and where the bulk of the government's funds are being spent.

"My IMS Doesn't Show the Whole Program" Well whose fault is that? The contractor doesn't want to add our stuff in? Doubt it. The contractor is precluded from entering the government only detailed tasks into the IMS and we can't hold contractors accountable for government tasks anyway, however, they do want to know what our milestones are (see Section VI, Best Practices later in this guide). That information is critical or they can't adjust properly when the dog eats their senior engineer's homework or other equally important reasons they are late.

One other point we need to touch on here is subcontractor work. What is in your program's/prime's IMS for efforts that the prime has subcontracted out? If you don't know, you better find out! Many primes do not put any subcontractor work in when their IMS is developed; they just display deliveries/events as milestones. That was probably okay when most of the work was being done in-house. But this is not okay when they are subbing out larger and larger portions of the workload (60-70%) as we are seeing in today's marketplace. That insight into the subcontractors' work may make or break your program. Understand what is in and/or NOT in your IMS!!

If the prime cannot show the Program Manager a subcontractor IMS – whether integrated into the prime schedule or not - it is probably an indicator that the prime isn't doing their job of managing the sub.

"I'm in the Test Phase and need to focus on that, not what the Contractor is doing."

It's great that you made it that far! What are you using to manage your test schedule? Do you have a test schedule? Our development and use of an IMS for internal work is much debated. There is no question we need something better than a PowerPoint schedule, but do we need an IMS in the truest definition? Whatever you decide, your government schedule should at least include:

- Linked/measureable tasks, showing duration
- Tasks showing interrelationships (linked successors and predecessors)
- Activities should be tied to major program/contractor milestones/events

"No One Ever Showed Me How to Use the IMS" You are right, no one ever did. Using the IMS is based on common sense but there are some key things you need to understand and watch for, and there is no available training on how to manage a

program using an IMS. A lot of training is available on building an IMS, but there is no training that focuses on managing a program with an IMS. Stay tuned though! You just may see some offerings in the next few months; based on survey feedback, this was a frequent topic.

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IV. Let's Get On With It (Or What's the Rest of This Guide About?)

"Keep moving forward with your work. I'll go find out what the requirements are!"
- Un-credited Team Lead in 1994

We have discussed a lot of background material up to this point. The rest of this guide covers information you really need to know to build and manage to an IMS. We have compiled hundreds of best practices learned throughout our interviews, we have a FAQ section, and we list available training and what will be available. We also have some contract considerations and language that you can tailor for what best fits into your program if you're going down that route. Finally, there is also an IMS "Gold Card" among other things. This Gold Card is a cheat sheet for asking the right questions when you are reviewing an IMS. Of course, we have included references and appendices as well.

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V. Building and Managing to an IMS

"Next week there can't be any crisis. My schedule is already full." - Henry Kissinger

V.a. Building an IMS

Consider and involve those IPTs you'll need cooperation and inputs from; such as, Engineering, Logistics, and Test and Evaluation.

Note - 1 number in Figure 4 equates to the paragraph number in the text below.

1. The Program Manager submits a request for a scheduler to AIR-4.2.3 who organizes a meeting to discuss resource options and funding impacts. If the PM/IPT approves of the resources, then a scheduler will be assigned to the Program office. If not, then PMA/IPT/AIR-4.2.3 will meet to discuss options and way forward.

2. The initial meeting is the In-House Scheduler's first opportunity to initiate a working relationship with the Program Manager, and lay the groundwork for a productive relationship. At a minimum, the meeting should include formal introductions, a description of the program, and an exchange of expectations and goals.

After the initial meeting with the PM, the Scheduler is introduced to the Responsible Managers or IPT Lead. The Scheduler discusses the basic scheduling process and the benefits of a networked schedule. The purpose of this meeting is to obtain "buy-in" and foster cooperation from the Responsible Managers to make way for productive interaction throughout the scheduling process.

3. Schedule Workshop Plan of Action & Milestones (POA&M) Brief

The schedule workshop provides Program Leadership with an understanding of expectations and schedule architecture prior to schedule development. The expected outcome of the schedule workshop includes:

- Defining roles and responsibilities
- Providing scheduling basics
- Discussing schedule architecture and reports
- Reviewing schedule maintenance requirements

3A. Schedule 101 Training

As part of the schedule building process, the IPT members should complete AIR-4.2.3 Scheduling 101 prior to starting the schedule build. This 101 class is a high level basic instruction on scheduling terms, tools, processes, and analysis. The Scheduler should arrange this class during the second week of the In-House schedule POA&M.

Work Breakdown Structure (WBS) Creation – Initial

The WBS is a tool that groups the project's discrete work elements into a product and helps organize and define the total work scope of the project. The WBS provides a framework for managing and organizing the approved project scope and helps to ensure that all work has been defined. MIL-HDBK-881A provides the guidance for developing a DoD WBS. For additional support, contact AIR-4.2 as they have a designated point of contact for WBS questions.

Define Major Milestones

The Scheduler assists the PM in identifying/defining critical milestones that will help measure progress towards completing the planned program objectives. A major milestone can be defined as a significant event in the project, usually completion of a phase or of a major deliverable. When building the In-House schedule, endeavor to plan at least one major milestone per quarter. This helps to ensure confidence in the logic of the schedule.

Use Organizational Breakdown Structure (OBS) and WBS to Identify Responsible Managers

The Scheduler identifies points of contact (POCs) for each work product or deliverable required for the program. To do this, he utilizes a WBS and OBS to create a Responsibility Assignment Matrix (RAM). The WBS facilitates resource allocation, assignment of responsibilities, as well as measurement and control of the project. When merging the WBS and the OBS, a RAM is established that depicts the relationship between the Work Breakdown Structure elements and the organizations assigned responsibility for ensuring accountability and structure. The RAM is used to link activities to resources to ensure that the scope's components are each assigned to an individual or team.

4. Define Roles and Responsibilities / OBS

During the development of the schedule the PM is responsible for creating an OBS. The OBS is a functionally oriented structure which depicts organizational relationships and is used as a framework for the assignment of work responsibilities. Through the creation of the OBS, the Program Manager defines the role and area of responsibility of the team members.

5. Meet with Each Responsible Manager to Build Internal Schedule
After the Scheduler has identified the Responsible Managers and linked them to the work that they are responsible for completing, the Scheduler will meet with and begin to develop a schedule for completing their work. The goal will be to build a valid, realistic schedule with dates assigned, showing the start date, task durations, task relationships, and constraints.

The schedule build is an iterative process and will require several meetings with Responsible Managers. The initial information gathering process consists of seven areas. Program/Responsible Managers will:

1. Develop and document schedule assumptions.
2. Identify the detailed tasks specific to their portion of the work effort
3. Identify the associated task constraints and relationships to those tasks
4. Iterate with the Scheduler for further clarification and validation
5. Identify Most Likely, Optimistic, and Pessimistic Durations (3 point estimate) on each individual task
6. Provide rationale for the 3 point estimate including identifying risk
7. Relate these durations to a resource Basis of Estimate

Each schedule building session will typically require approximately two hours.

Validate Schedule and Work Scope

Once the Scheduler has gathered the inputs and built the Internal IMP/IMS, he needs to ensure that the schedule is accurate and valid relative to the scope of work of the program.

If applicable, the In-House IMP/IMS must reconcile and/or trace back to the dates in the Contractor's schedule. The dates of the major milestones in the In-House IMP must exactly match those same milestones in the Contractor's IMP. Therefore, the Scheduler works closely with the AIR-4.2.3 Schedule Analyst in an effort to monitor those dates, looking for any differences or potential risk of date changes in the future.

6. After the In-House schedule is complete, it is reviewed with the Program Manager and the IPT as a whole to ensure that all linkages between work efforts are accurate/valid.

7. Once there is buy-in on the In-House IMP/IMS, the scheduler will "snap" the baseline and then move from the schedule build phase to the schedule maintenance phase.

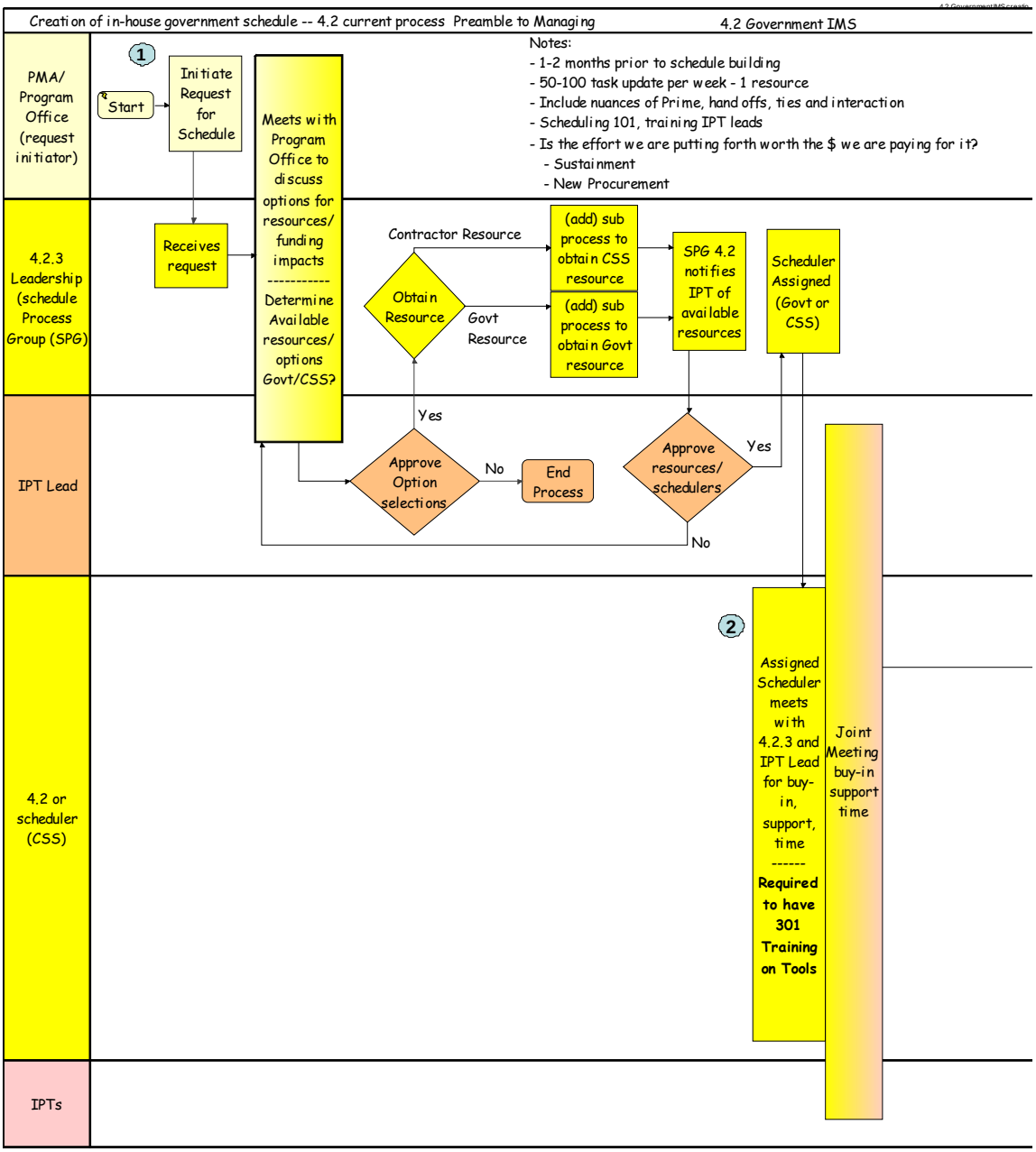


Figure 4: AIR-4.2 Government IMS Creation

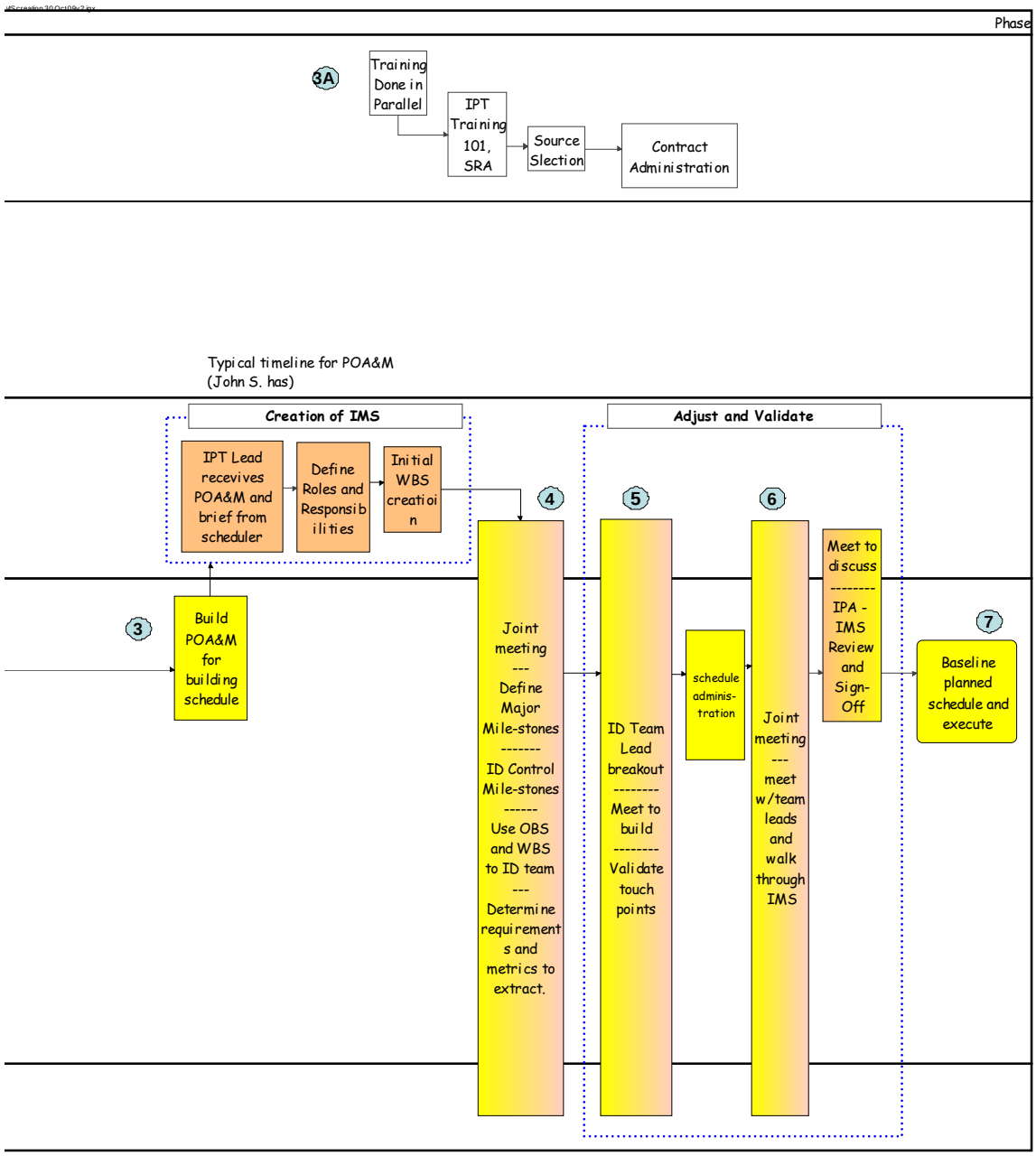


Figure 4: AIR-4.2 Government IMS Creation

Figure 5. provides a high level overview of the major functions required to develop a schedule. More detailed information related to each of the major areas can be acquired by taking Principles of Schedule Planning and Construction (IMS 101) training. So, sign up and take that training!!

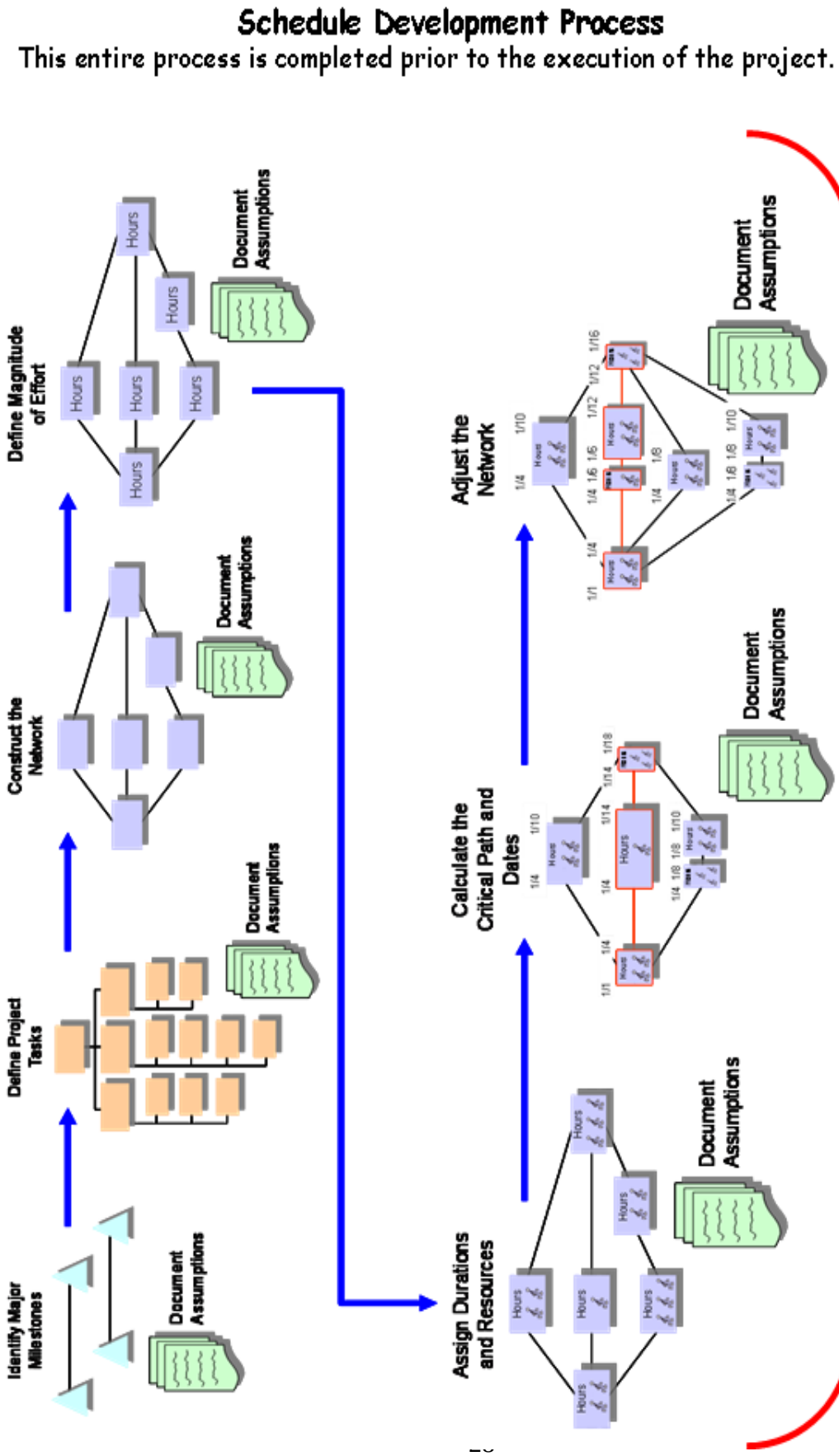


Figure 5: Schedule Development Process

V.b. Using an IMS

The flowchart (Figure 6.) depicts the nominal flow of events to "managing to an IMS." Following this flow and making it a normal part of program office battle rhythm will provide early risk detection and afford the PMA the opportunity to mitigate risk. Following this flowchart is considered a best practice.

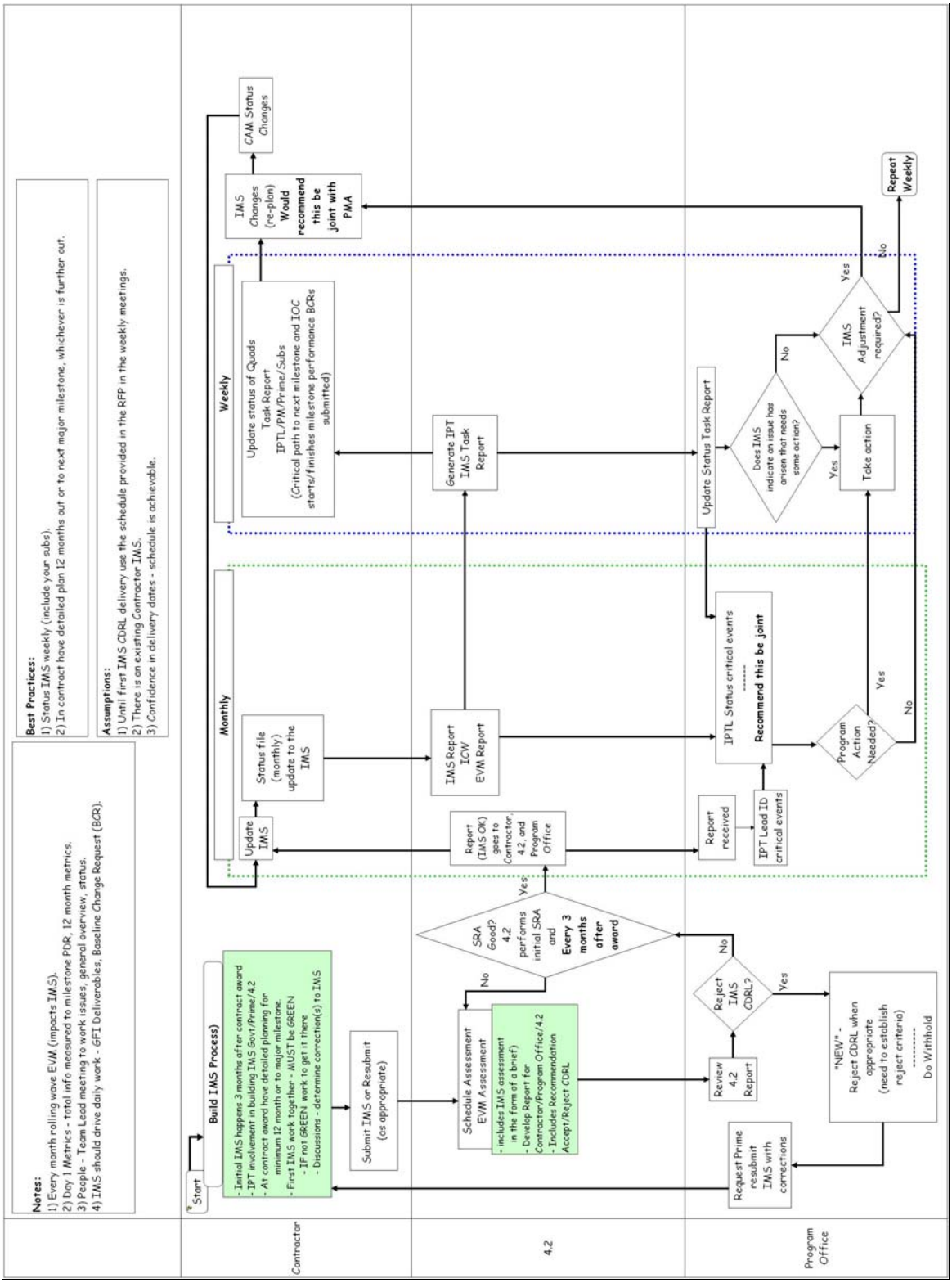
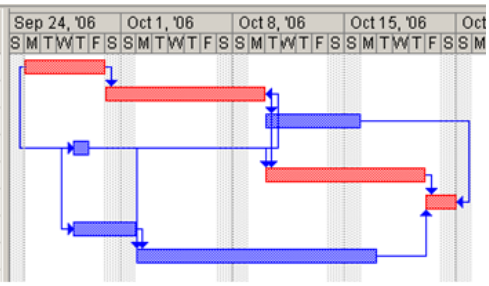


Figure 6: Using a Government IMS

V.c. Critical Path

	Task Name	Duration in Days	Successors	Free Slack	Total Slack	Early Start	Late Start	Early Finish	Late Finish
1	A	5 days	2,4SS+3 days	0 days	0 days	9/25/2006	9/25/2006	9/29/2006	9/29/2006
2	D	10 days	3,5	0 days	0 days	9/30/2006	9/30/2006	10/9/2006	10/9/2006
3	F	6 days	6FF	5 days	6 days	10/10/2006	10/16/2006	10/15/2006	10/21/2006
4	B	1 day	5,7SS,8,2FF	0 days	3 days	9/28/2006	10/1/2006	9/28/2006	10/1/2006
5	G	10 days	6	0 days	0 days	10/10/2006	10/10/2006	10/19/2006	10/19/2006
6	H	2 days		0 days	0 days	10/20/2006	10/20/2006	10/21/2006	10/21/2006
7	C	4 days	8	0 days	3 days	9/28/2006	10/1/2006	10/1/2006	10/4/2006
8	E	15 days	6	3 days	3 days	10/2/2006	10/5/2006	10/16/2006	10/19/2006



= critical path

Figure 7: Critical Path Example

What is critical path? Despite what you may have heard, critical path is NOT the dotted lines many Program Mangers physically draw between events on their top level PowerPoint program schedule. Critical path is something that is calculated by a scheduling tool using a properly networked schedule as shown in Figure 7. The calculated critical path shows the activities that cannot be delayed without delaying the finish of a project and should be used to alert the Team where most of the schedule risk will occur. For Program Managers and IPT leads, this is valuable information needed to formulate risk mitigation strategies.

On a properly networked schedule, you can calculate critical paths for a multitude of different scenarios. Maybe the PM requests the critical path to program completion – generally called "Program Critical Path'. Maybe the PM wants to understand the critical path to the next major milestone. Maybe the Engineering Lead needs to understand the critical path to the next significant Engineering event. A properly networked schedule will allow you to perform these calculations. Keep in mind that it is not unusual to have more than one critical path on a project. This occurs when two or more paths tie for the longest path. In this event, schedule risk is increased because there is an increased number of ways the project could be delayed.

Does a program's critical path ever change? Absolutely! A program's critical path is always changing. To explain why, you first need to understand the term "Total Float". Total Float is simply how much time a particular activity can slip (be delayed) before its path changes the "Critical Path". If an item is on the critical path, it is on the path that has the lowest total float to the selected end point. By understanding the term 'total float', it becomes obvious to see that any activity that slips past its original due

date can eventually run out of total float and impact the program critical path. A good PM will frequently conduct a critical path analysis to identify the tasks that impose the most schedule risk to the program. Or in simpler terms - identify and deal with the alligator(s) closest to the boat!

Did you notice above that we said "LOWEST float" vice just stating "zero float"? That's because through scheduling tool options, you may see a critical path with 'zero float', 'positive float' (i.e., a value of 1 or greater) or even 'negative float' (-1 or less) – Yes, it is true! Therefore, you need to know how the critical path was determined, or is being represented, to understand what 'Total Float' value you should expect.

To give an example of how float could be other than zero: perhaps a prime has a contract end date of 01 June 2020 for delivering the final product. The prime's latest and greatest schedule shows the product to be delivered by 01 March 2020. In this scenario, the prime can either show critical path as a 'zero float' path through the March 1st milestone or, through scheduling tool options, the prime may choose to show "Total Float" in reference to the contractual end date – in which case the prime's critical path would show a positive three-month calendar float (much greater than zero yet still the same program critical path).

Let's go the other way now and state the prime's latest schedule shows the product to be delivered by 01 August 2020. Now the prime can once again show critical path as a 'zero float' path through the August 1st milestone or, through scheduling tool options, the prime may choose to show "Total Float" in reference to the contractual end date – in which case the prime's critical path would show a negative two month calendar float (much less than zero yet, once again, the same program critical path).

"Level of Effort" tasks can prevent the calculation of good critical paths if they are not linked correctly. You'll see more on this in Section VI b.

V.d. Near-Critical Path

So what's near-critical path? This is a term used for items in the schedule not directly on critical path but close enough that if issues arise they could possibly match or overtake the existing critical path. Teams managing critical and near-critical tasks are addressing those items with the highest schedule risk to completing their respective goals (both technical and contractual).

So, what is a good Total Float value that a team should be concerned with to encapsulate both critical and near-critical tasks? That's up to the Program Manager's discretion but considerations should include what is a manageable amount that the team can effectively address and how often is the schedule updated. At NAVAIR, we have seen teams define near-critical as items with five working days (one week) or less total float while other teams define it as 22 working days (one month) or less total float. Some of these differences were a result of how often the prime calculates the schedule – if weekly, five days may be a good value to use to see what could pop up in a week onto critical path, while if calculating monthly, 22 may be a better value. In these cases the value selected matched the timetable between schedule calculations – essentially ensuring the team was looking at all tasks, that if not worked a single day since the last calculation, could possibly be on critical path.

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VI. Best Practices

"Weaseling out of things is important to learn. It's what separates us from the animals ... except the weasel." -Homer Simpson

The following best practices have been identified, each representing an approach to the development and/or management of an IMS that aided in the successful execution of numerous programs. Not all of the best practices may be applicable to your program. Some will need to be tailored to meet your specific demands. Work with your AIR-4.2 Schedule Analysts or Competency personnel to tailor these best practices as required.

VI.a. General Information

- As questions on building or analyzing a schedule arise, please contact your team's AIR-4.2.3 representative or, if one is not assigned, call AIR-4.2.3 directly. AIR-4.2.3's senior scheduling subject matter experts enjoy answering scheduling questions (and 'meaning of life' questions during off-hours). Please remember that AIR-4.2.3 considers no scheduling question as too menial or unimportant – so ask away!

- **Build a Government IMS!**
  - **Government is NOT exempt.** It is strongly recommended you consider developing an IMS to plan and manage to for government events and milestones (e.g., schedule for GFE/GFI delivery, events leading up to the Milestone B, etc.) and provide it to your contractor. Feedback from Government programs that have used them has been very positive. Even if plans are not to have the Government IMS and prime IMS into a singular file, a Government PM should consider having a Government IMS.

- **Don't Forget or Overlook Staffing!**
  - Evaluate your staffing needs. Do you need a full time scheduler and/or a scheduling analyst?
  - Did you request a scheduler and/or scheduling analyst?
  - Are your requirements loaded in Command Staffing?
  - Don't forget to capture the cost in your funding profile
  - Talk to BFM to get funding ready
  - Please contact AIR-4.2.3 at the first consideration of having a Government IMS or possible need of a Schedule Analyst to review a prime's IMS. AIR-

4.2.3 can provide guidance and possible resources to perform these functions - remember the mottos 'early bird gets the worm' and 'first come first served' do apply!

- **Try to Build in Safeties to Ensure Completion of the Project!**
  - **Schedule Margin:** Any plan that contains no margin for risk (cost or schedule) is considered high-risk. Conceptually, a contract should not be awarded to the finish date of the last task established by the program critical path. Instead the contractual end of the period of performance should consider some measure of margin to ensure there is some ability to account for risks that are likely to occur during execution of the effort. A best practice might be for the Government PM to ensure there is a buffer (an actual gap) between the Contract Completion date and the true Government need date established by Senior Naval Leadership (we will call this "Period of Performance Margin"). Then, if the Contractor does exhaust all of the slack to the Contract Complete Milestone, there is still margin to absorb additional slips without impacting the external Navy 'need' date. There are two types of margins:
    - Period of Performance Margin (margin to government need date)
    - Contractual Period of Performance Margin (i.e., margin between the prime's current schedule projection to a selected milestone and the contractual obligation date to that milestone)
      - Like the Government PM, a prime PM will want to build or execute a schedule so that there is some margin between a schedule milestone to IMS dates
  - Team Experience/Knowledge: A PM starting a project with a team experienced in building/using schedules (both Government and Prime) has a huge advantage in overcoming potential schedule issues. Unfortunately, this scenario is not always an available option - so what should a PM do if personnel are not well versed in schedules? Besides having them review this guide, try to have your key personnel:
    - Attend available schedule training (described in section VIII)
    - Make sure staffing covers any needed scheduler(s) and/or schedule analyst(s) positions
    - Lead by Example – Ensure personnel know intentions and expectations with knowing schedules (see "Leadership and Accountability" section).

- **Leadership and Accountability**

Every level of leadership from our Admiral and PEOs down to Program Managers and IPT Leads should be engaged.

Do it!

- Leadership needs to demonstrate their commitment in using the IMS as a management tool.
- Leadership's commitment to emphasizing the importance of an IMS will drive PMs/IPTLs to get IMS training and develop standardized knowledge of IMS.
- Leadership needs to encourage appropriate training at all levels.
- Different levels of leadership need to review the IMS at different (appropriate) levels of detail – see the "IMS GOLD CARD" in Appendix B for what IMS questions different levels of leadership should ask.
- Make sure accountability (cost, schedule, performance) and ownership at all levels is understood. Hold IPTLs and CAM counter-parts accountable.

Best Practice

More "Help" – Grey Hair Reviews

Early in your process, conducting an independent senior review on your IMS (at the Program Managers discretion, of course) could pay huge dividends! This review could help determine executability and identify top risks areas for your program. There are probably dozens of ways to approach this and this guidebook will give you some pointers. For instance, your review could be handled like a spec review board or a tech review board. And rather than "inspect in quality" you could use your Grey-Hair Reviewers to help "build-in" quality by maybe doing "incremental" reviews along the way. You can also do a "wall-walk" evaluation of your IMS with the Grey Hair Reviewers. It is best if all (or most) of the competencies are represented for your review(s), and, it is recommended you get all stakeholders to sign-off on the IMS when all is said and done. Your program office already has Engineers, Logisticians, Project Managers and IPTL, etc., reviewing and working on your IMS, but over time they may become a little too close to it to see problems or maybe lack the experience to catch things. So, borrowing the time of some <u>independent</u> reviewers is really best. Work with your PEO office to help get the support you need. NAVAIR has a commitment to using IMSs as management tool and will ensure the appropriate support. If your Program is planning on a major modification or a large ECP for some critical development work, you probably need an IMS, and a Grey Hair Review will help!

Tip or Advice

This works for both contractor IMS and Government IMS.
As a matter of fact, you really need to do them together!

Always perform an IMS "wall walk" by printing the IMS on large paper, hanging it on a wall, and reviewing it thoroughly as a group.

VI.b. Building the Perfect Beast

- **Advanced Planning on the IMS Will Save You Time Later**
  - AIR-4.2.3 is your local expert; contact them initially to discuss strategy
  - Take appropriate training (see *Section VIII, Training* in this guide)
  - Build an IMS then determine budget spread. Ultimately, this will be an iterative process.
  - Ensure your contract to the prime contains all IMS requirements
    - An appropriate IMS CDRL (see AIR-4.2.3 for the latest version)
    - States ANY additional expectations, not already covered by the IMS Data Item Description (DID), in the SOW. Please do not assume that a prime will naturally do something outside of what is stated in the IMS DID or their system description because you believe they will understand that it is the best for the team and/or program. **Having your expectations in writing will make everyone's life easier** – for the prime (in seeing and signing to what is expected) and the Government (in setting expectations and being able to hold the prime accountable to these expectations).
      - Examples of SOW adds could be:
        - Complete integration of subcontractor schedules (i.e., the schedules, as used at the subs' sites, are fully included in the prime's IMS).
        - Any expectations for an initial Integrated Baseline Review (IBR) to occur earlier than during the sixth month from contract award.
        - Having a detail planning window (i.e., the work broken down to the tasks that will be executed vice being in planning packages) that exceeds the minimum requirements as stated by the prime's System Description. This could be for IBR or for the entire contract.
          - An example would be if the Government wants to see 12 months of detail planning while the prime's system description allows for a minimum of three months.
      - AIR-4.2.3 has standard SOW wording concerning the IMS – the key word here is 'STANDARD' - if you have unique requirements or expectations, such as the earlier SOW examples, tell AIR-4.2.3 so

you can be assured to receive a SOW version that meets your needs.

- Place into the SOW, wording to capture a requirement for weekly IMS status updates as part of a battle rhythm and include wording stating that 'leading indicators' should be a key part of the routine meetings.

- As you can imagine, 'Advanced Planning' requires an understanding of the essential data items that are/were used in developing the IMS (e.g., Basis of Estimates, SOW etc...) and then using the same approach for building the IMS in the routine process of maintaining and executing the IMS. Appendix I (IMS Checklist for IPT) is an aid for personnel to use as a template in verifying that key items have been addressed while developing the IMS (Section A of the checklist) and maintaining the IMS (Section B of the checklist). Note that the checklist has a block for the Government person responsible for the work to acknowledge completion and a block for the Government person to state that the Prime (if a Prime is involved) also has satisfied the item.

- **Not so Tried But (Hopefully) True Way of Improving Schedule Realism:**
  - Top-Down versus Bottom-up planning: Impress onto the schedule builders the importance of having a realistic schedule, with acceptable risk (i.e., non-high risk), that is well-built from the bottom-up and displays a true and achievable end date vice having a schedule that satisfies a top level end date but is not supported by well-built lower level tasks (i.e., essentially "backing into" a schedule)
  - Unconstrained scheduling: Instead of starting with an end date determined from a very top level schedule and "backing into" the schedule all of the lower level tasks, have the contractors submit the lowest risk (unconstrained) schedule that was built bottom-up.
  - Establishing competitive environment contracts (e.g., dual primes in Top Down phase) is a relatively new approach at NAVAIR. One of the hopeful results from this approach is that primes will take an even heavier consideration to Government requests for lower risk schedules with better IMS construction and management. Primes in this atmosphere should determine the best value and risk acceptable to their customer in hopes of earning the Engineering Manufacturing Development (EMD) contract award. In a non-competitive environment the government and contractor can collaborate on possible "trades" to bring schedule back into an acceptable range. In either case, a more realistic understanding of the schedule risks

inherent in the effort will benefit the entire team and help to establish proactive mitigation priorities rather than wait for risks to be realized.

- **Flow down of IMS Requirements to Appropriate Subcontractors is Important.**
  - Identify who your critical subs are and make sure IMS/EVM flow down happens with those contractors. Critical subcontractor determination is a "risk-based" decision. See "*Subcontractor 101*" guidebook, Section XI References for further information.

    Note - don't fall into the following traps:
    - ECPs don't need a separate IMS. Note – sometimes this is true.
    - Only subs that are on non-FFP contracts of over $20M in value need (or, should have) an IMS. Regardless of dollar value or contract type you should consider developing an IMS based on risk.
  - Prior to awarding the contract, determine what effort the prime is stating that subcontractors will perform. These efforts, per the IMS DID, will be represented in the prime's IMS at a minimum by milestones showing the hand-offs/touch-points between the prime and subs. But what if you wanted more detail on the sub effort? What if the sub effort is the most critical area, or perhaps just considered non-low risk? What can we do?....Well, put into the contract your expectations to see the effort(s):
    - If any of these developmental or WBS/ critical elements/ items are deemed to be medium-to-high risk, the Government could require, via the SOW, that these sub-efforts have their entire schedules placed into the prime's sub (full integration) – thereby allowing the Government to have one schedule capturing deep detail on risky work and facilitate better weekly status meeting insight onto these efforts.
    - If the prime passes on an IMS requirements via an SDRL, to a sub who is not already fully integrated in the prime's IMS, the Government can ask the prime to send those SDRLs along with the prime's IMS CDRL.
    - If you have other risky subcontractor effort, regardless of reason, you may want to consider revising the contract for the prime to send you, via CDRL, an IMS or some kind of schedule so you can observe progress.
  - Primes should incorporate IMS requirements (Appendix E) within appropriate subcontract SDRLs.

- **Creating an IMS**
  - Some basic tips are:
    - Start with clear and understood requirements – both in scope and expected period of performance.

- Your IMS will always be inadequate unless you include subcontractors up front.
- Create program Level ACQ board to review IMS milestones/ make decisions.
- Government tasking IS NOT exempt from being integrated into schedule as per IMS DID requirements (i.e., identifiers of hand-offs/ touch-points).
- IMP and IMS need to work together.
- Request your technical team to think of milestones (zero duration items) that could be placed into the IMS as checkpoints for the technical community to denote technical progress towards major SETR events. Utilize these items along with an IMP (if on contract).

o Ensure that enough resources are available in order to create a quality IMS. Perhaps a larger number of schedulers are needed upfront to support establishing a Performance Measurement Baseline (PMB) and the needed detail planning window to support a successful IBR.

o Have stakeholder sign off on the schedule for accountability. Provide venue for stakeholder buy-in. (See "*Grey-Hair Review*", Section VI a.)

o Government needs to provide the contractor with their key acquisition milestones and events so the Contractor's proposed IMS will support the government's schedule.

o Need to prevent forcing a schedule into an unrealistic period of performance.

o Government must understand and accept the implications of driving the increased requirements into the process.

o Provide solid and realistic baseline requirement up front with sufficient detail in the IMS to allow for day to day management.

o Your IMS should not be so detailed that it is not useful. Seek "lessons learned" from those that have gone before.

o PMs/IPT Leads should carefully plan for IMS development/maintenance tasks to ensure that the IMS is built correctly to the level of detail required and use the AIR-4.2 IMS assessment (see Appendix C) to continually evaluate the IMS.

o Creating an IMS takes a tremendous amount of time. IPTLs should spend time ensuring links are correct. The sequence of events and the interdependencies of tasks should be linked. Additionally, the IPTL should spend time QA-ing to ensure realistic estimates of task durations. Tasks should be small and measurable. Tasks such as software development, apply EVM-type criteria as to when/how we would take credit. Once the IMS is established, consider a full-time government scheduler who will work with

- By contract, the contractor is responsible for the contractor IMS. Government should participate in construction of the IMS. The contractor is responsible for maintaining it; and, an AIR-4.2 scheduler should verify compliance.
- The IMS must be at a level of detail that allows the program to manage its work, report progress, model the effect of changes and risks, and meet the needs of the customer, contractor, and stakeholders. The IMS must have methods by which the impact of changes can be readily assessed without added constraints from elements that have not been intimately involved in the day-to-day management of a complex program. Everyone must agree on the verbiage contained within DI-MGMT-81650, not have the arguments stating that the contractor's interpretation is incorrect. In addition, the Government must understand and accept the implications of driving the increased requirements into the process. Accept that guidelines are just that, guidelines not policy.
- Excel spreadsheet schedules do not allow you to assess risk or see linkages between tasks.
- Understand that an IMS does not show the dates for events and milestones you <u>need</u> to achieve. It shows the dates and milestones you <u>will</u> achieve, unless you take action.

- AIR-4.2 has good metrics on what makes a good/bad schedule.
- The Contractor's IMS should include government GFE/GFI need dates.
- The Contractor and Government tasks should be integrated into "one" schedule.
- The prime contractor's IMS should be linked with subcontractor's IMS
- Build an IMP code for deliverables.
- Don't transfer information from the actual IMS to a PowerPoint briefing without understanding the big picture/content. The tendency is to make the IMS show you what you want to see and not reality.
- The Government should be involved with building the Contractor IMS up front and early; this improves accuracy and communication.
- Don't forget long lead items in your IMS.
- The IMS submitted in the Contractor's proposal should be similar in "content, detail, accuracy" as the one used for the IBR after award.

- **Sub Contractor Integration**

- Primes should incorporate DI-MGMT-81650 requirements within their subcontract CDRLs. It is important to Flow-Down IMS requirements to appropriate subcontractors.
- "Which" subcontractors should get IMS Flow-Down is based on risk analysis which includes not only technical/programmatic risk but also health of subcontractor as well.
- See Section IX, "*Contract Considerations*".

Technically Speaking

Sound cost estimating and schedule development practices are necessary regardless of the existence (or size) of the supply chain. But, business plans that are disconnected from the technical experts will rarely result in realistic baselines. It is the technical team which comes up with the technical assumptions of the cost or schedule estimate. The best estimators and schedulers in the world will not make up for lack of technical involvement in the planning and management of the effort. Program Managers should expect the technical team to address and be accountable for their own budgets, baselines, schedules, performance monitoring, etc., not just the technical aspects of the program. This is true of the Government as well as the Contractor, during the bid and proposal phase, as well as execution and during all phases of the Acquisition lifecycle (EMD, LRIP, Full Rate Production, etc.).

Guidelines on Building a Good IMS:

Your IMS should only contain the necessary leads, lags, constraints, and logic ties required to accurately reflect how your work will be performed. Once these are appropriately laid into your IMS, the resultant total float "is what it is". The issue is; history has shown that these items have been used inappropriately; and, in excess. Therefore, percentages shown in the following items represent potential issue **flags** that require further evaluation to determine if an issue truly exists. Evaluation of the schedule is greatly facilitated when the builders of the IMSs place notes either in their IMSs or capture them externally (e.g., Excel spreadsheet) expressing why each item, such as the lag or lead, is being used.

- **Leads -** Leads should not be used; therefore, the **goal for this metric is 0.**
- **Lag** - The number of relationships with lags should be minimized; **flag** is greater than **5%.**
- **Constraints** – The number of tasks with hard constraints; **flag** is greater than **5%.**
- **Relationship Types** – The Finish-to-Start (FS) relationship type ("once the predecessor is finished, the successor can start") provides a logical path

- **Float** – As previously stated, float is controlled by the use of logic ties, constraints, leads, and lags. For the number of tasks with a float of 44 or more workdays (high float) the **flag** is greater than **5%.**
- **Negative Float** – Defined as float with a value of less than zero. Ideally, there **should not be any** negative float in the schedule. Negative float can only be present through the use of deadlines, constraints or the presence of "out-of-sequence" (which means in-progress tasks are worked in a sequence other than how the logic ties dictate).
- **Logic** - The number of tasks without predecessors and/or successors; **flag** is greater than **5%.** Essentially, the only tasks that shouldn't have both a predecessor and successor are the first and last tasks in your schedule.
- **Duration** – Duration length of a task is dependent upon three key items:

  1st) Every task should have a defined work scope with a clear entry/initiation point and a defined completion/end point – i.e., no task should be so vague in work scope that a Control Account Manager (CAM) cannot define the duration required to perform the work (often we have seen this where CAMs will incorrectly shorten the length of a task to fit a fiscal window for reporting purpose vice having duration based on the actual endpoint of the work).

  2nd) Known hand-offs should be represented via Finish–to-Start relationships as much as possible. This item, correlates with all previous discussions in this doc that states lags/leads and constraints should never be used in place of appropriate logic ties between tasks; e.g., an originally three month task involved performing a test and gathering test data (2 month effort) and then writing a official report on that test (1 month effort) by the same CAM. Upon a schedule scrub with the team, it is determined that another CAM has existent effort within the IMS that also requires the test data to initiate their effort – the appropriate action to be taken should be for the 1 first CAM to break up the three month task into the two efforts (a two month task for test and gather data, a one month task to write a report) and the second CAM to make a finish-to-start logic tie of his effort directly off of the 'test and gather' task - vice keeping the three month task as is and having the second CAM make a start-to start relationship with a two month lag of the first CAM's effort.

3rd) This item relates to tasks in work packages (vice planning package tasks): Can the CAM effectively manage the task at the duration stated – i.e., does the CAM have an effective means to measure earned value performance and provide accurate forecast dates to support the program business rhythm. Though this may sound simple – it is the most important. Schedulers who have been around awhile have all experienced the scenario in which a CAM, who had a three month or longer task, consistently stated no change in the forecasted end date at every schedule update until the update in which the task was expected to be called done, the CAM tells you that 50% more time is needed – WHY DOES THIS HAPPEN? What appears to be the answer is the inappropriate action of people not reporting bad progress, to avoid management scrutiny, in hope that they will make up the effort in the time remaining to avoid any conflicts. Often, personnel believe that hiding poor performance is reduced by having shorter tasks in the schedule because a CAM may have a harder time covering up the fact of a task being done or not – unfortunately, this is not a fool-proof method. Basically, unless there are checks into CAM reporting accuracy, there is always the chance of false reporting occurring. IMS having 5% or more population of incomplete work package tasks with 44 or more work days duration is a flag. The flag should be a question as to whether shorter durations are needed and the answer should be based on whether the three factors are being correctly applied or not.

- **Invalid Dates** – There should not be any invalid dates in the schedule. As stated in the IMS DID, status (start, progress and finish) needs to be accurately identified and represented in the IMS. For example: If you're statusing your IMS on 1 January 2010, then no tasks in the IMS should show an 'ACTUAL START' or 'ACTUAL FINISH' later than 1 Jan (e.g., having a 1 February 2010 finish date would be invalid as you can't say that it actually finished at some point in the future). Also, forecast start and finish dates cannot sit in the past without an actual date applied – that means, if updating on 1 Jan, I can't show a task sitting with no 'Actual Finish' date in the past yet having a forecast finish date in the past (such as 15 Dec 2009) – how is that possible? Either the work is already done, or the remaining work needs to show as starting on 1 Jan and finishing later as required.
- **Resources** – Provides verification that all tasks with durations greater than zero have dollars or hours assigned (e.g., no tasks with 'actual' starts and/or finishes in future, no tasks in past with empty actual starts and/or actual finishes).

- **Missed Tasks** – Helps identify how well or poorly the schedule is meeting the baseline plan. The number of "Missed Tasks" **should not exceed 5%.**
- **Critical Path** – If the project completion date (or other milestone) is not delayed in direct proportion to the amount of intentional slip that is introduced into the schedule as part of this test, then there is broken logic somewhere in the network. Broken logic is the result of missing predecessors and/or successors on tasks where they are needed.
- **Critical Path Length Index (CPLI)** – Measures critical path "realism" relative to the forecasted finish date. Target is "1.00" with a threshold of "0.95"; Greater than 1.00 = favorable; Less than 1.00 = unfavorable.
- **Baseline Execution Index (BEI)** – Measures the number of tasks that were completed as a ratio to those tasks that <u>should have</u> been completed to date according to the original (baseline) plan. Target efficiency ratio is "1.00" with a threshold of "0.95"; Greater than 1.00 = favorable; Less than 1.00 = unfavorable.
- **Level of Effort (LOE)** - Level of Effort tasks are often included in the IMS and may create difficulty determining the critical path if they are not correctly linked. Level of Effort activity should never drive a discrete effort; in other words, the finish of the LOE shouldn't be linked to a discrete effort. This is usually more of a concern in contractor schedulers where resources are included and integration between the schedule and cost system is important. By abiding by these rules for Level of Effort or support type tasks, the LOE tasks in the schedule (Government or Contractor) won't pose a problem later when determining critical path and won't get in the way of running a Schedule Risk Assessment.
  - 1) Always link Level of Effort as a "Start to Start" successor with the tasks or effort that it supports.
  - 2) Create a collector milestone at the end of the schedule that all LOE tasks will be linked to.

  By using these rules, the LOE tasks will never show up on the critical path to the end milestone.

New Approach – Promoting Culture Change through Metrics/Measurements and CDRL Approach!!

Current Philosophy

Currently, we collect IMS metrics through end of contract. (Do we need them for that long?)

We also only "comment" on the EVM CDRLs (IMS & CPR) vice "accepting or rejecting" them. Why? Shouldn't we hold contractors accountable? Recently, "withholds" for poor IMS CDRLs have not occurred.

Also, we expect to jump right into a full-up IMS, when there is no IMS "initial detail planning window", to support the IBR. (Perhaps changes to contract language are needed!)

Proposed Approaches

- Where it is deemed appropriate, for new contracts, add that the initial IMS CDRL deliverable should include detailed planning for all tasks with a baseline start (BLs) date of not less than 12 months (recommended) from contract award. (i.e., you want to have a minimum of a year's detailed planning reflected in that initial IMS CDRL deliverable.)
    - Detailed planning: applies to all tasks with a BLs less than "X" months from contract award be detailed planned (i.e., not in planning package status)
    - PM/IPTL should determine how far detail initial planning, 12 months or greater, should be applied.
        - Leadership should consider whether detailed planning application be up through a specific major program milestone (Preliminary Design Review (PDR), Critical Design Review (CDR), etc.) or some other understandable/ measurable point.
    - Program Team needs to understand the prime's process for maintaining a detailed planning window throughout program execution.

Structured Approach to Correct IMS Issues

- The goal is to have good Health Metrics for the entire IMS.
    - Therefore, Health metrics must continue to be measured for the entire program (i.e., through contract completion).
- All metrics must be validated. If IMS issues are determined, the Program Team must apply a structured approach to correct.
    - The recommended structured approach is to apply concentrated focus on a specific window.
        - The first window must include 'detailed planning' tasks and go out to an agreed to milestone.
    - Satisfaction of issues in the first window will initiate focus to move onto the next subsequent window.
        - Each subsequent window must include the previous and go out to a specific milestone until the entire IMS is addressed.

        - The process is continuous throughout the program lifecycle.
- Expectation needs to come from PM/IPTL that the Government team is accountable to validate all metrics ("Green and non-Green").
    - Issues ("non-Green" or false 'Green' conditions) may lead into IMS CDRL rejections and require resolution.
    - PM/IPTL leverage/actions on IMS issues:
        - Initiate structured approach to resolve
        - Determine if IMS CDRL should be "rejected"
            - Determine the number of IMS CDRL rejections that will result in the action of 'with-holds' until issue resolution
        - Unsatisfactory metrics should strongly influence the Program Team in taking the next corrective actions (i.e., CDRL rejections, withholds etc.)

VI.c. Managing to the Perfect Beast

- **Establish a Battle Rhythm:**
    - We found that programs with a well-established/advertised DRUMBEAT for updating, reviewing, and disseminating IMS information had better overall communication and knowledge of their program including risks and mitigation plans. We found a "weekly" DRUMBEAT worked best. Included in this weekly rhythm should be opportunity for internal, government only review, and combined review with Contractor.
        - Each individual member of the Government team and their industry counterpart should meet prior to the weekly meeting. Together, both should be prepared to discuss, in depth, the progress, concerns, and help needed for their respective areas at the program level meeting. The program team leader should ensure that issues and help needed are conveyed to the PMA if they are not in attendance.
        - Section V, "Building and Managing to an IMS", provides a process flow diagram including weekly team meetings.
    - Establish a culture that focuses on logic ties and uses the IMS in day to day work.
    - Risks and opportunity management should be included in the weekly battle rhythm. As risks are identified and mitigation plans developed, you need to understand the schedule impact to execute the mitigation plan. Also, to understand the impact to the schedule if the risk is realized.

- **Tips and True-isms for Managing to an IMS**

- The IMS is a useless tool if we ignore what it tells us.
- The IMS is the most effective thing we have for forecasting the future.
- Be aware that Poor Requirements identification or changes in requirements impact the IMS (e.g. schedule growth). For tips on how to improve on requirements quality see "Subcontractor 101" guidebook, referenced in Section XI.
- Reporting variances should be looked at as an opportunity to improve.
- The IMS is the bread and butter of EVM.
  - Use the EVM GOLD Card.
- The IMS must be mature before initiating the program.
- Managing to critical path and near critical path and monitoring resources such as manpower are keys to "success."
- Establish a routine program office process for using the IMS in planning and execution of your program.
- Have Government-networked schedule as well as contractor and seriously consider networking them together as well.
- Consider human resource requirements up front and early in your program (e.g., Do you need a full-time scheduler?).
- Some of the key "basics" are:
  - Use the WBS.
  - Establish Communication Rhythm.
  - Roles/Responsibilities for the team.
  - Establish Change Management, Risk Management procedures.
  - Share Evaluation Tool Sets, etc.
- An IMS dashboard (*Metrics, Section VII*) could be an excellent tool for regular review by higher level leadership, thus emphasizing the importance of an IMS and driving PMs/IPTLs to manage using the IMS and dashboard, vice using it as a report only.
- An IMS dashboard (*Metrics, Section VII*) might make it easier for an inexperienced person to use the IMS. Properly done, an IMS dashboard could greatly enhance the usefulness of the IMS in the following ways:
  - Increase IPT lead commitment to the process; enhanced ownership.
  - Streamline management using IMS.
  - Focused IMS deep dives.
  - Inspire confidence in IMS or at least awareness of its weaknesses/limitations.
- Use IMS similar to your Microsoft calendar. It takes discipline from the team, but it allows the team to see clear expectations for what and when they are expected to do something. The IMS is a tool to manage the future of the project as well as the present and when used consistently it improves

the team's ability to forecast and predict durations of tasks adding to the fidelity of proposals and future project schedules.

- The IMS must be the only schedule.
- The IMS gives you the capability to do "what-if" drills and sensitivity analysis of specific events, and their impact to critical path. Knowing float and balancing resources is key.
- An IMS allows you to see the impacts of seemingly insignificant events falling behind. It also allows us to build in float in critical areas to reduce risk.
- Risk Cube - Risky Business in an Uncertain World
  - Risk assessments should be routinely conducted on proposed schedule and cost estimates and reassessed during execution. (For more on Schedule Risk Assessment see Appendix F.)

Structured Approach - EXAMPLE of Initiation (As Shown in Figure 8)

- Contract is awarded with first major milestone (PDR) occurring two months beyond the detailed planning window (PDR stands at 14 months and the next milestone is CDR at 26 months after contract award)
  - Satisfactory metrics for the entire IMS is an expectation of each IMS CDRL
- First IMS CDRL deliverable analysis/validation from the Program Team resulted in unsatisfactory metrics (IMS Issues)
  - As a result, the PM/IPTL initiates the structured approach resolution
  - First focus area selected was from time-now through PDR (which included the detailed planning window). Continue to monitor entire IMS.
- Satisfaction of first window, results in second window of focus continuing to CDR, while monitoring of entire IMS continues.
- Move to each successive window until full resolution. Continue to monitor entire IMS.

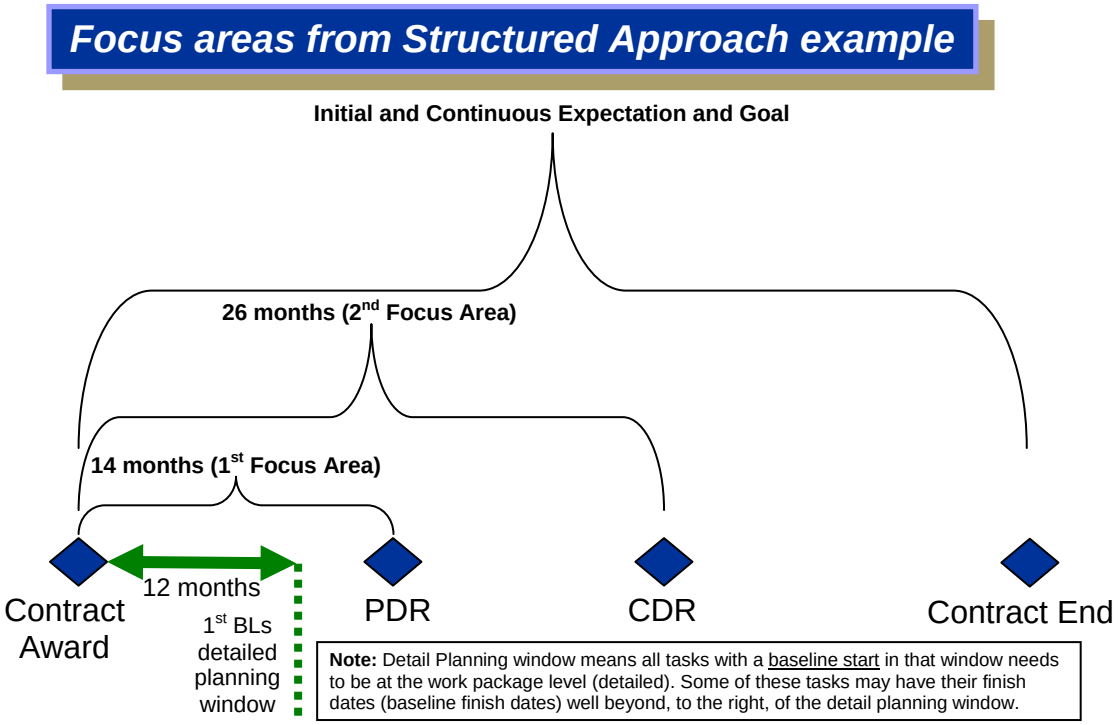

Figure 8: Example of Structured Approach

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VII. Metrics

"To measure is to know." - Lord Kelvin

Metrics are a very important ingredient in making our program successful. Remember the old adage "you get what you measure!" If you've set your program up properly you should be getting monthly schedule analysis reports from your prime. An excellent example of one is shown in Appendix G. This report contains many metrics that can help you understand your program. The following are examples of various forms of metrics typically contained within schedule analysis reports that can help you manage your program to a successful conclusion. Remember, these are only examples and are meant to give you an idea of the types of metrics available. For more detail refer to Guidelines on Building a Good IMS in Section VI.b above; and Appendix G at the end of this guide.

B	C	D	E	F	G
	JUN06	JUL06	AUG06	SEP06	OCT06
Status Date:					
Total Tasks	6152	6241	6296	6297	6349
Completed Tasks	505	688	878	1194	1402
% Complete	8%	11%	14%	19%	22%
Incomplete Tasks	5647	5553	5418	5103	4947
% Incomplete	92%	89%	86%	81%	78%
Tasks Not Started	5357	5161	4953	4759	4490
Tasks in Progress	290	392	465	344	457
% w/ WBS Reference	100%	100%	100%	100%	100%
Baseline Rate	579	831	1054	1399	1632
Missing Logic	35	60	22	19	29
% Missing Logic	1%	1%	0%	0%	1%

Figure 9: Metric Sample 1.

Metric Sample 1 (Figure 9) is a typical review of basic progress to plan over time. Word of caution, just because lots of tasks were completed does not mean the right tasks were completed to maintain schedule. Remember all tasks are not created equal!! Often times when a hard task becomes "stuck", other easier tasks are started and completed out of phase to keep the program moving.

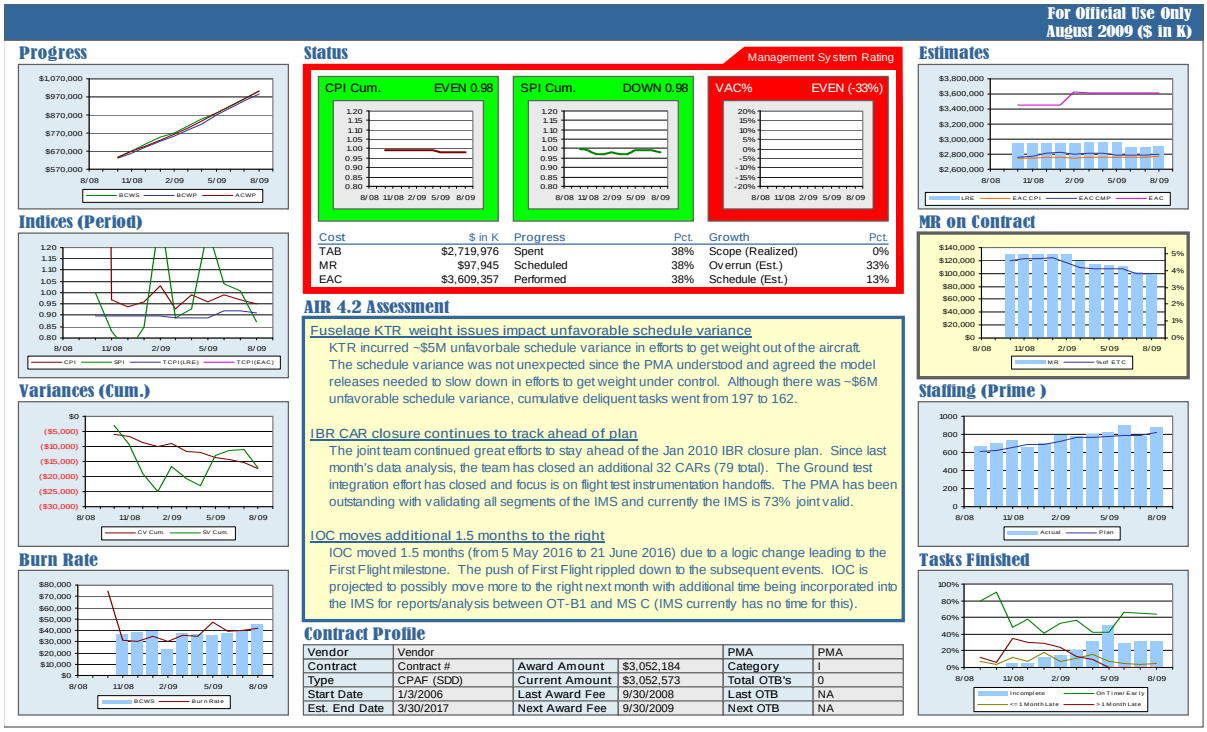

Figure 10: Metric Sample 2.

Metric Sample 2 (Figure 10) is the standard "dashboard" used in many program offices. The lower right hand side depicts task executions month-by-month, historical trend analysis as well as the number of cumulative delinquent tasks.

IMS CAR Cleanup SCORECARD

Percent Complete Through 10-18-2009

Process Area	Airframe		Avionics		Flt Controls	
	To Go	Valid	To Go	Valid	To Go	Valid
High Float	3	844	11	1,122	66	749
		100%		99%		92%
Excessive/Improper Lags	23	351	19	374	9	241
		94%		95%		96%
Major Subcontractor Incorporation *						
IFMs/Connectivity	10	31	1	571	0	192
		76%		100%		100%

Figure 11: Metric Sample 3.

Metric Sample 3 (Figure 11) is another key way to view data. In this metric we see major IPT products like airframe and avionics tracked against key IMS attributes like float, lag, etc.

		Total # detail of Tasks	Total # remaining tasks	Missing Predecessors		Missing Successors		Missing Predecessors and Successors		Tasks w/ Constraints		Durations over 60 Cal days		Number of Negative Lags *		Lags over 30 Days *	
	Raw	17224	6072	734	11%	666	10%	235	3%	1214	17%	92	1%	62	1%	157	2%
	Totals w/ Exceptions			345	5%	425	6%	235	3%	326	5%	92	1%	62	1%	157	2%
2-Mar-06	IMS Total	17224	6944	345	5%	425	6%	235	3%	326	5%	92	1%	62	1%	157	2%

Raw Metrics - Precedent Logic	1635	26.93%
Exception Metrics - Precedent Logic	1005	14.47%

0-5% - Acceptable | 6-20% - Marginal /may require improvement | 21-100% Justification or Corrective Action Requ

Figure 12: Metric Sample 4.

In Metric Sample 4 (Figure 12) we set up Business Rules for red, green, yellow color ratings so we can quickly see status of key IMS attributes such as "missing successors."

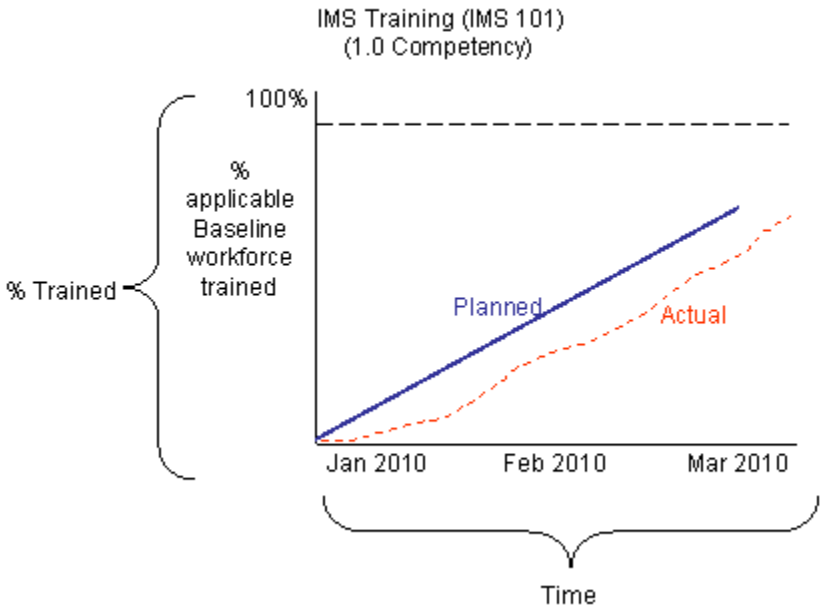

Figure 13: Metric Sample 5.

In Metric Sample 5 (Figure 13) a program office or home office competency can track the number of people trained in IMS against a plan.

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VIII. IMS Related Training

"I hated every minute of training, but I said, don't quit. Suffer now and live the rest of your life as a champion. " - Mohammed Ali

Do it!

Training is the key to successful IMS implementation! IPT leaders and their teams should take IMS training as early as possible during the development of the acquisition strategy and prior to proposal receipt. In the case of competitive source selections, IPTs need to attend training well in advance of release of the Request for Proposal. During source selection you may be asked to evaluate the offeror's IMS. Interesting point, do you think the person that puts together the IMS for the proposal has to execute it? Absolutely not! Most contractors have one group of schedulers that develop schedules for proposals but another group of schedulers that develop schedules for program execution. You need to be on your game when you are evaluating proposal schedules, either sole source or competitive, since you will have to live with it!

So, take the plunge! Training is available from two sources: AIR-4.2 and the Defense Acquisition University. From AIR-4.2, the following classes are available or about to be available:

Principles of Schedule Planning and Construction (IMS 101) - Provides the basics on how an IMS should be built. If you have never been exposed to a real IMS or understand how one is built, this class is for you!

Principles of Schedule Management and Use (IMS 201) - This class in currently under development. IMS 201 will expound on how a PM/IPTL & Program Team should "manage with"/use an IMS. Highlights include:

- Talks to Business Rhythms
- Examples of Leading Indicators & use of
- How program Tailorability applies
- Best Practices/Lessons Learned
- SOW Language, Contract DID, capturing subcontractor tasks

Advanced Scheduling Application (IMS 301). This class has not yet entered development. IMS 301 is needed only if personnel (schedulers or schedule analysts) are not familiar/proficient with IMS software (e.g., Microsoft Project, Open Plan Professional or Primavera, etc…). IMS 301 provides lessons

learned/common issues to using the selected tool that are not covered in OEM Training. Highlights include:

- Tool Settings (why these choices)
- Data Dictionary
- Basis of Assumptions Approach
- Tool Options (impact if these are turned on or off)

DAU Training offers the following:

The Defense Acquisition University offers the training course:

- BCF 263 (DAU) Principles of Schedule Management.
- BCF 262 (DAU) EVMS Validation and Surveillance
    - For an understanding of the relationship between EVM and IMS (addresses the 32 EVM guidelines)

Additional IMS training is available through your Program Management Competency:

"Brown Bag" training developed by AIR-4.2 is available upon request. It is approximately 45 minutes long and in no way fully trains you in IMS or makes you an IMS expert. However, it will familiarize you with high level concepts and provides a nice overview of Integrated Master Schedules.
Interested? For more information contact AIR-4.2 or your scheduler.

Additional (non AIR-4.2) Schedule Tool Training:

For schedulers and non-schedulers: the best way to learn a schedule tool is through a controlled process consisting of personalized (tailored to your job needs) one-on-one training combined with on-the-job-experience of using the scheduling tool – with both mentored by qualified instructors and/ or experienced schedulers.

The ideal situation of mentoring personnel being available at your worksite is not always a viable option, therefore the following lists alternative learning methods available to you for the Primavera, Open Plan Professional and Microsoft Project scheduling tools.

1. Utilize 'HELP' files: Each schedule tool comes equipped with in-depth 'help' files. These 'HELP' files contain, generally via a 'content tab', a hierarchal approach to introducing the functionality of the tool. In addition, these tools include 'search' capabilities that allow quick access to specific areas/ topics. Even the most seasoned scheduler utilizes these 'HELP' files when trying to better understand a tool operation.

2. Some schedule tool vendors offer ***free*** webcasts, demos or 'white papers' on their sites to help better explain the operation and functionality of their products – (See the web-links listed under # 3 below).

   Ensure that the training you select is for the version of scheduling tool in your possession (e.g., one would not want to attend 'Microsoft Project 2007' training if scheduling tool 'Microsoft Project 2003' is what you have).

3. Some schedule tool vendors offer further detail in ***purchased*** webcasts or classroom training sessions.

   The same caution about 'tool version' applies.

   The following are links to training areas for three schedule tools:

   Microsoft Project:
   http://office.microsoft.com/en-us/training/cr061832711033.aspx

   Open Plan Professional Demos and Webcasts (by DELTEK):
   http://www.deltek.com/products/epm/learningtools.asp

   Primavera Training (by ORACLE):
   http://education.oracle.co.uk/html/oracle/30US/SCHED_MP_1431.htm

The following are some examples of possible classroom courses:

Primavera (P6) – a product of 'ORACLE':

1. Available training and web-link from ORACLE (Primavera owner): **Basic and Advanced Project Management in Primavera P6 Rel 6.2 - LVC (E-Business Suite)**

   Course Objective: Learn how to use Primavera to manage a project from creation through execution. Topics include adding activities, scheduling, assigning resources, updating the project schedule, and reporting. This course also provides in-depth project management training in P6. Topics include updating baselines, importing and exporting project data, and top-down budgeting.

   NAVAIR note: The above is a five day course. ORACLE does not offer 'basic only' training sessions

2. Additional non-ORACLE training and web-link from Innovative Management Solutions (non-vendor): **Oracle Primavera Training - P6 Course (102)**

   Course Objective: Provides hands on Oracle Primavera training for Oracle's client/server-based solution, leading participants through the entire project life cycle, from planning to execution. Topics include adding activities, assigning resources, and creating a baseline. Participants also will gain a thorough background in the concepts of planning and scheduling. All workshops and instruction stress the three basic elements of project management: schedule, resource and cost

   NAVAIR note: The above is a three day course. Innovative Management Solutions is an Oracle Certified Advantage Partner. Innovative Management Solutions offers training for all Oracle Primavera and Risk Analysis (formerly Pertmaster) software products. Innovative Management Solutions has more certified Oracle Primavera Trainers than any other partner of Primavera, and has trained all over the world.

Open Plan Professional (OPP) – a product of 'DELTEK':

1. Available training and web-link from DELTEK (OPP owner): **Deltek Open Plan Professional Fundamentals**

   Course Objectives: This course provides participants with an overall view of working with Open Plan Professional on a day-to-day basis. Topics include: creating projects and ancillary files, using and customizing standard reports, navigating through the system, progressing activities and resources, and managing resources and costs. Considerable emphasis is placed on using a top-down WBS approach to critical path and earned value techniques in order to plan, execute, and manage change within a project environment.

   NAVAIR note: The above is a three day course. A minimum understanding of earned value techniques is recommended as a prerequisite.

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IX. Contract Considerations

"Contract: an agreement that is binding on the weaker party." - Frederick Sawyer

So you need to get a contract in place? While no one size fits all, we have some common SOW language around IMSs that can get you going in the right direction. Most of the language is based on EVM being required as a part of the contract. Even if EVM is not required on your contract, some of this language will continue to help you get the quality schedule that you need.

IPTs should contact AIR-4.2, PCO and Legal for assistance in the development of Statement of Work language for relating the Integrated Project Management (IPM) for both competitive and sole source procurement. The following are highlights of the Statement of Work language to be tailored:

SOW Language (TAILOR for your program!)

Paragraphs below are broken into three sections: 1) Business Rhythm, 2) EVM Contracts, and 3) Non-EVM Contracts. They contain suggested SOW language for each area related to IMS:

1) Draft SOW Language for Business Rhythm:

Business Rhythm/drumbeat: Contractor shall host bi-weekly/monthly (frequency to be determine by the program team) forums (WebEx/conference call or similar) to review program progress against IMS scheduled activities and events. Primary briefing materials will be the applicable sections contained within the approved program IMS. (CDRL XXXX, see Appendix D)

2) Draft SOW Language For EVM contracts:

Program Management Reviews: The Contractor shall conduct Program Management Review (PMR) meetings at mutually agreed upon dates and locations. During these reviews, the contractor shall present integrated cost, schedule, and technical performance status. Integrated Product Team leads or functional managers shall include cost information in discussions of schedule status, technical performance, and risk using earned value as an integrating tool. The following shall be addressed (including subcontract efforts): Cost/schedule trends, significant cost/schedule/technical variances, projected impacts, quantified risk assessments, and corrective action plans.

Contractor Integrated Performance Management:
DFAR 252.234-7001 and 252.234-7002 apply. The CPR (DI-MGMT-81466A) and IMS (DI-MGMT-81650) shall be developed, maintained, updated/statused and reported on a monthly basis per CDRLs (XXX) and (XXX) requirements, respectively. The contractor shall establish, maintain, and use in the performance of this contract, an integrated management system that is in compliance with the Industry Guidelines for Earned Value Management Systems (EVMS) ANSI/EIA-748-B as determined by the Defense Contract Management Agency (DCMA) . The application of these concepts shall provide for early indications of contract cost and schedule problems. Earned value assessments shall correlate with technical achievement.

Integrated Baseline Review (IBR):
The contractor shall review its performance measurement baseline plan with the Government within 180 days after contract award or initiation of an Un-definitized Contract Action, and subsequently, when warranted, following major changes to the baseline. The contractor will assure the Government that effective earned value methods are used to accurately status contract cost, schedule, and technical performance. The IBR will be used to achieve a mutual understanding of the baseline plan, cost and schedule risk, and the underlying management processes used for planning and controlling the project.

Subcontract Cost/Schedule Management and Reporting:
The contractor shall manage all subcontracts, including those that are FFP, to include the timely award of the subcontract, integration of the subcontractor's plans into appropriate schedules with sufficient detail, and monitoring the subcontractor's staffing plans, to include the execution of those staffing plans to the required levels with the required skills. Subcontractor staffing plans and actual staffing achievements shall be either integrated into the prime's CPR Format 4, or explained in a similar format in CPR Format 5. Special attention shall be applied to the technical accomplishment of the subcontractor's critical tasks.[1]

[1] Note: there may be conditions, warranted by the Government PM, to have an IBR occur earlier than the last 30 days of the 180 day window. Perhaps this is a short duration (less than 2 years) competitive TD phase contract and a subsequent 2nd IBR in the TD phase is planned for EMD award – the PM may want to have the initial IBR as soon as possible not only for the normal reasons of having an IBR but also to allow an as large as possible window between IBRs to allow ample time for the prime to apply lessons learned from the initial IBR to the next IBR. In case of warranting an earlier IBR, the Government should ensure that '180 days' is replaced with a lower numerical value so that if the prime starts the IBR on the last day of the window that the Government PM's is satisfied. Please note that if an earlier IBR date is warranted, consider if the prime can provide all of the normal IBR data to satisfy the IBR date – a PM may need to consider concessions in the IBR process to facilitate the prime making the date (such as possibly cancelling the MSA, perhaps making the detail planning window requirement smaller, do SRR after IBR vice before, etc….)

Non-FFP subcontracts at or exceeding $20M in then year dollars will have applied to them the requirements of DFAR clauses 252.234.7001 and 252.234-7002, Integrated Master Schedule (DI-MGMT-81650) per CDRL XXX, and the Contract Performance Report (DI-MGMT-81466A) per CDRL XXX.

Application of EVM to Firm Fixed Price (FFP) subcontracts greater than $20M that exceed 12 months in duration is a risk based decision as determined by the government Program Manager (PM). Based on risk identified by the government PM, the following developmental or WBS/critical elements/items will have applied to them the requirements of DFAR clauses 252.234.7001 and 252.234-7002, Integrated Master Schedule (DI-MGMT-81650) per CDRL XXX, and the Contract Performance Report (DI-MGMT-81466A) per CDRL XXX: (fill in the name of the critical elements)

DCMA will be considered the Cognizant Federal Agency (CFA) for determining EVMS compliance for NAVAIR.

Each subcontractor with an IMS CDRL requirement working any portion of the following identified developmental or WBS/ critical elements/ items, as determined by the Government PM, will be fully integrated into the prime's IMS:

TO BE FILLED OUT BY PROGRAM MANAGEMENT
(CDRL XXXX, see Appendix D)
Contract Work Breakdown Structure (CWBS): The contractor shall develop and maintain the CWBS and CWBS dictionary in accordance with DI-MGMT-81334C, using the work breakdown structure contained in Cost and Software Data Reporting (CSDR) plan Attachment_____. (See CDRL XXXX, see Appendix D)

Over Target Baseline (OTB)/Over Target Schedule (OTS)/Restructure: The contractor may conclude the baseline no longer represents a realistic plan in terms of budget/schedule execution. In the event the contractor determines an

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Since we mentioned 'Detail Planning Window' (the window in which only 'work' packages exist and not 'planning' packages), here is an additional IBR note:
Like an earlier IBR, a Government PM may want available for review at the IBR a 'detail planning window' larger than the prime's System Description minimum allowed 'detail planning window'. This is generally to allow the Government team the opportunity to see detail for a forward looking period to instill a greater confidence in the plan. Many programs like to see 'detail planning' through the next major milestone beyond the IBR for the IBR. For some, this has resulted with programs having 12 months of detailed planning in place for the IBR. Like the IBR, and even though having this larger window may sound like the right thing, unless it is in the SOW, you are really pushing the prime to kindly do the request at no extra cost; this could be a very hard sell. Therefore, if a specific window is needed for IBR, place wording in the SOW stating what the 'MINIMUM' number of months of detail planning can be in place for the IBR.

OTB/OTS/Restructuring action is necessary, the contractor must obtain customer approval prior to implementing an OTB/OTS/Restructuring action. The request should also include detailed implementation procedures as well as an implementation timeframe. The contractor will not implement the OTB/OTS/Restructuring prior to receiving written approval from the Contracting Officer.

Schedule Risk Assessment (SRA): A Schedule Risk Assessment section shall be included in the monthly IMS deliverable analysis. This section shall either: 1) provide the results from the Contractor's internal SRAs, as described below, or 2) address how major areas of uncertainty in the schedule could impact contractual milestones, including all assumptions and any potential effects of the identified schedule risks.
If the Contractor conducts internal SRAs as part of their standard business practices (i.e., independent of those executed with the Government), the Contractor shall submit those assessments to the Government. The following data, if generated and documented while conducting an internal SRA, shall be submitted: 1) the minimum, most likely and maximum durations for all activities assessed as well as the rationale/ assumptions from the Contractor's technical team members for these values, and 2) Monte-Carlo simulation histograms for the milestones being assessed, including calendar dates for the selected program milestones representing, at a minimum, the 10%, 50% and 90% probability that the milestone(s) will be achieved on or before the date calculated. (CDRL XXXX, see Appendix D)

Quarterly Schedule Risk Assessments: The prime will participate in a Government conducted quarterly probabilistic Schedule Risk Assessments (SRA). The SRA is to provide program management with an understanding of the potential schedule impacts associated with existing/emerging program risks. These analyses will compute the probability of completing key milestones, events, and tasks/activities by specific dates.

The contractor shall report optimistic, pessimistic, and most likely remaining durations and rationale for the values in accordance with IMS CDRL XXXX for each task/activity on any of the following paths: critical path to Program Completion, critical path to the next Major Milestone, the next three near critical paths to the next Major Milestone. For tasks/activities not identified being on any of the following paths: critical path to Program Completion, critical path to the next Major Milestone, the next three near critical paths to the next Major Milestone) - Global Weighting Values and rationale will also be provided by the contractor. The Global Weighting Values will be used to establish minimum and maximum remaining duration estimates. In addition, technical team members will be asked to provide pessimistic, most likely and optimistic durations for any moderate to high risk activities identified

in the Program Risk Database (generally identified through a risk cube) that are associated with IMS tasking.

The government will use a standard process facilitated by NAVAIR for performing the quarterly Schedule Risk Assessment. A complete SRA can be performed outside of routine scheduled occurrences, at the request of the customer, particularly when the schedule is a significant issue for the customer due to operational requirements, funding limitations, or when scheduling is considered a major risk element to the acquisition effort. (CDRL XXXX, see Appendix D)

3) Draft SOW Language for Non EVM Contracts:

IMS (DI-MGMT-81650) shall be developed, maintained, updated/statused and reported on a monthly basis per CDRLs. The contractor shall establish, maintain, and use in the performance of this contract, an integrated management system that is in compliance with the Industry Guidelines for Earned Value Management Systems (EVMS) ANSI/EIA-748-B as determined by the Defense Contract Management Agency (DCMA) . The application of these concepts shall provide for early indications of contract cost and schedule problems. Earned value assessments shall correlate with technical achievement. (CDRL XXXX, see Appendix D)

The contractor shall manage all subcontracts, including those that are FFP, to include the timely award of the subcontract, integration of the subcontractor's plans into appropriate schedules, and monitoring the subcontractor's staffing plans, to include the execution of those staffing plans to the required levels with the required skills. Special attention shall be applied to the technical accomplishment of the subcontractor's critical tasks. Sufficient detail necessary to manage subcontractor's effort will be included in the prime's IMS. (CDRL XXXX, see Appendix D)

After Award: the IMS is a contract deliverable via the CDRL process and stated in the SOW

Appendix H contains Sections L and M Suggested Language.

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X. IMS Frequently Asked Questions

"If you can't convince them, confuse them!" - Harry S Truman

What is an IMS? What is an IMS? Across NAVAIR the term Integrated Master Schedule (IMS) can mean different things to different people. For the purpose of this guidebook, the IMS is viewed as your primary schedule management tool which should be rigorously managed throughout the life of the project. The IMS enables schedule control, which is essential to ensuring time-related performance of a project is in line with the plan. Schedule control allows the Program Manager/IPTL to be out in front of the project, influencing changes before they affect the project.

Should my program use an IMS? The short answer is YES! As a command, we are focused on fleet readiness. Delivering products on time and on cost has a direct impact on readiness. The IMS is your primary schedule management tool. A properly networked IMS which includes the appropriate level of detailed tasking is necessary to ensure successful program execution.

Can a program have more than one IMS? Sure they can! Some ACAT programs have a separate IMS for their prime contractor and an IMS to also track government activities. For most ACAT programs it is a SECNAVINST 5000.2D requirement for the prime contractor to deliver an IMS as a contract deliverable. However, it may be equally important to track government activities to ensure we keep our own program efforts on schedule! Activities to consider adding into your government IMS can include: GFE/GFI activities, acquisition documentation development activities, pre/post PDR activities, pre/post SETR activities, governmental test activities, fleet deliveries, fleet installations, etc. Delivering products on time applies to the entire IPT, not just the prime contractor. Schedule planning and control across the entire program is the key to success!

If I build a government IMS, how much detail is required? As a program manager it's up to you to decide the level of detail that you require to manage your program on time and on budget. There is no right or wrong answer. However, with most NAVAIR programs, there are always a lot of moving parts. It is easy to get bogged down in the details in one area and lose track of completing a time critical event that could cause a ripple affect across the entire program. A logical network-based schedule that is routinely managed will ensure that government activities also do not fall through the cracks.

Is this guidebook specifically aimed at ACAT I programs? Absolutely not! Analysis conducted by NAVAIR's Program Performance Team has identified the need to return to the fundamentals of program planning and execution for all NAVAIR programs. One of the fundamentals of program management is the utilization of a detailed IMS. Getting back to fundamentals is key to delivering aircraft, weapons, and systems on time to our Sailors and Marines.

I inherited a mess! The contractor's IMS is woefully out of date and the program has been managing to a PowerPoint schedule. What do I do?
First review your contract. Is there an IMS CDRL or contract or SOW wording stating to develop a schedule in accordance with DI-MGMNT-81650? If so, use the DID to explain to the prime what an IMS, and any analysis it is supposed to contain. Use this guidance, and the existing contractual language, to influence/enforce the prime to use and manage the actual schedule. Inquire if AIR-4.2.3 is available to assist your efforts in explaining what an IMS should be. Most importantly, don't try to shoot for the moon as soon as possible; instead of demanding an immediate full correction of the ENTIRE schedule, try to come up with a window (perhaps a 90- or 180-day window) in which the expectation is for the prime to go and build a realistic schedule. Set up a battle rhythm for weekly reviews and interactions for the entire program team to review schedule construction, performance and leading indicators during this building process. Set the tone and lead by example! Once the schedule is delivered satisfactorily, move on to a larger window, etc. Your efforts can change a negative culture in IMS use and management.

My prime contractor has put the bulk of his work out to Subs on FFP contracts so I can't see via the IMS how the Subs are performing. What should I do?
First, hopefully you got a chance to look at the prime's strategy for selecting & awarding to critical/major subcontractors and that you agreed that FFP contract type was appropriate given risk, etc. Even if FFP contract type was selected, depending on risk/concern, you already requested an IMS or some sort of development/production schedule in the contractor's format to provide insight. <u>But</u>, assuming you came to the program after this part was already complete, i.e., Subs already awarded and data sets are locked-in, then you're not totally hosed…yet! But you will have to work fast. You should work with your prime to review what was done and why. Not as a witch hunt but to become smarter! Who does the prime consider to be your critical/major Subs? What are the concern areas for those contractors? If it's too late (or too expensive) to get an official IMS from a particular worrisome Sub at this late date, then what can you get? Those subs are managing their work to "something". Work through your prime to get your hands on those schedules to get insight. The fact that you're interested will make the prime very interested as well (if

he isn't already). There are also other health metrics you can possibly get through the prime on how well that Sub is performing. The key is to be persistent. The first answer you'll probably get is…"it's too late, you missed the boat, it will take too long or cost too much, etc" or …"not to worry, we've got it covered; they've never been a problem before!" The old adage… *Trust but Verify* can best summarize the approach you need to use here. The new NAVAIR "Subcontractor 101" guidebook, referenced in Section XI, is an excellent source on how to gain the insight you need into the subcontractor world. Look for it on the NAVAIR Program Management Community (PMC) web tool website; https://homepages.navair.navy.mil/pmcwebtool/

Here is a suggested route to take: Did the prime put ANY schedule requirements onto the Sub? If no schedule was requested, see if the prime involves the Subs in battle/business rhythm meetings to speak to the milestones/hand-offs that is represented (and required, at a minimum, to be represented per the IMS DID). At a minimum hold the prime and their respective subcontractor CAMs responsible to speak to the Subs' performance and if not satisfied with their insight into this area let it be reflected in IPAR, CPAR, Award Fee, etc.

Can I get an IMS on a FFP contract?

Absolutely! Any time we put something on contract, regardless of contract type, an IMS should be considered. Remember to budget for one upfront and keep it up to date! However, do I need an IMS on all FFP contracts? Depends on whether the sub is working a key developmental or WBS/critical elements/items or not – if so, the Government's PM should decide if we should apply an IMS requirement.

Where can I go for more help?

Turn the page…

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XI. References

"No finite point has meaning without an infinite reference point." - Jean-Paul Sartre

So, you've got the Basics; here's some additional material for you to check out. Become familiar with this information before you take IMS training and you'll get more out of it!

The NAVAIR Program Management Community (PMC) Web tool website is a valuable resource for Program Managers, contains links to additional scheduling information, and, has this guidebook available in digital (soft-copy) form:
https://homepages.navair.navy.mil/pmcwebtool/

Note: If you are reading this in hard-copy form you can see updated material on the NAVAIR Program Management Community (PMC) Web tool website shown above.

Other IMS information can be found at:

NAVAIR Acquisition Guidebook:
https://acc.dau.mil/CommunityBrowser.aspx?id=290012&lang=en-US

Defense Acquisition Lifecycle - Systems Engineering Technical Review Timing: https://acc.dau.mil/TechRevCklist

Data Item Description (DID) DI-MGMT 81650:
http://www.acq.osd.mil/pm/currentpolicy/cpr_cfsr/IMS%20Final%203-30-05.pdf

Defense Acquisition Guidebook:
https://acc.dau.mil/dag

DoD IMP and IMS Guide:
http://www.acq.osd.mil/sse/docs/IMP_IMS_Guide_v9.pdf

DoD 5000.2 Instruction of December 2008
DoD Instruction 5000.02, December 8, 2008

DoD 5000.2 Policy Memo of July 2005:
http://www.acq.osd.mil/pm/currentpolicy/EVM%20Policy%20letter%203-7-05.pdf

IMS Contract Deliverable Requirements List (CDRL) Regulation:

See Appendix D of this guidebook.

MIL Handbook 881 – (for those building internal schedules or working with new contracts (proposals/schedule development), use of MIL-HDBK 881 is encouraged. This will provide consistency across programs for comparison and historical reference.)

http://www.acq.osd.mil/pm/currentpolicy/wbs/MIL_HDBK-881A/MILHDBK881A/WebHelp3/MILHDBK881A.htm

Program Managers e-Tool Kit (https://pmtoolkit.dau.mil/)

NAVAIR guidebook "Subcontractor 101". - to be posted to the NAVAIR Program Management Community (PMC) web tool website

https://homepages.navair.navy.mil/pmcwebtool/

When all else fails –
contact AIR-4.2, starting with your schedule analyst.

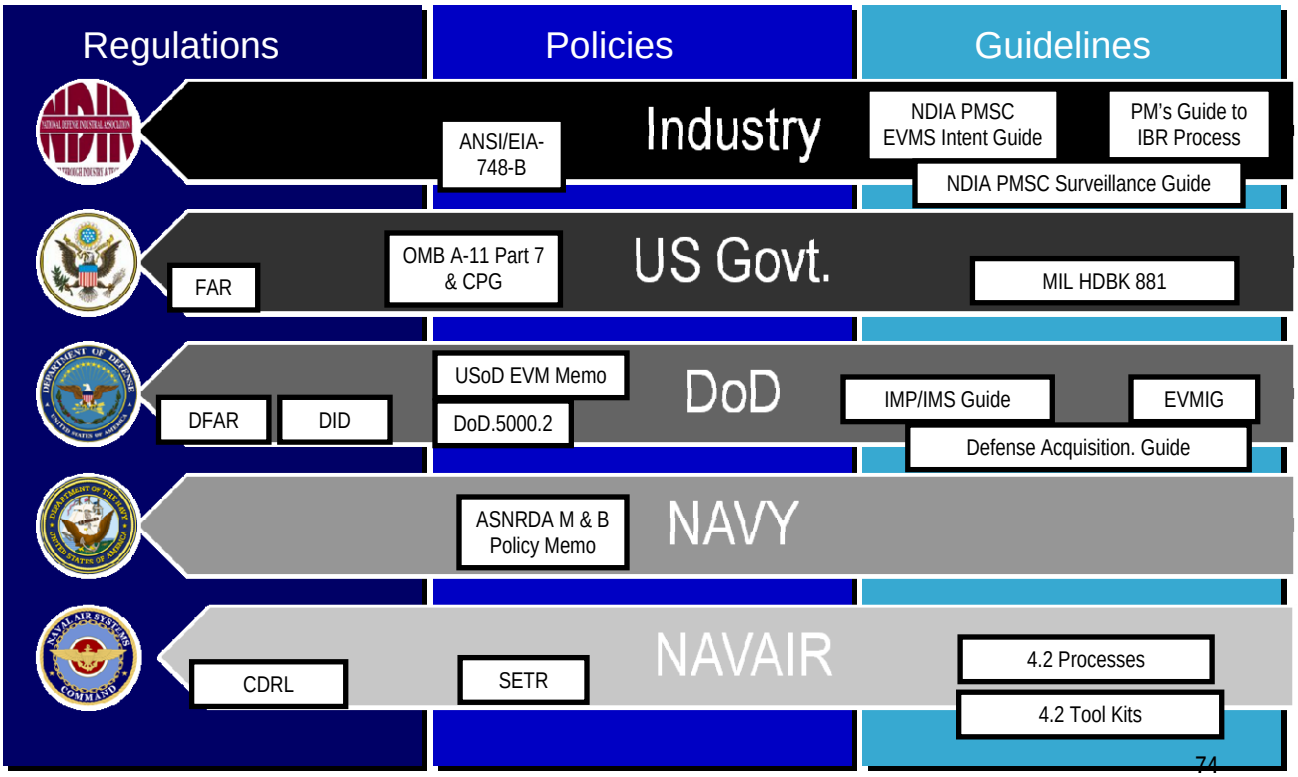

Figure 14: Quick reference snapshot: Scheduling Related Documents

XII. Appendices

"No fun quote here. The internet is simply not bursting with appendix quotes."
- IMS Team Member

Appendix A: Terms and Definitions

Actual Start and Finish Dates - Actual start and actual finish dates shall be recorded in the IMS. Actual start and actual finish dates, as recorded, shall not be later than the status date.

Authority to Proceed, ATP, is a term commonly used by government organizations with reference to an organization or department providing services, or to an individual waiting for go-ahead signal to take a certain action. In commercial contract terms, ATPs are normally issued to parties providing services under phased agreements. For example, it's common to hear people saying ATP for Phase 2 is obtained after successful completion of testing of Phase 1.

Baseline Schedule – Baseline dates in the IMS shall be consistent with the baseline dates in the PMB for all work packages, planning packages and control accounts (if applicable). The guidelines for maintaining the baseline schedule are as follows:

1) Schedule Changes - Changes to the schedule are not incorporated into the baseline until the schedule is officially re-baselined.

2) Baseline Schedule Changes - Changes to the baseline schedule shall be approved according to the approved EVM process. Any movement of contractual milestones in the baseline schedule requires customer approval.

3) Constraints – Limits applied to network start and finish dates (e.g., "finish no later than"). Certain types of constraints shall be used judiciously because they may impact or distort the network critical path.

Calendar – The arrangement of normal working days, together with non-working days, such as holidays, as well as special work days (i.e., overtime periods) used to determine dates on which project work will be completed.

Contract Work Breakdown Structure (CWBS).
The complete WBS for a contract, developed and used by a contractor within the guidelines of MIL- HNDBK 881 (latest revision) and according to the contract's work statement. The CWBS includes the levels specified in the contract and the contractor's extension.

Critical Path –

The longest path through the project network with least amount of float.

A sequence of discrete tasks/activities in the network that has the longest total duration through the contract or project. Discrete tasks/activities along the critical path have the least amount of float/slack. The critical path and near-critical paths (reporting requirements for near-critical paths may be specified in the CDRL) are calculated by the scheduling software application. The guidelines for critical path and near-critical path reporting are as follows:

1) Methodology – The IMS software application computes a critical path and near-critical paths based on precedence relationships, lag times, durations, constraints, and status. Artificial constraints, and incorrect, incomplete or overly constrained logic shall be avoided because they can skew the critical path and near-critical path.

2) Identification – The critical path shall be easily identified.

Current Schedule – The IMS reflects the current status and forecast. It includes forecasted starts and finishes for all remaining tasks/activities and milestones. Significant variances to the baseline schedule shall be explained in the periodic analysis. Thresholds for reporting are provided in the CDRL.

Duration - The length of time estimated (or realized) to accomplish a task/activity.

Early Start (ES) - The earliest start date a task/activity or milestone can begin the precedence relationships. Early Start is a computer-calculated date.

Early Finish (EF) - The earliest finish date a task/activity or milestone can end. This is a computer-calculated date.

Earned Value (EV) - Refers to the budgeted resources that have been earned when work is accomplished. ($ + work = Earned Value)

Earned Value Management (EVM) - Refers to the overall method of managing projects with earned value processes.

Earned Value Management System Guidelines (EVMS). The set of 32 statements established by DoD 5000.2 which defines the parameters within which the

contractor's integrated cost/schedule management system must fit. Refers to contractors' internal management control systems that meet the guidelines.

Engineering Manufacturing Development (EMD) – One of the acquisition phases.

External Dependencies – The IMS shall identify significant external dependencies that involve a relationship or interface with external organizations, including all government furnished items (e.g., decisions, facilities, equipment, information, data, etc.). The determination of 'significant' shall be defined, documented, and agreed to by the government on a continuing basis. The required or expected delivery dates shall also be identified in the IMS.

FF (Finish to Finish) – A predecessor task/activity or milestone that must finish before a succeeding task/activity or milestone can finish.

Free Float/Slack - The amount of time a task/activity or milestone can slip before it delays any of its successor tasks/activities or milestones.

FS (Finish to Start) - A predecessor task/activity or milestone that must finish before a succeeding task/activity or milestone can start. FS relationships shall be used whenever possible.

Integrated Master Plan (IMP) - Event-based plan consisting of a hierarchy of program milestones where **e**ach milestone is supported by specific tasks and e ach task is associated with specific criteria to be satisfied for its completion. Normally part of the contract and thus contractually binding it is a document explaining the overall management of the program

Integrated Master Schedule (IMS) – An integrated schedule containing the networked, detailed tasks necessary to ensure successful program execution. An IMS is supposed to contain the milestones, accomplishments, and discrete tasks/activities (including planning packages where applicable) from program start to program completion. The detail should be sufficient to verify attainability of program objectives, to evaluate progress toward meeting program objectives, and to integrate the program schedule activities with all related components. It is task and calendar-based (time) with tasks traceable to cost and schedule and the level of task description necessary for day-to-day execution.

I&T Integration testing (sometimes called Integration and Testing, abbreviated "I&T") is the phase in which individual modules are combined and tested as a group. It

occurs after unit testing and before system testing. Integration testing takes as its input modules that have been unit tested, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for system testing.

IPT-Lead The IPT lead manages the planning, monitoring and controlling of assigned programs within the organization and the organization's guidelines.

Lag - An interval of time that must occur between a predecessor and successor task/activity or milestone. Since negative time is not demonstrable, negative lag is not encouraged. The following are guidelines for use of lag:

Limitation – Lag cannot be used to manipulate float/slack or constrain schedule.

Application – Lag can be used when no budget and no physical work is represented.

Late Start (LS) - The latest start date a task/activity or milestone can start without delaying the contract or project target completion date. LS is a computer-calculated date.

Late Finish (LF) - The latest date a task/activity or milestone can have without delaying the contract or project target completion date. LF is a computer-calculated date.

Level of Effort (LOE). Effort of a general or supportive nature which does not produce definite end products.

Milestone - A specific definable accomplishment in the contract network, recognizable at a particular point in time. Milestones have zero duration and do not consume resources.

Organizational Breakdown Structure (OBS). A functionally oriented division of the contractor's organization established to perform the work on a specific contract.

Percent Complete (Schedule) – The proportion of an activity or task that has been completed to time now. This usually involves updating or providing status of the activity or task utilizing one of two methods: (1) update the remaining time to complete (remaining duration) and the scheduling software will then automatically update the schedule percent complete or (2) update the schedule percent complete and allow the scheduling software to calculate the time remaining (remaining duration) to complete. Either method will use the following formula:

Percent of Duration Completed = (Actual Duration / Total Duration) X 100

Performance Measurement Baseline (PMB). The time-phased budget plan against which contract performance is measured. It is formed by the budgets assigned to scheduled cost accounts and the applicable indirect budgets. For future effort, not planned to the cost account level, the performance measurement baseline also includes budgets assigned to higher level CWBS elements, and undistributed budgets. It equals the total allocated budget less management reserve.

Planning Package (P/P). A logical aggregation of work within a cost account, normally the far-term effort, that can be identified and budgeted in early baseline planning, but is not yet defined into work packages.

Precedence - Precedence defines task sequencing order and how tasks are related to one another in the plan. If one task must be completed before the next task can be started, the first task has precedence over the second task. Though some tasks must precede others in the logical order of work, many tasks can be started in parallel with other tasks.

Progress Line/Status Line - The progress line depicted in a Gantt chart shall be applied to the current schedule.

RAM - Responsibility Assignment Matrix (RAM) depicts the relationship between the Work Breakdown Structure elements and the organizations assigned responsibility for ensuring accountability and structure. The RAM is used to link activities to resources to ensure that the scope's components are each assigned to an individual or team.

Relationship/Dependency – These identify how predecessor and successor tasks/activities and milestones are logically linked. Relationships, also called network logic, are modeled in four ways:

FS (Finish to Start) - A predecessor task/activity or milestone that must finish before a succeeding task/activity or milestone can start. FS relationships shall be used whenever possible.

SS (Start to Start) - A predecessor task/activity or milestone that must start before a succeeding task/activity or milestone can start.

FF (Finish to Finish) – A predecessor task/activity or milestone that must finish before a succeeding task/activity or milestone can finish.

SF (Start to Finish) - A predecessor task/activity or milestone that must start before a succeeding task/activity or milestone can finish.

Retention of Data for Completed Tasks/Activities – Historical performance on completed tasks/activities is to be maintained for analytical use. Data to be retained includes logic, actual and baseline durations, actual and baseline start and finish dates, and the three-point estimates that were used before the task/activity started.

Schedule Changes - Changes to the schedule shall be baselined when incorporated into the schedule.

Schedule Margin – A management method for accommodating schedule contingencies. It is a designated buffer and is identified separately and considered part of the baseline. Schedule margin is the difference between contractual milestone date(s) and the planned date(s) of accomplishment.

Schedule Progress – The IMS reflects actual progress and maintains accurate start and finish dates for all tasks/activities and milestones. The guidelines for reflecting schedule progress are as follows:

> **SF (Start to Finish)** - A predecessor task/activity or milestone that must start before a succeeding task/activity or milestone can finish.
>
> **SS (Start to Start)** - A predecessor task/activity or milestone that must start before a succeeding task/activity or milestone can start.

Task/Activity – An element of work with duration.

Task/Activity Codes and Data Dictionary – A list of field definitions and code structures shall be provided to the customer.

Task/Activity and Milestone Descriptions – These are descriptive titles that are concise, complete, and clearly identify the work effort being accomplished. Abbreviations may be used to shorten the descriptive titles.

Total Float/Slack – The amount of time a task/activity or milestone can slip before it delays the contract or project finish date; or impacts the critical path.

Work Breakdown Structure (WBS). A product-oriented family tree division of hardware, software, services, and other work tasks which organizes, defines, and graphically displays the product to be produced as well as the work to be accomplished to achieve the specified product.

Work Package (W/P). Detailed jobs, or material items, identified by the contractor for accomplishing work required to complete the contract. A work package has the following characteristics:

a) It represents units of work at levels where work is performed.

b) It is clearly distinguished from all other work packages.

c) It is assigned to a single organizational element.

d) It has scheduled start and completion dates and, as applicable, interim milestones, all of which are representative of physical accomplishment.

e) It has a budget or assigned value expressed in terms of dollars, man-hours, or other measurable units.

f) Its duration is limited to a relatively short span of time or it is subdivided by discrete value milestones to facilitate the objective measurement of work performed.

g) It is integrated with detailed engineering, manufacturing, or other schedules.

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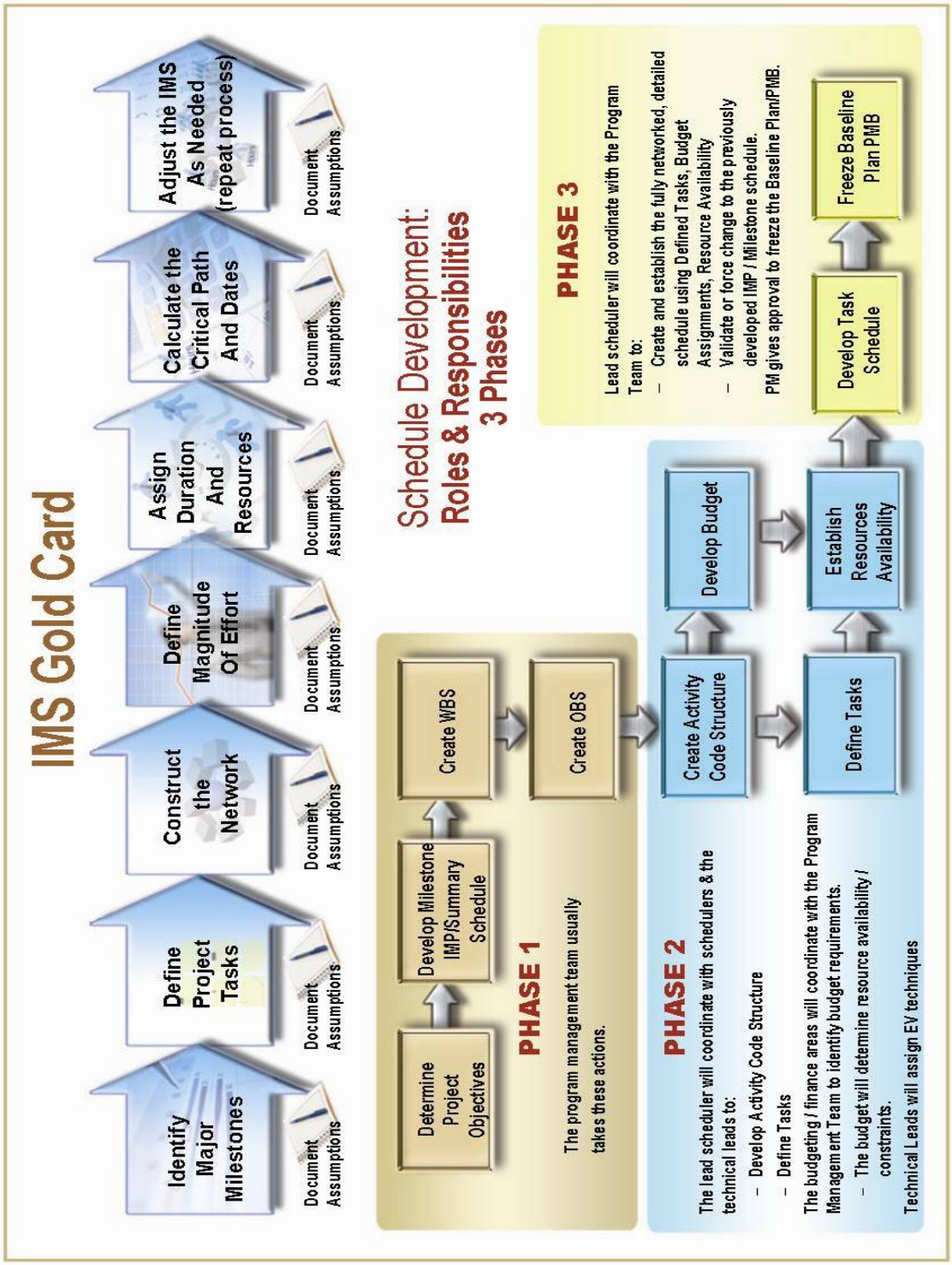
Appendix B: IMS Gold Card/Quick Reference



IMS Gold Card

Questions to be asked at program reviews by PEOs/DPEOs (look for DPEOs nod on these):

1. **What has changed on each critical paths to the next three key events/milestones in the Integrated Master Schedule?**
2. **What are the risks and mitigation actions associated with these events and the next major acquisition milestone?**
3. **Describe your strategy for the development and management of the IMS.**
4. **How is subcontractor or government workload being captured and integrated into your schedule? How are you managing those interfaces? (e.g., Do you have a schedule for GFE/GFI?)**
5. **What gives you confidence you'll be able to achieve the program objectives (cost, schedule, performance)?**

Questions for PMA Level (Questions for program initiation, these questions plus PEO questions interactive basis):

1. Have you and your IPT members attended IMS 101 training?
2. Have you contacted 4.2 and got a scheduler? Is the scheduler funded?
3. Have you and all your competency IPT members reviewed and concurred with the IMS?
4. Have you established a drumbeat/business rhythm to include Government, Contractor(s), and Sub(s)?
5. How are you going to bring me the highlights from your review(s)?
6. Do you or your team have any issues related to the last AIR 4.2 11-point assessment?
7. What has changed on each critical paths to the next three key events/milestones in the Integrated Master Schedule?
8. What are the risks and mitigation actions associated with these events and the next major acquisition milestone?
9. Describe your strategy for the development and management of the IMS.
10. How is subcontractor or government workload being captured and integrated into your schedule? How are you managing those interfaces? (e.g., Do you have a schedule for GFE/GFI?)
11. What gives you confidence you'll be able to achieve the program objectives (cost, schedule, performance)?

IPT Leads and Schedule Analysts questions, (includes AIR 4.2 11 Point Schedule Assessment):

1. Does the plan reflect the work to be done? Does the plan include subcontractor and government workload; and to what level?
2. Are critical target dates identified, are they being used to plan the work?
3. Is work sequenced logically?
4. Are interdependencies planned in a logical manner?
5. Are constraints, leads, and lags justified?
6. Are duration estimates meaningful?
7. Are resource estimates reasonable; are key resources available to support the plan?
8. Does the critical path make sense; is it calculated by the scheduling software?
9. Are float times reasonable?
10. Does the schedule provide current status and forecasts of completion dates for all authorized work; are they logical?
11. Where are the highest risk areas in the schedule?
12. Can the program schedule, as displayed, be accomplished at an acceptable risk level?
13. Review the overall scheduling strategy (e.g., drumbeat, integration of Prime/Subcontrators/Government, IPT participation, scheduling tools)
14. Do the appropriate team members have access to the scheduling tool software and the schedule

Appendix C: Program Schedule Assessment

INTRODUCTION

Scheduling standards are intended to inform industry of the meaning NAVAIR attaches to various aspects of network scheduling. The criteria require a formal scheduling system be established and used consistently throughout the life of the contract. The contractor should demonstrate that the scheduling technique meets the minimum requirements of network scheduling (e.g., horizontal and vertical traceability) as defined in ANSI-748-98, and is consistent with the written system description and operating procedures.

The primary purpose of a program schedule assessment is to ensure that the right resources are available, scheduled, and applied at the appropriate time and in the proper amount. The initial assessment should be scheduled to begin as soon as the Performance Measurement Baseline (PMB) is implemented but no later than six months after contract award.

RELATED ANSI-748-98 GUIDELINES

#06 Task Sequence, Interdependencies

#07 Physical Products, Milestones

#23 Plan/Actual Schedule Performance

11 POINT ASSESSMENT

1. Does the schedule reflect the work to be done?

The program schedule should correlate to the contract WBS. The program schedule should also reflect all labor and material tasks to be performed. The inclusion of LOE tasks is optional if the resource feature of the scheduling tool is not being utilized. Where the entire effort is not subdivided into work packages, the contractor should identify the far term effort in larger planning packages. It is important that the contractor demonstrate that relevant subcontract work is integrated with the prime's work and is considered as part of the critical path calculation. Also, all government obligations (i.e., GFE, GFI) must be delineated. When determining whether the schedule reflects the work to be done, the analyst should crosscheck the program WBS Dictionary, RAM, and CPR to the SOW, ORD, and program schedule to ensure they match. Discrepancies should be documented and revisited for closure.

2. Are critical target dates identified; are they being used to plan the work?

Of prime importance is the identification of the schedule objectives of the contract, including the association of contract milestones with calendar dates for important contract development and production decisions. When determining whether critical target dates are identified and are being used to plan the work, the analyst should check to see if each task is traceable to an IMP event or program milestone. The analyst should also check to see if the program schedule has considered all IMP events and that there is at least one event or milestone per quarter for the length of the contract. The milestone should be logically tied showing changes when associated tasks move to ensure vertical integration exists.

3. Is work sequenced logically?

Major tasks and sub-tasks in the program schedule should be presented in chronological order, or some other logical order that reflects the manner in which the overall job is to be performed. The schedule should define a sequence of operations (or tasks) that must be performed in the order specified. It is important to remember that the network diagram reveals the workflow, not just the work. The sequence is further defined by imposing precedence among the tasks. That is, for each task, there may be one or more tasks that must be performed before it. When determining whether work is sequenced logically, the analyst should begin by getting the opinion of experienced technical personnel. Once this has been accomplished, the analyst should compare the baseline duration and start/finish dates to the current estimated duration and start/finish dates for each task and milestone to ensure that the order of work (or sequence) has not been altered. While the contractor will at times re-sequence those tasks that have not started, it is important that those changes be documented, communicated, and revisited for realism purposes.

4. Are interdependencies planned in a logical manner?

Development of a networked schedule requires a thorough knowledge of all work tasks within the program and their associated interfaces and interrelationships. The network should be constructed at the control account work package tasks and planning package level within, and across, WBS elements. In order to achieve horizontal integration each discrete task should have at least one predecessor and one successor but no more than ten. Likewise, each program milestone and IMP event should have at least one predecessor and one successor to establish vertical integration but no more than ten. The intent is not to force the contractor to make arbitrary cutoff points simply to have a limited number of predecessors and successors, but to reduce the complexity of the network where possible. Often

contractors will make improper successor selections in an attempt to maintain a precedence logic count that falls within the division's stated goal.
When determining whether inter-dependencies are planned in a logical manner, the analyst should compare the number of isolated tasks to the total number of tasks in the schedule. Discrete tasks without predecessors or successors should not exceed 5 percent of the total program schedule. The analyst should also check to see that predecessors and successors are not assigned to summary tasks. For network calculation purposes it is preferable that the contractor assign early dates and late dates to each task.

5. Are constraints, leads, and lags justified?

The use of large lead times, negative lag times, and constraints such as must-start-on, must-finish-on, start-no-earlier-than, start-no-later-than, finish-no-earlier-than, and finish-no-later-than should be minimal, approved by an appropriate authority, and reasons documented. The analyst should identify and assess the legitimacy of any delay between the start and finish of one task and the start and finish of another. Lag can be positive and negative. Negative lag is often used to 'overlap' related work efforts while positive lag is often used to reflect the consumption of non-resourced time. The analyst should pay particular attention to the contractor's use of constraints in the stated logic and recognize the 'overriding' affect they have on the calculation of early and late dates. For example, if a task cannot start until a specified date has been reached due to the availability of machinery or key resources the contractor may choose to add a soft constraint to the network. For network calculation purposes it is essential that the contractor limit and control the use of constraints. The total number of discrete tasks with either hard or soft constraints should not exceed 5% of the total number of discrete tasks for the program.

6. Are duration estimates meaningful?

Estimating the duration of tasks is one of the most important aspects of the program scheduling process. Where possible, the analyst should seek out the most experienced team members who are responsible for the work to help determine the realism of duration estimates. A key feature from the standpoint of evaluating the schedule is the desirability of having short-term discrete tasks to detail the lowest WBS levels. A discrete task is simply a lower level work assignment having a duration that is limited to a manageable, realistic span of time, preferably no more than 60 calendar days (or 2 months) in length. The intent is not to force contractors to make arbitrary cutoff points simply to have short-term tasks, but to plan according to the

way the work will be done. For network calculation and monthly forecasting purposes it is important that the contractor have short-term discrete tasks.
When determining whether duration estimates are meaningful, the analyst should compare the number of discrete tasks that exceed 60 calendar days in length to the total number of discrete tasks in the schedule for a specified period of time, typically 6 months in length. Also, task durations should be measured in days using the normal workweek of Monday through Friday, unless the contractor specifies a different work calendar. Holidays should be identified and considered in the schedule calculation. Discrete tasks with durations greater than 60 calendar days should not exceed 5 percent of the total number of discrete tasks within a rolling wave (or 6 month) boundary.

7. Are resource estimates reasonable; are key resources available to support the plan?

The sum of all work package hours and planning package hours within a control account should equal the total hours assigned to the control account. Likewise, the sum of all control account hours should equal the total hours for the program. When determining whether resource estimates are reasonable, the analyst should pay particular attention to ensure that the resource hour allocation does not exceed the associated task's individual duration. Also, the analyst should investigate whether the contractor's allocation of resource skill sets does not exceed their availability and the rational distribution of resources from month to month. Where possible, the analyst should seek out the most experienced team members who are responsible for the work to help determine the realism of resource estimates. Discrepancies should be documented and revisited for closure.

8. Does the critical path make sense; does the scheduling software calculate it?

The contractor should identify the longest, continuous sequence of tasks with the least amount of total float through the network between two scheduled dates. When determining whether the critical path makes sense, the analyst should calculate and graphically display the path from contract start (or the current status date) to contract completion. The analyst should also calculate and graphically display the path from 'time-now' to PDR, CDR, First Flight, or other major program milestone. The analyst should seek out the most experienced team members who are responsible for the work to help determine the reasonableness of the Critical Path(s).

9. Are float times reasonable?

The calculation of float is designed to provide a means for manipulating resources and durations to achieve targets. The use of total float is shared in common by the tasks in any particular path. If it is used in any one task, it is no longer available for any other task. For this reason, total float must be managed judiciously otherwise; many formerly non-critical items may rapidly become critical. When determining whether float times are reasonable for the type of work to be accomplished, the analyst should check to see that a positive total float value is calculated on all but the critical path. For example, if a task depends on an integration process with another system, the total float metric will indicate whether there is time enough to complete the integration within the time parameter of the program. The analyst should pay special attention to tasks with excessively large total float values. This may indicate that the contractor has not matured its network by neglecting to add a successor or soft constraint in any particular path. When determining whether total float values are reasonable, the analyst should compare the number of task with float values that exceed 60 calendar days to the total number of tasks in the schedule. Discrete tasks with a total float value of greater than 60 calendar days should not exceed 5 percent of the total program schedule.

10. Does the schedule provide logical status and forecasts of completion dates for all authorized work?

The contractor should identify, at least monthly, the significant differences between both planned and actual schedule performance. When determining whether the schedule adequately provides current status and forecasts of completion dates, the analyst should compare the program's schedule performance to the program milestone schedule (Tier I). The analyst should pay particular attention to whether the contractor's scheduling system calculates a duration-related percent complete separate from the earned value percentage.

The analyst should identify and record the contractor's current assessment of the date for completing all open and remaining work on the program. The schedule variance should indicate fluctuations in planning versus implementation of the plan and, should indicate the stability of the contractor's way-forward plan. Also, the analyst should crosscheck the contractor's current assessment to the Latest Revised Estimate (LRE) to ensure they match. For the estimated completion date, record the contractor's current assessment of the date that the contract or critical milestone actually will be completed. For contracts with a Cost Performance Report (CPR), this should be when the cumulative Budgeted Cost for Work Performed (BCWP) equals the Performance Measurement Baseline (PMB).

The analyst should perform a "Hit or Miss" ratio analysis. These numbers are derived from comparing the baseline or planned finish date for each task for the last three

months through the current status date. The analyst should also perform a "Hit or Miss" ratio analysis to identify projected future misses beyond the current status date up to the next major program milestones. If a task finish date is realized when planned, it is considered a hit, if it misses by a day or more it is a miss. If it finishes early it's treated as a hit. Discrete tasks with actual finish date misses should not exceed 5% of the total number of discrete tasks for the last three months.

11. Can the current program schedule be accomplished at an acceptable risk level?

When determining whether the program schedule can be accomplished at an acceptable risk level, the analyst should identify risks associated with the timely completion of the program's overall schedule objectives. All tasks with zero total float are deemed critical and possess a degree of risk in that no delay is permissible in their execution. First, the analyst should identify the critical path and where there is zero or negative total float in the program schedule. Next, if time permits, the analyst should generate a probabilistic estimate showing the risk level for critical tasks and program milestones following the proper Schedule Risk Assessment (SRA) technique. The analyst should provide this probabilistic estimate in the integrated forecast of the analysis and be prepared to talk about the risks and contingencies associated with all remaining work.

SCHEDULE METRICS CHART

To help in addressing the 11 point assessment, AIR-4.2.3 has established standard metrics and goals to help flag possible issues in scheduling techniques and to provide insights into the condition of the IMS for reporting and execution. Investigation into these metrics can reveal whether the contractor's scheduling system and processes are inadequate and need immediate attention – "in other words, where there is smoke there could be fire".

AIR-4.2 has identified a number of metrics and is always looking to see if better metrics can be created. Industry also follows this approach. As a result, metric tools such as NAVAIR's METLITE and industry metric tools (e.g. Steelray) are constantly going through revisions for improvements. Exhibit A (Figure 15) is an example of some of the metrics that AIR-4.2 measures.

AIR - 4.2.3 Standard Schedule Instruction Metric Goals		Legend					
		< 5%					
		5% to 20%					
		> 20%					
Program:		Analysis Toolkit					
Next Milestone:		Milestone					
Milestone Baseline Date:		xx/xx/xxxx					
Metrics For:		Total Project			MAR06		
IMS Date:		JAN06	FEB06	MAR06			
Schedule Status Date:		1/27/2006	2/24/2006	3/31/2006			
Statistics	Total Tasks	21276	23929	25598			
	% Complete	44%	42%	16%			
	% Incomplete	56%	58%	83%			
	Tasks Not Started	10749	12800	19742			
	Tasks In Progress	1159	1134	1581			
	% w/ SOW Reference	99%	99%	0%			
	Baseline Rate	9530	9958	6145			
Health	% Missing Logic	3%	4%	32%			
	% Constrained	10%	17%	19%			
	% High Float	68%	70%	48%			
	Average Float (Tasks > 44wd)	195	248	997			
	% High Duration (RW)	56%	53%	55%			
	Average Duration (RW)	100	94	148			
	% Tasks Missed (Cumulative)	31%	31%	51%			

Figure 15: EXHIBIT A. SCHEDULE METRICS

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Appendix D: IMS Contract Deliverable Requirements List (CDRL) Regulation

AIR-4.2.3 Standard Integrated Master Schedule (IMS) CDRL Language

CONTRACT DATA REQUIREMENTS LIST (1 Data Item)	Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 110 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302 and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503. Please DO NOT RETURN your form to either of these addresses. Send completed form to the Government Issuing Contracting Officer for the Contract/PR No. Listed in Block E.

A. CONTRACT LINE ITEM NO.	B. EXHIBIT	C. CATEGORY:
	A	TDP TM OTHER: X

D. SYSTEM/ITEM	E. CONTRACT/PR NO.	F. CONTRACTOR

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
XXXX	***INTEGRATED MASTER SCHEDULE (IMS)***	Page 1 of 2

4. AUTHORITY (Data Acquisition Document No.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
DI-MGMT-81650	SOW PARA X.X.X	AIR-4.2.3

7. DD 250 REQ	9. DIST STATEMENT	10. FREQUENCY	12. DATE OF FIRST SUBMISSION	14. DISTRIBUTION
LT	REQUIRED	Monthly	See BLK 16	ELECTRONICALLY
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**	
N/A	D	N/A	See BLK 16	

16. REMARKS

The contractor shall provide the IMS per DID ***DI-MGMT-81650*** except or as modified by the following:

Block 4: The contractor shall submit internal Schedule Risk Assessments (SRA) and be prepared to actively participate with Government in quarterly SRAs.

Near-critical paths included in the SRA will be those paths to the milestone or event determined by the Government Program Manager.

The first narrative submission shall include the Basis and Assumptions (B&A) of the IMS.

Monthly analysis is required for those items within 3 months of the status date that are on the critical and near-critical paths with less than 22 working days of total float.

Block 12: The first submission is due within 12 working days after the end of the first full accounting period following authorization to proceed. First submission shall include reporting to the Intermediate level schedule, at a minimum.

Block 13: Subsequent submittals are due within 12 working days after the close of the contractor's accounting period, all schedule levels.

a. ADDRESSEE	b. COPIES: Draft	Final: Reg.	Final: Repro
PMA-XXX		1	
AIR-4.2.3		1	
DCARC		1	
15. TOTAL		3	

G. PREPARED BY	H. DATE	I. APPROVED BY	J. DATE

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CONTRACT DATA REQUIREMENTS LIST *(1 Data Item)*	*Form Approved OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 110 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302 and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503. Please DO NOT RETURN your form to either of these addresses. Send completed form to the Government Issuing Contracting Officer for the Contract/PR No. Listed in Block E.

A. CONTRACT LINE ITEM NO.	B. EXHIBIT	C. CATEGORY:
	A	TDP TM OTHER: X

D. SYSTEM/ITEM	E. CONTRACT/PR NO.	F. CONTRACTOR

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
XXXX	***INTEGRATED MASTER SCHEDULE (IMS)***	Page 2 of 2

4. AUTHORITY (Data Acquisition Document No.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
DI-MGMT-81650	SOW PARA X.X.X	AIR-4.2.3

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION	14. DISTRIBUTION ELECTRONICALLY
LT		Monthly	See BLK 16	
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**	
N/A	D	N/A	See BLK 16	

16. REMARKS

Block 14: Data will be provided in contractor's approved scheduling system in its original format (e.g., Primavera, Open Plan Pro or Microsoft Project). Capability to access the data in the native format from Government sites will be provided by the prime contractor. In addition to the monthly IMS submitted to the DoD program manager and other designated addressees, an additional submission must be made quarterly to the central repository. The first IMS quarterly submission will coincide with the first submission of the Contract Performance Report (CPR) to the Central Repository. Add the DCARC as a distribution point as follows: All IMS related forms must be electronically forwarded to the central repository at the DCARC Web site in native format on a quarterly basis only at https://ders.dcarc.pae.osd.mil/DCARCPortal/.

a. ADDRESSEE	b. COPIES Draft	Final Reg.	Final Repro
PMA-XXX		1	
AIR-4.2.3		1	
DCARC		1	
15. TOTAL		3	

G. PREPARED BY	H. DATE	I. APPROVED BY	J. DATE

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Appendix E: DID 81650

MARCH 7, 2005

DI-MGMT-81650

DATA ITEM DESCRIPTION

TITLE: INTEGRATED MASTER SCHEDULE (IMS)

NUMBER: DI-MGMT-81650 **APPROVAL DATE**:
AMSC NUMBER: **LIMITATION**:
DTIC APPLICABLE: **GIDEP APPLICABLE**:
OFFICE OF PRIMARY RESPONSIBILITY: OUSD(AT&L)ARA/AM(SO)

APPLICABLE FORMS: None

USE/RELATIONSHIP: The Integrated Master Schedule (IMS) is an integrated schedule containing the networked, detailed tasks necessary to ensure successful program execution. The IMS is vertically traceable to the Integrated Master Plan (IMP) (if applicable), the Contract Work Breakdown Structure (CWBS), and the Statement of Work (SOW). The IMS shall be used to verify attainability of contract objectives, to evaluate progress toward meeting program objectives, and to integrate the program schedule activities with all related components. This DID is applicable to development, major modification, and low rate initial production efforts; it is not typically applied to full rate production efforts.

a. This Data Item Description (DID) contains the format and content preparation instructions for the data product generated by the specific and discrete task requirement as delineated in the contract.

b. This DID shall be applied to contracts that require Earned Value Management (EVM) and other contracts based on the contract risk assessment. Refer to the Earned Value Management Implementation Guide (EVMIG) for guidance on tailoring reporting.

c. The prime contractor is required to include significant external interfaces and critical items from suppliers, teammates, or other detailed schedules that depict significant and/or critical elements and Government furnished equipment or information dependencies for the entire contractual effort in a single integrated network. The determination of significant and critical shall be agreed to by the Government and the contractor and shall be defined and documented in the Contract Data Requirements List (CDRL).

d. The IMS shall be statused according to the contractor’s management control system and shall be submitted no less frequently than monthly. If a Contract Performance Report (CPR) is required, the IMS shall be statused and submitted to the procuring activity prior to or concurrently with CPR Formats 1-5 (as applicable). The IMS may reflect data either as of the end of the calendar month or as of the contractor’s accounting period cutoff date, provided it is consistent and traceable to the CPR (if applicable). When subcontractor schedule data reflects a different status date than the prime contractor’s schedule status date, these status dates shall be described in the analysis section of the IMS.

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e. This DID shall be used in conjunction with the CWBS DID, DI-MGMT-81334A, and the CPR DID, DI-MGMT-81466. (Note: The IMS DID may be required when there is no EVM (CPR) requirement.)

REQUIREMENTS:

1. Format. The IMS shall be created using a network capable Commercially Off the Shelf (COTS) scheduling software application. Unless otherwise in the CDRL, the IMS shall be delivered electronically in the native digital format (i.e., an electronic file produced by the contractor's scheduling tool). (Note: When the technology is available, the CDRL may be tailored, upon agreement between the prime contractor and the Government representative, to allow the American National Standards Institute (ANSI) X12 standard (806 transaction set), the United Nations Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) standard (PROTAP message), or the XML equivalent to be used to submit data electronically to the procuring activity with on-line access to the data.)

2. Content. The schedule shall contain the contract milestones, accomplishments, and discrete tasks/activities (including planning packages where applicable) from contract award to the completion of the contract. The schedule shall be an integrated, logical network-based schedule that correlates to the CWBS, and is vertically and horizontally traceable to the cost/schedule reporting instrument used to address variances such as the CPR (if applicable). The schedule shall have a numbering system that provides traceability to the IMP (if applicable) and SOW. It shall contain contractual milestones and descriptions and display summary, intermediate, and detailed schedules, and periodic analysis of progress to date. It shall include fields and data that enable the user to access the information by product, process, or organizational lines.

2.1 Contract Milestones and Definitions. Key programmatic events, which define progress and completion for each CWBS element, along with the definition for successful completion of the milestone.

2.2 Summary Master Schedule. A top-level schedule of key tasks/activities and milestones at the summary level of the CWBS and IMP (if applicable). It shall be an integrated roll up of the intermediate and detailed schedules (see 2.3 and 2.4 below) (vertical integration).

2.3 Intermediate Schedules. Mid-level contract schedules that include key tasks/activities and milestones and all associated accomplishments in the summary master schedule, traceable to the CWBS element or IMP event as necessary to display work effort at the intermediate level of summarization. There may be several intermediate schedules that depict varying levels of detail. They shall be integrated roll ups of the detailed schedules (see 2.4 below) (vertical integration).

2.4 Detailed Schedules. The lowest level of contract tasks/activities that form the network. The detailed schedules shall contain horizontal and vertical integration, as a minimum, at the work package and planning package level. The detailed schedules shall include all tasks/activities, work packages, and planning packages identified in the contract Performance Measurement Baseline (PMB). Every discrete task/activity, work package, and planning package shall be clearly identified and directly related to a control account. Work packages and planning packages shall be individually represented and summarize to or reconcile with the total budget for that control account. If Level of Effort (LOE) control accounts, work packages, or planning packages are included as tasks in the IMS, they shall be

clearly identified as such. The detailed tasks/activities, work packages, and planning packages shall be traceable to only one CWBS, IMP, and performing organizational element, as applicable. The level of detail in the IMS (including number and duration of tasks/activities) shall follow the contractor's EVM process as documented in the EVMS system description, program directives, etc. Shorter-term work packages (ideally equal in length to the statusing interval) are preferred because they provide more accurate and reliable measures of work accomplished.

2.4.1 Key Elements of Detailed Schedules. The key elements of the detailed schedules include the following:

2.4.1.1 Task/Activity. An element of work with duration.

2.4.1.2 Milestone. A specific definable accomplishment in the contract network, recognizable at a particular point in time. Milestones have zero duration and do not consume resources.

2.4.1.3 Duration. The length of time estimated (or realized) to accomplish a task/activity.

2.4.1.4 Percent Complete (Schedule). The proportion of an activity or task that has been completed to time now. This usually involves updating or statusing the activity or task utilizing one of two methods:

(1) update the remaining time to complete (remaining duration) and the scheduling software will then automatically update the schedule percent complete or

(2) update the schedule percent complete and allow the scheduling software to calculate the time remaining (remaining duration) to complete. Either method will use the following formula: Percent of Duration Completed = (Actual Duration / Total Duration) X 100.

2.4.1.5 Task/Activity and Milestone Descriptions. These are descriptive titles that are concise, complete, and clearly identify the work effort being accomplished. Abbreviations may be used to shorten the descriptive titles.

2.4.1.6 Task/Activity Codes and Data Dictionary. A list of field definitions and code structures. This list shall be provided to the procuring activity.

2.4.1.7 Relationship/Dependency. These identify how predecessor and successor tasks/activities and milestones are logically linked. Relationships, also called network logic, are modeled in four ways:

2.4.1.7.1 FS (Finish to Start). A predecessor task/activity or milestone that must finish before a succeeding task/activity or milestone can start. FS relationships shall be used whenever possible.

2.4.1.7.2 SS (Start to Start). A predecessor task/activity or milestone that must start before a succeeding task/activity or milestone can start.

2.4.1.7.3 FF (Finish to Finish). A predecessor task/activity or milestone that must finish before a succeeding task/activity or milestone can finish.

2.4.1.7.4 SF (Start to Finish). A predecessor task/activity or milestone that must start before a succeeding task/activity or milestone can finish.

2.4.1.8 Total Float/Slack. The amount of time a task/activity or milestone can slip before it delays the contract or project finish date.

2.4.1.9 Free Float/Slack. The amount of time a task/activity or milestone can slip before it delays any of its successor tasks/activities or milestones.

2.4.1.10 Lag. An interval of time that must occur between a predecessor and successor task/activity or milestone. Since negative time is not demonstrable, negative lag is not encouraged. (Note: Lag should not be used to manipulate float/slack or constrain schedule.)

2.4.1.11 Early Start (ES). The earliest start date a task/activity or milestone can begin the precedence relationships. A computer-calculated date.

2.4.1.12 Early Finish (EF). The earliest finish date a task/activity or milestone can end. A computer-calculated date.

2.4.1.13 Late Start (LS). The latest start date a task/activity or milestone can start without delaying the contract or project target completion date. A computer-calculated date.

2.4.1.14 Late Finish (LF). The latest date a task/activity or milestone can finish without delaying the contract or project target completion date. A computer-calculated date.

2.4.1.15 Critical Path. A sequence of discrete tasks/activities in the network that has the longest total duration through the contract or project. Discrete tasks/activities along the critical path have the least amount of float/slack. The critical path and near-critical paths (reporting requirements for near-critical paths shall be specified in the CDRL) are calculated by the scheduling software application. The guidelines for critical path and near-critical path reporting are as follows:

2.4.1.15.1 Methodology. The IMS software application computes a critical path and near-critical paths based on precedence relationships, lag times, durations, constraints, and status. Artificial constraints and incorrect, incomplete, or overly constrained logic shall be avoided because they can skew the critical path and near-critical paths.

2.4.1.15.2 Identification. The critical path shall be easily identified.

2.4.1.16 Constraints. Limits applied to network start and finish dates (e.g., “finish no later than”). (Note: Certain types of constraints should be used judiciously because they may impact or distort the network critical path.)

2.4.1.17 Current Schedule. The IMS reflects the current status and forecast. It includes forecasted starts and finishes for all remaining tasks/activities and milestones. Significant variances to the baseline schedule shall be explained in the periodic analysis. Thresholds for reporting shall be specified in the CDRL.

2.4.1.18 Baseline Schedule. Baseline dates in the IMS shall be consistent with the baseline dates in the PMB for all work packages, planning packages, and control accounts (if applicable). The guidelines for maintaining the baseline schedule are as follows:

2.4.1.18.1 Schedule Changes. Changes to the schedule shall be baselined when incorporated into the schedule.

2.4.1.18.2 Baseline Schedule Changes. Changes to the baseline schedule shall be made in accordance with the contractor's EVM process. Any movement of contractual milestones in the baseline schedule shall be derived only from either authorized contract changes or an approved over target schedule.

2.4.1.19 Schedule Progress. The IMS shall reflect actual progress and maintain accurate start and finish dates for all tasks/activities and milestones. The guidelines for reflecting schedule progress are as follows:

2.4.1.19.1 Actual Start and Finish Dates. Actual start and actual finish dates shall be recorded in the IMS. Actual start and actual finish dates, as recorded, shall not be later than the status date.

2.4.1.19.2 Progress Line. The progress line depicted in a Gantt chart shall be applied to the current schedule.

2.4.1.20 Retention of Data for Completed Tasks/Activities. Historical performance on completed tasks/activities shall be maintained electronically for analytical use. Historical performance shall be maintained at the time of key program events (Integrated Baseline Review, Critical Design Review, etc.) for all critical tasks/activities. Data to be retained includes logic, actual and baseline durations, actual and baseline start and finish dates, and the three-point estimates that were used before the task/activity started.

2.4.1.21 External Dependencies. The IMS shall identify significant external dependencies that involve a relationship or interface with external organizations, including all Government furnished items (e.g., decisions, facilities, equipment, information, data, etc.). The determination of significant shall be agreed to by the Government and contractor and shall be defined and documented in the CDRL. The required or expected delivery dates shall also be identified in the IMS.

2.4.1.22 Schedule Margin. A management method for accommodating schedule contingencies. It is a designated buffer and shall be identified separately and considered part of the baseline. Schedule margin is the difference between contractual milestone date(s) and the contractor's planned date(s) of accomplishment.

2.4.1.23 Schedule Risk Assessment. A schedule risk assessment predicts the probability of project completion by contractual dates. Three-point estimates shall be developed for remaining durations of remaining tasks/activities that meet any of the following criteria: (1) critical path tasks/activities, (2) near-critical path tasks/activities (as specified in the CDRL), (3) high risk tasks/activities in the program's risk management plan. These estimates include the most likely, best case, and worst case durations. They are used by the contractor to perform a probability analysis of key contract completion dates. The criteria for estimated best and worst case durations shall be applied consistently across the entire schedule and documented in the contractor's schedule notes and management plan. The guidelines for estimates are as follows:

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2.4.1.23.1 Most Likely Estimate. Schedule durations based on the most likely estimates.

2.4.1.23.2 Best/Worst Case Estimates. Best and worst case assumptions shall be disclosed.

The contractor schedule risk assessment shall explain changes to the critical
path, margin erosion, and mitigation plans. It shall be incorporated into the contractor's program risk management process. The schedule risk assessment shall be submitted as specified in the CDRL and prior to the Integrated Baseline Review. The risk analysis may be performed within the IMS or within a separate risk tool as appropriate based on the capability of the automated scheduling tool.

2.4.1.24 User Defined Fields. All user defined fields in the IMS shall be identified by providing a mapping of all fields used in the scheduling software application.

2.4.1.25 Reserved Fields. The Government may reserve some fields and/or require the contractor to use certain fields for specific information. The requirement for reserved fields shall be specified in the CDRL.

2.4.1.26 Calendar. The arrangement of normal working days, together with non-working days, such as holidays, as well as special work days (i.e., overtime periods) used to determine dates on which project work will be completed.

2.5 Monthly Analysis. Monthly analysis is a monthly assessment of schedule progress to date and includes changes to schedule assumptions, variances to the baseline schedule, causes for the variances, potential impacts, and recommended corrective actions to minimize schedule delays. The analysis shall also identify potential problems and an assessment of the critical path and near-critical paths. Thresholds for reporting significant variances to the baseline schedule and near-critical paths shall be specified in the CDRL. If a CPR Format 5 is required, the monthly analysis shall be submitted to the procuring activity prior to or concurrently with the CPR Format 5.

END OF DI-MGMT-81650

:

Appendix F: Risk Assessments

"I made the wrong mistake" -Yogi Berri

Risky Business in an Uncertain World

Risk assessments should be routinely conducted on proposed schedule and cost estimates and reassessed during execution.

The Cumulative Distribution Function (a.k.a. "S-curve") is a graphical depiction of the range of potential cost (or schedule) estimate outcomes and their associated probability of occurrence.

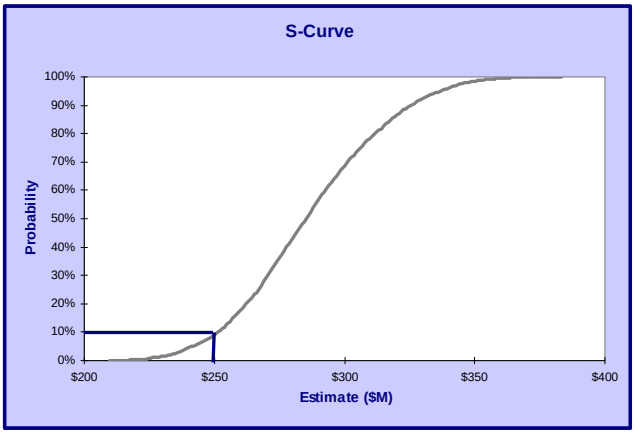
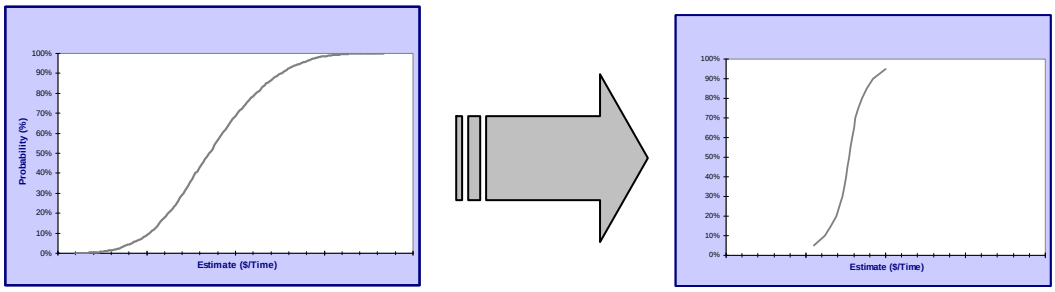


Figure 16: S Curve Example 1

The value to the Program Manager is a more accurate sense of the risk (or uncertainty) inherent in the underlying effort. For example, an estimate of $250M with no S-curve provides little to no information on the "realism" in this number. Even providing a range of $200-$250M is only marginally more useful. Once the PM is able to determine the associated probability of coming in "at or below" the estimate (about 10%, in this instance) he has a powerful piece of information (and some serious thinking to do!).

Additionally, risk assessments/cost estimating methodology should be based on a solid understanding of the program's Technology Readiness Level (TRL). The lower the maturity of the technology the larger the accommodation for risk/uncertainty in the cost/schedule estimate (wider range between the minimum and maximum expected values, more MR, more slack, etc.). In terms of the S-curve, the more risk (or lower the TRL) the flatter the S-curve; as the maturity of the effort increases the steeper the S-curve should become as illustrated below:



"Development" "Full Rate Production"

Figure 17: Variation in S-Curves due to product life cycle

Do it!

Therefore, combining these two concepts, probability and technical maturity, can be useful in assessing the "realism" in the contractor's plan. With an independently derived S-curve in hand, the PM can compare the contractor's cost or schedule estimate to the Government S-curve to get a feel for how much risk there may be in the plan (or put another way, what the prime has failed to consider in their plan). Often, we find the contractor's range, if provided (contractors almost exclusively provide single point estimates, currently), is extremely narrow given the inherent risk of the effort. Even worse, there are too many instances where the prime's number isn't even on the Government S-curve (i.e., there is a 0% chance of coming in "on or below" the contracted value).

Idea!

Even better, having the prime submit a risk-based estimate (Cumulative Distribution Function (CDF) or distribution or "S-curve") rather than a single-point estimate would enhance the Government's ability to assess whether or not the prime adequately represented risk in developing their plan. In any case, looking at the full range of possible outcomes enables the PM to determine how much risk he might want to assume in attempting to manage his program. The request for risk based estimates could be made as part of pre- or post award activities, but would, in all likelihood have to be contractually mandated.

Rainy Day Plan

Any plan that contains no margin for risk (cost or schedule) is un-executable. Program Manager's should expect to see a reasonable amount of Management Reserve (budget) in the program plans. The term "reasonable" is relative to the technical maturity, experience of the contractor, phase and general risk of the effort and may vary from program to program and contract to contract. General rules of thumb indicate that 10% Management Reserve should be held against remaining effort; however, more or less may be warranted based on the factors indicated above.

Don't Forget

Remember, too, that the Government can, and should, consider holding reserves beyond contractual agreements to account for differences between the Government and contractor positions with respect to cost and schedule. For example, the contract may be awarded to a certain probability estimate but the PMA may hold reserves (not on contract) to a higher probability of occurrence. True for schedule as well as cost, conceptually, a contract should not be awarded to the finish date established by a critical path where there are zero-days float (slack), instead the contractual end of the period of performance should consider some measure of margin to ensure there is some ability to account for risks that are likely to occur during execution of the effort. In reality, the Government awards to the contractor's proposed schedule regardless of their ability to meet the Contractual Period of Performance.

What the Government PM can do, however, is ensure there is a buffer between the Contract Completion date and the true Government need date established by Senior Naval Leadership (we'll call this "Period of Performance Margin"). Then, if the contractor does exhaust all of the slack to the Contract Complete Milestone, there is still margin to absorb additional slips without impacting the external Navy need date.

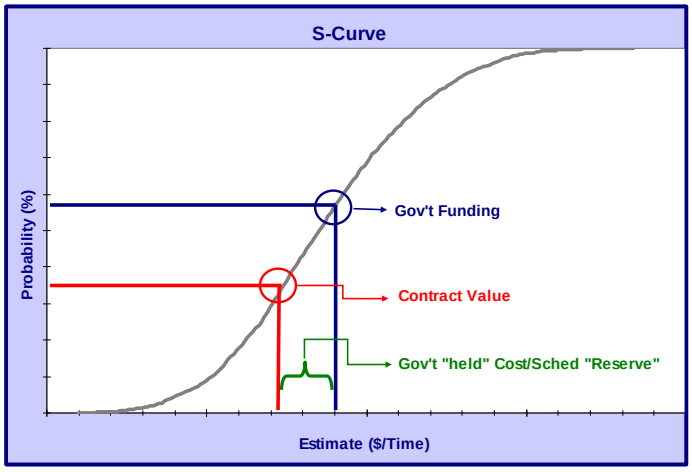


Figure 18: S-Curve Example 2

Competitive Advantage or Lowest Common Denominator

Bargain Shopping (or "You get what you pay for")

For competitive awards, avoiding the unforeseen consequences of the Government awarding to the "lowest bidder" (or more accurately, "offeror") is part of coming up with the appropriate weighting criteria. It is entirely appropriate to award to the low offeror when technical and schedule risk are low (or

non-existent). In all other instances, the criteria for determining the winner should be based on a combination of factors relevant to the particular acquisition being awarded: technical (TRL), schedule risk, cost risk, past performance, experience, contract strategy, desire to motivate risk reduction, etc. The award is typically based on a pre-determined weighting of criteria resulting in a "best value" winner. It is crucial that the weighting reflect the inherent risk the Government wishes to minimize.

Idea! Not so tried but (hopefully) true ways of improving cost and schedule realism

- Reward the PM that stands up and says "NO!" If a PM has the courage to do so, there's probably an issue which requires serious consideration.
- Signal in the RFP the expected range for the cost/schedule estimate and down select to only those offerors who demonstrate an ability to execute within that range.
- Throw out bids that are significantly (preset percentage) out of bed with the Government Estimate for cost and schedule; if none of the offerors meet the cut-off, require a re-compete or resubmission of bids.
- Unconstrained scheduling. Instead of starting with an end date and "backing in to" the schedule, have contractors submit a lowest risk (unconstrained) schedule. Pre-award, can still base selection on "best value" evaluation. Post award, allows joint (Government/contractor) collaboration on trades to bring schedule back in to acceptable range. In either case, a more realistic understanding of the schedule risks inherent in the effort will benefit the entire team and help to establish proactive mitigation priorities rather than wait for risks to be realized.

Appendix G: Prime Monthly Schedule Analysis – What it should Contain and How to Use it in Your Reviews.

INFORMATION NOTE:

The following is a generic example of a schedule analysis report from a Prime with Microsoft Project (MSP) as the scheduling tool software.

The purpose of this document is to try to display what level of detail is expected from the Prime IAW the IMS Data Item Description.

For this example, less emphasis was placed on having correlating data values, graphics and write-ups vice setting the correct tone of what is expected to be presented/ discussed in the sections – this was accomplished thru highlighting specific items and/ or by inserting comments.

The graphics and sections shown are not all inclusive and are only meant to display what could be presented. Each Prime will most likely populate these areas with their applicable material/ sections deemed appropriate for the correct level of management.

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Schedule Information

MSP File Names …….……..	<List all MSP modules sent>
Contract Name……..	XYZ
Status Date…….……	08/20/08
Submittal Date ……..……	09/01/08
Submitted by ……	Mr. Robert Jones (999) 555-11114
Attachments ……	(See below)

Notes:
MSP File Names - should denote the name of the single IMS CDRL file sent to NAVAIR. If the IMS CDRL file consists of multiple modules (subprojects), each module name should be included here – this allows a means for the Government to confirm that all files were sent as part of the CDRL and also allows a mechanism to denote. If a file was added or removed since the last CDRL deliverable that should be explained in the overview narrative.
Status Date - should match the CPR CDRL status date. The IMS should be statused to one date but if for some reason a module was not statused to the same date that should also be captured here and explained in the overview narrative
Submittal Date - State this CDRL's required due date.
Submitted by - Name and contact number of the Prime's Point Of Contact for questions on this analysis.

Overview

To enhance tool capability and reporting, XYZ Pre-implemented CCP-809-01349 ("Program IMP Update") which is an expansion of the Integrated Master Plan that adds or modifies 54 Accomplishments Criteria and 9 Significant Accomplishments. This exercise consisted of two phases. Phase one was a validation of the top level flows and dependencies to the expanded IMP, while at the same time identifying schedule issues and opportunities that could enhance the IMS. Phase two consisted of validating the network from right to left. We expended a full week conducting a scheduling deep dive exercise to update the tier 4 linkages to the expanded IMP. The purpose of the scheduling exercise was to drive down top level plan into detail IMS, (i.e.; the Tier 4s and planning packages). The approach we took was to assign the focal for IMP Events, Accomplishments and Criteria. The focals are responsible for completing their work, or for coordinating work inputs from other teams required to satisfy the specific completion criteria. We then align Tier 4 and non-IMP Tier 3 tasks to the revised IMP. We did this by coding Tier 3s and Tier 4s (in the schedule tool) to reflect the appropriate IMP Accomplishment Criteria they satisfy. The focals were then required to validate the internal links in their schedules and link only the final/last task in a networked string to the appropriate Accomplishment Criteria.

We also began the process of improving the network/critical path flow from one that included IMP flows to one that drives solely through the appropriate tier 4 work and planning packages. The replaced IMP flows are then restructured as milestones. This process of removing and replacing links is incomplete in this submittal. Therefore the network and critical path in this submittal do not accurately reflect the XYZ Program position. The Path forward is to continue to align Tier 4 work/planning packages to the expanded IMP and to other Tier 4s. This will improve the IMP/IMS architecture to reflect program network/critical path through Tier 4 work/planning packages instead of the IMP. In the upcoming March rolling wave (detailing out work packages through 2009) we

will validate there are adequate T4s representation to support IMP Criteria for Test Readiness Review, and Production Readiness Review as well as continue to replace IMP flows with appropriate tier 4 flows.

In summary the -10 days of float to IOC is not an accurate Critical Path. The ECD to finish rebuilding the network to show true program Critical Path is March 5. The true program critical path will be reflected in the March IMS submittal.

Throughout this document, files are attached to help with the understanding and assessment of the schedule data submitted. This area should be an overview or the main items of concern for this report. One would expect critical path performance for the program completion milestone and near term milestone to be mentioned briefly here though explained in greater detail later in the report as well as any significant items of concern that could impact current or future performance.

IMS Metrics

Note: This section denotes metrics for the entire IMS. In addition, some breakout metrics for each major player (Prime, each Sub).Some analysis denote only the total IMS values and have an additional column or two to denoting previous submittal values for trending purposes.

	Total XYZ	Prime '123'	Sub '234'
Total number of activities ……	3437	2238	1201
Number of relationships ……	3761	2514	1247
Number of Detailed Tasks ……	2401	1417	984
Number of Hand-off Relationships …… (ICPs all in PLATFORM 'S')	77	64	13

The following metrics are for informational purposes only and are used to identify the current status in key areas important to the quality of the program schedule / network. This area should include a graphic (e.g., a screen shot or Excel spread sheet) denoting all of the metrics for the entire IMS. Some Primes also include break outs, via subsequent graphics, of the metrics for each major player of the IMS.

<GRAPHIC OF METRICS>

'XYZ' Metrics

<Some Primes include past months values for metrics: such as below>

B	C	D	E	F	G	H	I	J	K	L	M	N	O
ate:	JUN06	JUL06	AUG06	SEP06	OCT06	NOV06	DEC06	JAN07	FEB07	MAR07	APR07	MAY07	JUN0
dule Status Date:													
Total Tasks	6152	6241	6296	6297	6349	6664	6687	6822	6964	8285	7646	9547	87
Completed Tasks	505	688	878	1194	1402	1598	1858	2096	2283	3187	2782	3668	33
% Complete	8%	11%	14%	19%	22%	24%	28%	31%	33%	38%	36%	38%	3
Incomplete Tasks	5647	5553	5418	5103	4947	5066	4829	4726	4681	5098	4864	5879	53
% Incomplete	92%	89%	86%	81%	78%	76%	72%	69%	67%	62%	64%	62%	6
Tasks Not Started	5357	5161	4953	4759	4490	4602	4456	4249	4186	4657	4408	5186	49
Tasks in Progress	290	392	465	344	457	464	373	477	495	441	456	693	4
% w/ WBS Reference	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	10
Baseline Rate	579	831	1054	1399	1632	1845	2177	2488	2738	3791	3361	4260	39
Missing Logic	35	60	22	19	29	32	29	24	28	2	9	8	
% Missing Logic	1%	1%	0%	0%	1%	1%	1%	1%	1%	0%	0%	0%	
Constraint Metric	0	0	0	0	1	1	0	0	0	0	0	0	
% Constrained	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
High Float	4337	4406	4564	4366	4064	4434	4345	4504	4122	4419	3944	4877	45
% High Float	77%	79%	84%	86%	82%	88%	90%	95%	88%	87%	81%	83%	8
Average Float (Tasks > 44wd)	654	540	511	499	554	536	519	438	374	213	223	219	1
High Duration (RW)	632	740	801	691	808	927	971	1213	1230	1430	1258	1426	10
% High Duration (RW)	34%	34%	37%	35%	36%	38%	40%	48%	51%	53%	52%	52%	4
Average Duration (RW)	82	79	78	85	95	143	193	237	237	231	238	192	1
Cumulative Missed Tasks	245	386	516	651	764	888	1053	1221	1384	1694	1714	1862	19
% Tasks Missed (Cumulative)	42%	46%	48.96%	46.53%	47%	48%	48%	49%	51%	45%	51%	44%	5

		Total # detail of Tasks	Total # remaining tasks	Missing Predecessors		Missing Successors		Missing Predecessors and Successors		Tasks w/ Constraints		Durations over 60 Cal days		Number of Negative Lags *		Lags over 30 Days *	
	Raw	17224	6072	734	11%	666	10%	235	3%	1214	17%	92	1%	62	1%	157	2%
	Totals w/ Exceptions			345	5%	425	6%	235	3%	326	5%	92	1%	62	1%	157	2%
2-Mar-06	IMS Total	17224	6944	345	5%	425	6%	235	3%	326	5%	92	1%	62	1%	157	2%

Raw Metrics - Precedent Logic	1635	26.93%
Exception Metrics - Precedent Logic	1005	14.47%

0-5% - Acceptable

6-20% - Marginal / may require improvement

21-100% Justification or Corrective Action Requ

Notes:

1.) Metrics include the measuring of detailed tasks only and do not include subprojects or Tier 1 AC Deliveries (Subcontractor 'EFG' Production schedule will link to the AC deliveries).

2.) 60 calendar day duration requirements are applied to all detail tasks. The metrics result is not surprising and is expected due to 632 activities represent recurring production lead times for "Large Structure' and "High Value' parts. We do not anticipate this metric to change.

3.) The constraint metric is applied to all detailed tasks; but as noted in Overview that some Lusby, Maryland plant Line positions are constrained and not networked. These will be replaced with Lusby, Maryland plant productions schedule once subcontractor 'EFG' Prime 'A' data is integrated.

4.) Standard 10 day positive lag/delay is used from Part On Dock to allow for Stock/Inventory time.

5.) A total float metric over 60 days is applied for all detailed tasks. Note: Having positive float is not necessarily a bad metric; but we are monitoring all float trends both positive and negative.

6.) Explanations / justification for Tasks with no Predecessors/Successors, Constraints and Durations are available.

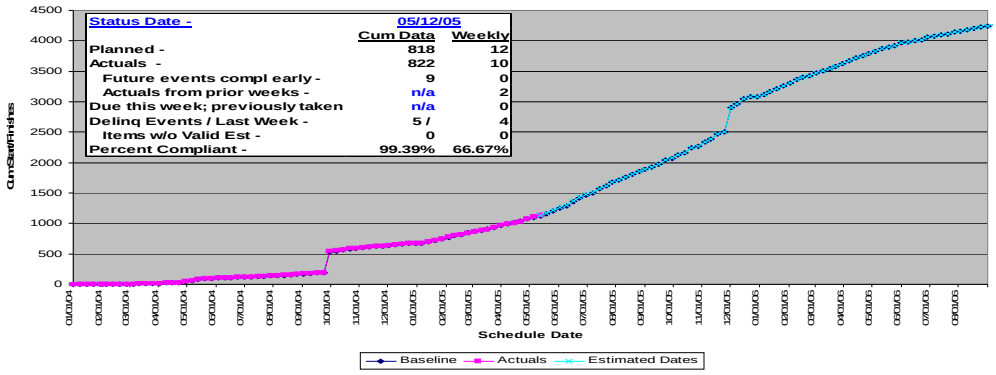
IMS BASELINE PERFORMANCE Metrics

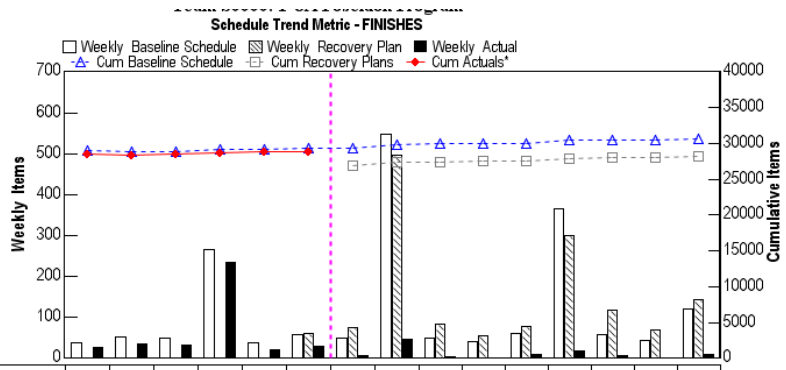
Note: This section should contain Graphics of specific metrics deemed of importance for this section. Each program may denote items unique to their programs depending on what's deemed appropriate leading indicators and how risk is being addressed. This area can also include the DCMA trip wire information, BEI and/or other applicable metrics.

This chart depicts the Total XYZ Schedule Performance trend in comparing baseline start/finish dates vs. actual dates.

<Should attach files and/or applicable products/ graphics that capture the data – the following are just minor examples of partial data>

<GRAPHICS OF METRICS>





	10JAN08	17JAN08	24JAN08	31JAN08	07FEB08	14FEB08	21FEB08	28FEB08	06MAR08	13MAR08	20MAR08	27MAR08	03APR08	10APR08	17APR08
Weekly Baseline Schedule	37	54	50	267	39	58	49	548	49	42	60	365	58	45	120
Weekly Recovery						62	75	497	84	56	78	301	117	69	143
Weekly Actual	26	35	33	236	22	29	8	48	3	1	11	18	7	1	9
Cum Baseline Schedule	28832	28886	28936	29203	29242	29300	29349	29897	29946	29988	30048	30413	30471	30516	30636
Cum Recovery						26800	26876	27373	27456	27512	27592	27892	28009	28080	28224
Cum Actuals thru Status Date*	28371	28454	28522	28763	28794	28851			Actuals Scheduled in the Future: 218						
Cum Late to Baseline	335	354	371	402	420	449									
Cum Late to Recovery						152									
Cum % Late to Baseline	1.2%	1.2%	1.3%	1.4%	1.4%	1.5%									
Cum % Late to Recovery						0.6%									

No Late Items | Up to 5% Late | Greater than 5% Late

*Excludes actuals with baseline schedules after the Status Date

This chart depicts the Prime 'XYZ' Schedule Performance trend in comparing baseline start/finish dates vs. actual dates. (As stated earlier, this section could contain specific breakout metrics of subs.)

<GRAPHIC OF METRICS>

Critical Path Analysis

Current Status of Program Critical Path:

The following section should describe the 'Program Critical Path'; and any other near term milestone and/or event based critical path deemed appropriate by management.

The critical path remains build 2.6, however the float increased from 5 days to 6 days.

Current critical path is the Build 2.6 software which is scheduled to be received in the Prime's Lab in November 2006. Due to software typically being more complex in functionality in later deliveries the schedule was set with a mandatory amount of flight time required (a lag) in the schedule. This currently contains 6 days of float. Once the software is delivered it will be tested in the Prime's Lab and a review will be held prior to release for Flight Test.

<Should attach files and/or applicable products/ graphics that capture the data>

<CRITICAL PATH as displayed in the IMS>

<Display should be a GANTT chart with a table that denotes dates of each task if not displayed on the bar chart>

Current Float: 6 days

Critical Path activity currently in work: K_FBV.FBV2.DRQ.2.2- C2.6 Coding Iteration 2 - QSCD
Current status: This task has a baseline start date of 1/3/06 and baseline completion of 2/17/06. This task has started on the 1/3/6 date. It is scheduled to complete on its baseline finish date of 2/17/06. It is 54% complete

Changes to Critical Path to First Flight:

The critical paths to first flight have changes. The first path is the Center/Aft fuselage work being done on Aircraft 1. There is 2 days of float. The second path is with the deliver of WRA 8 from Lusby. This path has 6 days of float. The third path is Software integration testing in the Prime's Lab. This has 7 days of float. The fourth path is the Build 1.0 software deliver from 'ABC' contractor at 15 days..

Description of Critical Path to First Flight:

The critical path is now being driven by the completion of the Center/Aft fuselage work going on in the ZSD shop. The modification will be complete on the aircraft once this is complete. This leads to Dedicated Final Assembly activities and then the OA Water Check which leads to Ramp IOC and the rest of the path remains the same. This path has 2 days.

<Should attach files and/or applicable products/ graphics that capture the data>

<CRITICAL PATH as displayed in the IMS>

<Display should be a GANTT chart with a table that denotes dates of each task if not displayed on the bar chart>

Status of First Critical Path:

Current Float: 2 day

Critical Path activity currently in work: K_MFG.ABC/ W213.MOD.CA - CEN/AFT FUS Work

Current status: This activity is in the Manufacturing/ZSD Shop schedule. It is a visibility task of tracking work being done on the Center/Aft that needs to be completed. It has a baseline start of 2/01/06 and a baseline finish of 5/22/06. This started early on 01/09/06 however; they have an expected finish date of 5/21/06.

Current Status of Second Critical Path:

Current Float: 6 day

Critical Path activity currently in work: K_DFR.CP14.6 - WRA 8 TPS Multi Ch Software

Current status: This activity has a baseline start of 08/01/05 and a baseline finish of 01/31/06. The actual start is 08/01/05 however it is not expected to finish until 03/10/06. It is now 77% complete.

Current Status of Third Critical Path:

Current Float: 7 day

Critical Path activity currently in work: K_AIT.F3.SIT.TST.DHL_0176- Perform Final System Integration Tests for Build 0.1 w/ focus on AEA Functionality
Current status: This activity has a baseline start date of 2/2/06 and finish of 03/06/06**.** This packages was started early on 1/18/06 however is not expected to end until 3/17/06. This activity is 36% complete.

Current Status of Third Critical Path:

Current Float: 7 day

Critical Path activity currently in work: K_IT.IT2.SWIT.4.2.2 - Build 1.0 SW check out complete

Current status: This activity has a baseline start date of 1/3/06**.**

Description of Critical Path to Program 'XYZ' D1010 Fuselage Delivery:

This critical path for Program 'XYZ' D1011 is being driven by the critical path described on the previous page. As you can tell by the below path, this same late part delivery has resulting impacts to subsequent AC deliveries and results in –13 day float condition for the final XYZ Aircraft Delivery PLATFORM 'S' D1011.

<Should attach files and/or applicable products/ graphics that capture the data>

<CRITICAL PATH as displayed in the IMS>

<Display should be a GANTT chart with a table that denotes dates of each task if not displayed on the bar chart>

Current Status of Critical Path:

Current Float: -13 Days Float

Current status: Same as critical path described on previous page for D1010.

Recovery Plan Action: By solving and establishing a recovery plan to baseline will also pull these critical paths back to supporting baseline/deliveries.

Critical Path Watch List

Note: This section could contain float breakouts of remaining tasks, perhaps with trend data since last deliverable, and then how any additional efforts would be performed to further improve these values to validate that a well integrated schedule exists.

Due to how the Master Production Schedule is planned (i.e. right to left to takt time) and the 'Large Structure' and 'High Value' parts are planned to support production just in time; the schedule data reflects many paths with zero float conditions. So, it is not surprising to see so many paths with minimal float. Note, that we do establish a hotter plan to an internal completion keeping some schedule margin in reserve prior to contract delivery. Listed below are summary of parts and their current respective float conditions:

<Should attach files and/or applicable products/ graphics that capture the task data – the following are just a minor example of partial data is >

Float Value	Activity Count
less than 0	1
between 0 and 5	329
between 6 and 10	22
between 11 and 20	40
greater than 20	59

The look-ahead status provided by part line of balance charts will provide us with the ability to quickly forecast the impacts and develop recovery plans prior to impacting contract deliveries. In future assessments we are considering to prioritize zero float part paths by risk or complexity and we will establish a coding scheme to monitor those paths with some added oversight. It is our standard operating practice to periodically monitor all paths in the IMS and perform a critical path analysis.

Accomplishments

Note: This section denotes what was worked since the last deliverable

Total of 208 activities or events were completed since contract inception:

- All PLATFORM 'S' Fuselages remain on or ahead of plan to contract deliveries. First Lot PLATFORM 'S' Fuselage delivery (D1009) remains on or ahead of target date of 3/31/09.

Of the 208 activities or events completed:

- 118 Activities were 'Large Structure' part deliveries
- 68 Activities were are PLATFORM 'S' production activities
- 20 Activities/events were 'High Value' part deliveries
- 2 Other events (Contract Award, Work Authorization)

XYZ Accomplishments.

Late Item Analysis

Note: This section should contain a listing/graphics of tasks that are late and what changes has occurred since the last deliverable and what actions will be taken to recover.

The attached file contains a listing of all the IMS tasks that are currently late to baseline finish dates for XYZ contract. Late item analysis for all slides meeting the analysis thresholds (i.e., greater than 5 days late, and less than 5 days total float), is provided on the 'IMS Jan08_Variances.pdf' file, provided as attachment #4 to this report.

<Should attach files and/or applicable products/ graphics that capture the task data>

Schedule Basis and Assumptions

Note: This section should contain a write-up explaining the construction of the IMS (i.e.,, construction approach/ hierarchy and status routine/ execution approach– this can be in attached files. This section should be relatively constant from month to month with only the attached files being updated appropriately.

Tier 1/2 and Tier 3 Summary Schedules

The attached Tier 1/2 schedule was used as the basis for development of all program schedules for XYZ detail master production and part procurement schedules. Any changes that impact activities on the Tier 1/2 schedule requires the approval of the Joint Program Office Change Board. Additionally, a Tier 3 Summary Schedules are provided the Program 'XYZ' Aircraft (D1009, D1010, D1011). These Tier 3 Summary Schedules are built in Milestones Professional and then linked to activity IDs contained in the IMS. The schedules are then pasted into PowerPoint to allow for reader ease in viewing the schedule.

<Should attach files and/or applicable products/ graphics that capture the task data>

Key Dates

Start of Control Point 660 – Fuselage Splice on 8/5/08

1st XYZ Fuselage Delivery to Lusby, Maryland plant (D1009) on 3/31/09 or sooner

All XYZ Fuselage Deliveries on 1month centers with the last PLATFORM 'S' AC (D1011) delivery on 1/19/07

1st XYZ Aircraft Delivery to Customer on 11/30/09.

Last XYZ Aircraft (D1011) on 7/31/07

Network Ground Rules

Network includes: XYZ Master Production Schedule for PLATFORM 'S' & PLATFORM 'R', 'Large Structure' and 'High Value' parts for Program 'XYZ' Aircraft (D1009, D1010, D1011), Interface Control Points with Subcontractor 'EFG', and linkage to Tier ½ Fuselage deliveries.

Schedule margin reserve is planned for Fuselage deliveries.

'High Value' parts and PLATFORM 'S' Assembly and Integration Control Accounts are resource load in IMS (IPAS)

LOE and Apportioned is contained in IPAR not in IMS that is in IPAS.

Some discrete activities will not have predecessors and/or successors as identified/explained.

By definition, the parts recurring production flows are long lead durations and will exceed the 60 day metric threshold.

1. Attached is the current data dictionary and notes on how we create the multi-projects.

<Should attach files and/or applicable products/ graphics that capture the task data such as "Data Dictionary" etc…>

Known Data Issues / Exceptions

Note: This section should contain the rationale for Constraints, Lags, Long Durations and any other significant IMS item (e.g., touch points/ hand-offs, rolling wave status metrics) that help in analysis and understanding of the IMS.

Constraint Type, Date and Use Explanations

The attached file contains a list of all IMS tasks that currently have a Start or Finish date constraint and a rationale for why the constraint is needed. Explanations are in work for these items and this will in understanding the schedule health metrics on page 2. In general, the use of targets fall into the following categories: 1) RIL positions loaded in our Master Production Schedule for supporting part deliveries to Lusby, Maryland plant. These are networked and are targeted and will be removed once combined Subcontractor 'EFG' Prime 'A' network is created, 2) Interface Control Points with Lusby, Maryland plant and again once Subcontractor 'EFG' Prime 'A' Schedules are merged these targets will go away, 3) Logical Start Points for the Master Production Control Schedule and Logical End points to measure the network from

<Should attach files and/or applicable products/ graphics that capture the task data>

Long Duration Explanations

The attached file contains a list of all IMS tasks that currently have a long duration greater that 60 calendar days. Approximately 90% of this is a result of the lead times required for the recurring procurement of 'Large Structure' and 'High Value' parts.

<Should attach files and/or applicable products/ graphics that capture the task data>

Lag/Lead Use Explanations

The attached file contains a listing of all IMS tasks that have a lag and/or lead applied and the rationale for the use of their use. This data should help in understanding the schedule health metrics on page 2.

<Should attach files and/or applicable products/ graphics that capture the task data>

Note: This section should contain the Prime's latest SRA analysis – this material may only change per the SRA cycle of the Prime.

> This months IMS submittal (for Jan 2008 status) contains the Dec 2007 IMS SRA results in the form of the risk histogram reports for Aircraft Systems/Mission Systems Integration and IOC, on attachments 7 and 8 respectively. It is important to stress, that these results are predictive analysis only and do not represent official program estimated completion dates (ECD).
> In addition to these summary histograms for management review/presentation, we have attached the criticality Gantt reports for distribution to the team leaders of all work packages which had a high criticality index. These reports are used by the team leaders/schedulers to focus their schedule mitigation planning activities on their highest criticality tasks.
> We look to this process to lead to gradually improving mean finish dates in subsequent SRAs. This months mean finish date to hardware/software integration is 01 June 09 is an improvement from last month SRA mean finish date of 01 Oct 09. This months mean finish date to IOC of 7 Nov 13 is a decrement from last months SRA mean finish date of IOC of 21 Oct. The decrement is due to the well know issue of late instrumentation drawing. Management are continuing putting extra focus on in this area. We will continue to focus our attention on reducing these mean dates through the ongoing SRA/re-plan activities on the program.

Error! Reference source not found. represents the results progress trend to the AS/MS integration mean, 50% and 90% finish dates, following the Dec 2007 IMS SRA.

<Should attach files and/or applicable products/ graphics that capture the task data>

Appendix H: Sections L and M Suggested Language

Here is our recommendation but beware the source selection team generally uses a more generic criteria (this is captured further below).

Section L IMS wording:

The following sections provide examples of language to be incorporated in Sections L and M in solicitations. However, given that each procurement is unique, you are encouraged to review and discuss this sample language with your source selection team, PCO, and attorney to ensure that you construct language that will meet your individual requirements.

Note: Anything in **< >** means that this name/description came from a previous RFP or is an **info only** to people writing the final Section L. The **info only** should be removed on the final version and the name/ description may change based on the current RFP.

X.X.X.X Integrated Master Schedule (IMS) Sub-factor

The Offeror shall provide an Integrated Master Schedule (IMS) in <ANNEX <letter to be determined by team (FYI – the annex is just the actual IMS itself)> > that delineates the Offeror's planned schedule for all activities, events, milestones, and critical paths associated with all program efforts in accordance with DID DI-MGMT 81650. The IMS shall include the program schedule with technical tasks and activities necessary to complete the work effort scoped within the IMP/SOW. The program's critical path(s), based on critical path analyses, shall be identified in the IMS. The Offeror shall develop the IMS in accordance with MIL-HDBK 881A (as a guide). The Offeror shall provide in the submitted IMS all contractors' tasks, events, milestones which should be traceable to the contract WBS and contractor's cost management systems. The IMS shall be developed by logically networking (predecessor & successor logic) all discrete contractor and major subcontractor activities from contract award through program completion. <For purposes of developing the IMS, the Offeror shall use a contract award date of XX/XX/XX.>

The Offeror shall provide a program Schedule Risk Assessment (SRA), accomplished through the application of the Monte Carlo process on each task within the IMS. The Offeror shall provide all assumptions and input data used for their Monte Carlo process in the schedule narrative. The Offeror shall include three point estimates for each task on the critical paths, traced for each IMP event, in the MS Project file (populated in Duration 1, Duration 3, and Duration 2) with accompanying rationale for

these estimates included in the schedule narrative. For those tasks not on the critical paths to each IMP event, global values may be applied. The Offeror shall provide data reflecting probability values and their associated dates (e.g., SRA histograms) for all IMP events. The Offeror is cautioned to use credible/realistic data and assumptions to produce an honest risk assessment of the schedule and to reflect the identified risks with risk mitigation planning in the Risk Management Plan. The Government will perform an independent Schedule Risk Assessment of the material and will view with concern unrealistic assessment or failure to address risk areas. Additional instruction for completing the IMS is provided below.

a) For this evaluation, a major subcontractor is defined as a subcontractor who is required to have an Earned Value Management System (EVMS) in accordance ANSI/EIA-748-B or provides at least 10% of the proposed total price (excluding the prime's profit and/or fee).

    i. Required documentation standards are applicable to both prime and principal subcontractor(s). If a 2nd tier subcontractor provides at least 10% of the proposed total price (excluding the contractor's profit and/or fee), it is considered a principal subcontractor and the required documentation standards stated above are applicable. The Government does not require Cost Attachments or detailed substantiation for 2nd tier non-principal subcontractors or any 3rd tier subcontractor.

b) The level of detail in the schedule should be developed to at least Level 5 of the WBS, and go to the lowest level of tasks/activities that the effort will be managed. The Offeror shall provide an IMS to include significant external interfaces, critical items from suppliers, teammates, or other detailed schedules that depict significant and/or critical elements and Government furnished equipment or information dependencies for the entire contractual effort in a single integrated network. The Offeror shall provide an IMS that has the capability to roll-up from the lowest manageable level to the highest summary level with complete horizontal and vertical traceability and capability to produce a calculated program critical path. The IMS shall identify proposed labor hours by functional labor category (e.g., design engineering, systems engineering, manufacturing, etc.) for each task (utilizing MS Project 'Work' and 'Resource Name' fields). The Offeror shall provide a staffing plan by month and year for each functional labor category, identified in the 'Resource Name' field, to substantiate their

ability to meet the resource requirements in the IMS. The Offeror shall include a narrative on the Basis and Assumptions of the IMS. The Basis and Assumptions shall outline all program milestones/IMP events and document all major schedule assumptions that were utilized in the development of the plan. The Offeror shall provide ground-rules and assumptions as well as rationale for durations of activities with moderate-to-high technical or schedule risk, including but not limited to the following areas: <determined by the team, but most likely to include software development/testing, hardware and software interface/integration, subsystem and system test>. The Integrated Master schedule shall be submitted electronically in Microsoft Project 2003 version. All additional schedule information shall be submitted within a schedule narrative provided in hardcopy and electronic format.

c) Schedule Constraints: The Offeror shall develop their IMS within the following constraints:

   i. The Offeror shall propose a single numbering system that ties all activities in the network schedule to the events in the IMP – if an IMP is applicable.

   ii. The Offeror shall use a calendar consistent with the company's work schedule. A listing of company holidays, for each year of the proposed plan, should also be included in the schedule narrative.

   iii. The Offeror shall identify each activity in the schedule with the appropriate organizational (IPT) or functional code in the MS Project Text1 field (e.g., AV= Air Vehicle, SW=Software Design, INT=Integration and Testing; LOG=Logistics; MGMT=Management and System Engineering; HW=Hardware Design; MFG=Manufacturing; TEST=Flight Test activities).

   iv. For each IMS activity, the Offeror shall also identify in the Text2 field the corresponding Mission Capability subfactor <(as determined by the Program Office)> primarily related to that activity.

v. The schedule file(s) submitted on disk shall contain the following data, as a minimum for each event, activity, task, and milestone in the IMS:

-- Responsible CAM - (if available)
-- Control Account Number - (if available)
-- Unique ID
-- IMP Reference/Code (Text3 field) - (if applicable to RFP)
-- Name
-- Start
-- Finish
-- Duration (most likely) (use of elapsed days is only permitted for CDRLs)
-- Total Slack
-- Predecessors
-- Successors
-- Constraint Type (minimal constraints should be used)
-- Constraint Date
-- Organizational or Functional Code (Text1 field)
-- Corresponding Mission Capability Subfactor (Text2 field)
-- Level of Effort tasks (if applicable) (Text4 field)
  -- WBS (WBS field)
  -- SOW Reference (Text5 field)
  -- Resource Name (functional labor category)
  -- Work (labor hours)
  * additional fields may be required

d) The Offeror shall identify any customized fields used in the Microsoft Project schedule file and address their applicability in the schedule narrative. The Offeror must also provide tracking to the text fields used if they did not correspond to the assigned text fields as identified above.

e) Do <u>not</u> use the following Microsoft Project fields: Duration10, Number1, Number3, Number4, Flag1, Cost10, Text8, Text9, Text27, Text28, Text29, Text30, Finish8, Finish9, Finish10 – these fields are required to be empty unless being utilized to conduct an SRA.

f) Relationships with excessive lead or lag time should be <u>avoided</u> in the IMS submittal. If relationships with large lead or lag times **(greater**

than 5 working days) cannot be avoided, the Offeror shall explain the need for each lead/lag in the schedule narrative.

g) Any activity with duration greater than **125** work days should be divided into activities with smaller durations or the Offeror shall explain the duration within the schedule narrative.

h) The durations provided by the Offeror for each task in the network schedule shall represent most likely durations.

i) The Offeror shall let the logic determine the network and minimize the use of constraints. Constraints (other than "as soon as possible") and directed dates and rationale supporting the need for each constrained/directed date in the schedule shall be included in the schedule narrative. Each constraint other than "ASAP" shall be justified separately in the schedule narrative.

j) The Offeror shall describe its current or proposed schedule management system and how it will be used to plan, coordinate, integrate, control and manage the schedule of the program, including the plan for electronic data transfer of schedule information to the Government, within the schedule narrative.

Section M wording for IMS:

X.X.X. Integrated Master Schedule Subfactor

This subfactor will be evaluated to determine the offeror's ability to successfully provide a comprehensive, integrated, resource-loaded IMS that meets the requirements of the solicitation. The subfactor will also be evaluated to determine the reasonableness of the proposed IMS and the degree to which the IMS meets the solicitation constraints.

The IMS should be in a condition to be evaluated by the technical and schedule teams. Evaluation will be based on traceability of events, how they are logically sequenced, and whether the IMS supports performing an independent Schedule Risk Assessment (SRA).

The Government will assess the extent to which the IMS demonstrates the following:

1) Are the labor hours proposed accurately reflected in the IMS?
2) Is the calculated critical path demonstrable and logical?
    a. Determined by the technical team
3) Is logical rational provide for leads and lags 5 days or greater in duration?
4) Is logical rational provide for durations greater than 125 working days?
5) Is there at least 90% precedence logic present and logical?
6) Is at least 80% of the logic ties finish to start?
7) If applicable, is the IMP fully identified and logically sequenced?
    a. Criteria leads to accomplishment
    b. Accomplishment leads to events
8) Are all tasks in the schedule traceable to the SOW or SOO?
9) Does the IMS contain all the scope required to meet the technical requirements in the SOW or SOO?
10) Are significant subcontractor interfaces identified?

Source Selection Board proposed Section M wording for IMS (again generally captured under the 'technical' section):

Note: this section is provided as an example for SDD and LRIP-1. Anything in < > means that this name/ description should be updated to correlate to your current RFP. The following is a recommendation if putting an IMP on contract

Program and Schedule – The Government will evaluate the offeror's plans and ability to execute SDD and LRIP-1, and meet the requirements of the Statement of Objectives (SOO). The schedule and manpower resources to perform this effort and the realism of the offeror's schedule to achieve IOC will be assessed. Emphasis will be placed on the offeror's SDD Statement of Work (SOW), Integrated Management Plan (IMP), Integrated Master Schedule (IMS), and Systems Engineering Management Plan. Also, emphasis will be placed on the technological maturity of the proposed design necessary to support MS B approval for contract award. The evaluation will also include an assessment of the offeror's T&E program, Capability Maturity Model Integration (CMMI), transition to production approach and Risk management plan. The Offeror's Small Business subcontracting strategy for utilizing Small Business Concerns (including Small Disadvantaged Business Concerns) and Historically Black Colleges/Universities and Minority Institutions and its consistency with the Small Business Subcontracting Plan will be evaluated. Additionally, any proposed Small Disadvantaged Business targets will be evaluated.

Section L wording for IMP:

2.2.2 Integrated Management Plan – The Offeror shall provide an IMP as <Annex TBD>. The IMP will be incorporated in the contract. In general, the IMP shall provide the information as described below. Detailed Instructions for the IMP is provided at the end of this book under the title "<Annex TBD>".

The Offeror shall submit an IMP that is structured as an event-based schedule. Technical reviews applicable to the contracted event shall be included as events. The maturity of the technical performance approach as well as status of risk action plans will be reviewed per NAVAIRINST 4355.19B. The IMP shall include events, accomplishments that tie to these events and completion criteria for each accomplishment for the total contracted effort. The Government Draft Systems Engineering Plan (SEP), provided in the Government's Technical Library defines a minimum set of technical events to be included in the proposed IMP. Criteria for entry into any technical event will be tied to the associated accomplishment completion criteria. The Offeror may include additional technical events with associated accomplishments and completion criteria or more rigorous completion criteria as required. The Offeror shall describe the organizational structure of the proposed contractor team with emphasis on IPT implementation; technical and budgetary purviews; and the approach to communication and interface, including required Government participation and insight. Describe the relevant capabilities and commitment of the proposed contractor team. Show what resources (e.g., staffing, facilities, communications, supportability, manufacturing capability, GFE) will be used and how they will be integrated in conducting the <PROGRAM NAME> program from SDD through transition to production and IOC. Describe existing and future facilities required to perform engineering, test, production and operational support for the <PROGRAM NAME> program. Also identify the subcontractors/team members that will be needed to augment your capability and provide a description of how they will be used and controlled in execution of the program. Furthermore, provide a description of the planned approach for control and distribution of technical documentation.

The Offeror shall provide a program plan that describes existing resources, practices and capabilities and the manner in which they will be applied to this program, identifying any new resources, capabilities or personnel, which do not currently exist. The Offeror shall identify and describe organizational roles and responsibilities, key events and milestones, significant tasks, and success criteria for the <PROGRAM NAME> design, development, production and deployment. Success criteria may be presented in a tabular rather than narrative form.

2.2.2.1. GFP/GFE/GFF/GFI List – The Offeror shall describe its approach towards minimizing the amount of GFP/GFE/GFF/GFI required to perform the SDD and 1st LRIP contract. Provide a GFP/GFE/GFF/GFI List in <Annex TBD> that may be incorporated into the contract. Describe the risk associated with each Government Furnished item should the Government not be able to provide the item or provide it on time. If in the course of developing an approach that minimizes Government Furnished items, the Offeror believes that it is in the best interest of the Government to provide other item(s) not on the proposed list, then the Offeror should propose in Volume 7 these additional items, justifying that the benefit to the Government outweighs the risk to the Government.

ANNEX wording:

<ANNEX TBD> (paragraph 2.2.2) – Integrated Master Plan

The following are instructions for <Annex TBD>, which is to be provided in accordance with paragraph 2.2.2 above.

The Offeror shall provide their <PROGRAM NAME> program IMP, which integrates program cost, performance, and schedule. This annex shall contain a general description of planned reviews and audits necessary to track program progress.

The Offeror shall describe the interrelationship of the proposed SOW, CWBS, IMS, EVMS & Risk Management approach that together demonstrates the basis of the integrated <PROGRAM NAME> program. Top-level guidelines for the IMP are:

a. The delivered SOW shall meet the SOO and other requirements in the RFP.
b. The CWBS shall be defined to a level of sufficient detail to support the cost proposal of the RFP. The CWBS definition shall not be no less than to the third level (e.g., System-Air Vehicle-Engine-Bleed Air System) and shall include a dictionary.
c. The IMS shall be in accordance with <Annex TBD > described below. The SDD contract top-level schedule provided as part of the IMS covering the specific contract related activities as described in Annex to Book B below will become part of the contract. The detailed IMS will not become part of the contract.
d. The Offeror shall describe their EVMS approach with sample work packages that support the IMS, CWBS, and SOW.

Specific instructions for IMP preparation are provided in the following paragraphs.

Scope. The IMP is to include the planning for all SDD activities to the level of detail described below. The Offeror's top-level plan should be translated into the IMP, with the IMP addressing planning to the third level.

Introduction. The IMP is the Offeror's program to accomplish contract requirements. The IMP shall be submitted with the Offeror's proposal. The Offeror's IMP will become part of the contract.

The IMP as a Tool After Contract Award. The Offeror's IMP, as part of the contract, establishes the plan for what has to be accomplished and the criteria behind how completion of accomplishments will be verified. In conjunction with the IMS, which expands upon the IMP, both the Offeror and the Government will have a powerful tool for monitoring program progress, identifying problem areas, and allow for the reallocation of resources to mitigate program risk.

Metrics. The essential element for creating an effective IMP is the establishment of an effective means for measuring and tracking progress. Metrics will allow for the early identification of problems and enable continuous process improvement allowing the Offeror to maintain a proactive role in meeting programmatic performance objectives. The Offeror shall identify metrics for the proposed processes.

Government IMP Role. The Offeror shall include Government decision points, including technical reviews, and the Offeror's time phased need for GFE and Government Furnished Information (GFI) in the IMP.

Section 1 - Narrative Section Instructions - Under the following three parts the Offeror shall 1) Narrate the IMP Product and Process Sections, 2) Expand upon Government defined Events in the SOO, and 3) Add additional terms to IMP Criteria Terms and Definitions section which provides clarification for the Offeror's IMP.

> Part 1 - IMP Narrative - The Offeror shall create a descriptive narrative of the IMP Product and Process Sections. The Offeror shall discuss the contents of the IMP Product and Process Sections and discuss any key assumption used in the creation of the IMP.
>
> Part 2 - Event Definitions - The Offeror shall use the definitions of the events provided in the SOO. The Offeror shall define any additional events.

Part 3 - IMP Criteria Terms and Definitions - The following terms and definition apply to the IMP accomplishment criteria:

Accredited	Confirmed or approved by competent authority.
Activated	In an operational status.
Allocated	Apportioned to specific elements.
Analyzed	Critical, technical evaluation completed.
Appointed	Personnel selection process has been completed and individual has accepted.
Assembled	Joined or fitted together in accordance with configuration baseline documentation.
Assessed	Estimated by a method approved.
Assigned	Allocated.
Audited	Examination of records against established requirements.
Available	Item in question is suitable, in place, and operational, or is suitable and ready for use.
Awarded	Contract document completed and signed by both parties.
Cleared	Action items have been satisfactorily dispositioned without limitation or approved.
Communicated	Disclosed and confirmed in writing.
Completed	Prepared, reviewed, no further action required.
Confirmed	Truth, accuracy or validity made certain.
Corrected	Errors or faults removed.
Defined	Full and distinct explanation provided.
Delivered	In the legal possession of the intended recipient.
Established	Brought to a permanent basis.
Evaluated	Value, amount or status calculated or determined.
Finalized	Completed.
Included	Contained in or covered by.
Operational	In use and meeting requirements.
Provided	Delivered by CDRL or data based on IDE.
Reported	Disclosed in writing.
Reviewed	Critical reexamination completed.
Substantiated	Established by proof or competent evidence.
Updated	Made current by adding information or making corrections.

Validated	Demonstrated to predicted performance in agreement with experimental results for a stated purpose
Verified	Proven to meet requirements (system)
Verified	Confirmed to properly represent the source mathematical model (software only)

Section 2 - IMP Product Section Instructionstate

The IMP is constructed around three elements: events, accomplishment and criteria.

EVENTS: Major and minor program milestones throughout the program shall be provided.
ACCOMPLISHMENTS: Defines what work must be completed for each Event.
CRITERIA: Defines how the completed work will be measured.

The IMP ties the Events, Accomplishments, Criteria, Accomplishment Verification (Proof), CWBS, and proposed SOW (see sample IMP Product Section below).

Event Discussion: The IMP is based (or constructed) upon Events. Events should be envisioned as program reference points or milestones at which the contractor and Government jointly assess program status.
Accomplishment Discussion: For each event the Offeror shall state what progress is to be measured at each event. This breakdown of principal tasks and activities become the Offeror's accomplishments. The Offeror shall look at the SOO for help in scoping the tasks and activities. The Offeror should state accomplishment using finished terminology. The Offeror should develop and apply a consistent method in detailing tasks and activities. The Offeror should recognize that accomplishments go through a maturation process and that terminology reflecting this maturation process (i.e., preliminary, draft, version #1, final, etc.) may be used to describe phased accomplishments.
Criteria Discussion: For each Accomplishment the Offeror shall state how progress is to be measured. Criteria should be stated using objective methods to verify that the Accomplishment has been achieved. The Offeror should be able to document that the criteria have been satisfied. In total the criteria shall demonstrate that the Accomplishment has been achieved.

Sample IMP Product Section: Table 1 is a generic IMP Product Section. The Offeror may use this sample section as an aid in understanding the IMP Product Section concept.

ACTIVITY NUMBER	EVENT ACCOMPLISHMENT CRITERIA	PROOF (ref)	OPR	CWBS	SOW (ref)
W01	Design Review 1 (DR 1)			1600	
W0101	A/V Integration requirements established			1000	
W010101	Seeker configuration constraints developed			1110	
	Electromagnetic environmental effects			1110	
W010102	requirements established				
W0120	Acceptance of design qualification criteria			1000	
W012001	Design qualification plan delivered			1000	
W012002	Design usage finalized			1000	
W012003	Missile service use environments			1000	
W012004	established			1000	
W012005	Quality assurance provisions established			1000	
W012006	Material characteristics established			1000	
W012007	Design analysis established			1000	
W012008	Damage tolerance analysis complete			1000	
W012009	Life management program established			1000	
W012010	Design criteria established			1000	
	Durability test requirements established				

Table 1

Section 3 - IMP Process Section Instructions - As a minimum, the Offeror shall describe the critical processes listed below. Also the Offeror should explain how the Systems Engineering Management Plan and other functional plans such as QA, Configuration Management, and Manufacturing plans will be used to execute the program. The Offeror is free to add processes, which are critical to SDD. The specific data/information to be included in the IMP for each critical process should be covered in 3-10 pages with use made of flowcharts and functional block diagrams. Areas to be described include:

a. Summary description of critical SDD processes.
b. Description of how process implementation will be applied across the phases of SDD.
c. Identification of applicable process documentation, if any. This process documentation includes, but is not limited to: 1) company "in-house" and industry documentation and standards, 2) Process Title (e.g., Soldering), 3) Process identification number (e.g., ANSI/J-STD-001), 4) Process revision number or issue date (e.g., Revision B of 23 March 1996), and 5) any tailoring of referenced documents. Copies of company in-house documentation must be provided with the proposal.

d. Definition of metrics to be used to measure the critical process performance and the associated IMP Program events in which these metrics are to be evaluated. Process measurement should be appropriately identified within the IMP Product Section.
e. Describe how and to what extent described processes will be flowed down to subcontractors and vendors.
f. Describe how the EVM system will be integrated in the overall program management strategy and in accordance with the ANSI-EIA-748A EVM system guidelines. Provide as a minimum the following:
    1. The Offeror shall illustrate how Earned Value will be used as a tool to manage this effort and measure and control cost, schedule and technical deviations (including subcontractor efforts). Specifically provide a process description demonstrating what will trigger management actions and management response to these metrics. The Offeror shall consider the following: manpower required to successfully manage a program of this complexity; resources; staffing plans; tools required to generate reliable and timely data; and methods to communicate this information to the Government and contractor decision makers in a timely fashion. Provide examples to illustrate this process. In addition, provide the staffing plan that demonstrates how the program will be resourced to meet the major program milestones.
    2. The Offeror shall provide documentation or evidence of formal validation of their EVM system. If the Offeror does not have an EVM System that is compliant with the ANSI-EIA-748A standards, an implementation plan shall be included in the proposal.

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Appendix I: IMS Checklist for IPT

SECTION A (Page 1 of 3): INITIAL ACTIONS TO BE PERFORMED BY A GOVERNMENT IPT (Prime's Control Account Manager Counter-part) LEADING UP TO THE FIRST BASELINE FOR THE IMS:

		Done by Gov't IPT	Gov't IPT and Prime Agree
General IMS Overview			
A1	Do you have in possession the Integrated Master Plan (IMP), Statement of Work (SOW), Work Breakdown Structure (WBS) and Organizational Breakdown Structure (OBS) on contract for the effort - essentially the scope of the project and who will be working it	☐	☐
A2	Validate that your Prime counter-part is using the contract IMS (CDRL delivery) and not any other non-associated schedule - i.e., the schedule being used by your counter-part could be an extract/ subset of the actual IMS and may include even lower tasks (not in the IMS) but the schedule does not violate or operate external to the contractor's CDRL delivery IMS	☐	☐
A3	Do you understand what information is available within the Integrated Master Schedule (IMS) for the effort - i.e., IMP, WBS, SOW, Dates, Taskings, Resources (if applicable) etc…	☐	☐
A4	Do you have an agreed to business rhythm (routine meetings, phone-coms etc…) with your counter-part to perform this entire checklist and review status	☐	☐
A5	Identify what of the contract SOW is your responsibility - ensure Class Desk/ Lead Engineer agrees	☐	☐
A6	Identify what of the Contractor WBS is your responsibility - ensure Class Desk/ Lead Engineer agrees	☐	☐
A7	Do you understand that no task in the IMS should have more than one SOW, one IMP code, one OBS and one WBS assigned	☐	☐
Individual IMS Task Actions			
A8	Validate that all Contract WBS of your responsibility is in the Integrated Master Schedule (IMS)	☐	☐
A9	Validate that all SOW of your responsibility is in the Integrated Master Schedule (IMS)	☐	☐
A10	Internal Logic: Look at each path within your WBS or responsibility and validate that the correct sequence (logic) exists for each WBS path (this can be within an IPT)	☐	☐
A11	External Logic: look at your tasks in the IMS, determine if all external logic ties (i.e., predecessor and successor from another IPT, WBS, Sub-contractor and/or Government) is present on your tasks or responsibility in the IMS	☐	☐

SECTION A (Page 2 of 3): INITIAL ACTIONS TO BE PERFORMED BY A GOVERNMENT IPT (Prime's Control Account Manager Counter-part) LEADING UP TO THE FIRST BASELINE FOR THE IMS (cont.)

		Done by Gov't IPT	Gov't IPT and Prime Agree
Individual IMS Task Actions (continued)			
A12	For each task in your responsibility, determine if the correct IMP code is assigned. Remember, the IMP is broken out by Event, Accomplishment, Criteria and then remaining taskings. Taskings lead into Criteria, criteria lead into Accomplishments, and accomplishments lead into Events - therefore the IMP code means the task leads into something else all the way up to an Event so are the codes correct?	☐	☐
A13	For each task in your responsibility, determine if the duration (i.e., the number of workdays the IMS shows the task will take) is correct for the scope of effort or work (total number of man-hours needed to perform the task) involved for the task. To do this, one must understand what resource/ resources are applied or assumed to be applied for the task, what the work schedule (calendar) is for that resource/ resources and does that match the IMS standard workday duration, and what the total number of hours effort (work) the resource/ resources have to perform to accomplish the effort (note: use the proposal's Basis Of Estimate as a starting point to familiarize yourself with the scope of the effort) - out of this process the duration in workdays can be determined. Note: Some schedules contain resource fields with data entered - this could simply contain only the name or names (persons or groups) of who will be doing the work. Some schedules go beyond this and list the hours that the individual resource will be working the effort, others go even further by time-phasing the resource hours against	☐	☐
A14	Review the IMS items and determine which tasks or milestones are logical points to gauge technical performance progress - since these points can help the engineering community in determining if the program is on course to meet the Government's needs. Note: these are not always present in an IMS, so you may need to work with your counter-part to have them at least place milestones, that you both agree to, into the IMS - otherwise, if not presetn, you will have to stay on top of the effort to report technical progress to leadership.	☐	☐
A15	For each task in your responsibility, determine if the planned cost (BCWS in dollars; total dollars to perform the task) is correct - note that every task in the IMS has a corresponding Control Account (CA - a CA exists for every intersection of WBS and OBS in the program) capturing the planned and executed cost. Remember that CAs may correlate to only a single task in the IMS while other CAs may be made up of multiple IMS tasks. Some schedules do not contain any task cost data, while others may contain the exact task planned cost (BCWS in dollars), while others may contain only the total number of hours of task planned effort (planned work - BCWS in hours) for all the resources to complete the task.	☐	☐

SECTION A (Page 3 of 3): INITIAL ACTIONS TO BE PERFORMED BY A GOVERNMENT IPT (Prime's Control Account Manager Counter-part) LEADING UP TO THE FIRST BASELINE FOR THE IMS (cont.)

		Done by Gov't IPT	Gov't IPT and Prime Agree
Individual IMS Task Actions (continued)			
A16	For each detailed task in your responsibility, determine if you agree with the EV method applied. Remember that the EV technique is directly related to how performance on the task will be measured against and statused to. So if an incorrect EV technique is applied, determining how a task is exactly performing from the data could be distorted. Note: tasks that are at the work package level - mean an Earned Value Method is assigned. Tasks in the detailed window are to have EV techniques applied. How far tasks are detailed ahead of the status date is dependant on how the Prime's system description states (sometimes the detailed window is described as the rolling wave window). Tasks outside of the detailed window (aka rolling wave window) are generally planning packages (no EV technique assigned).	☐	☐

SECTION B (Page 1 of 4): ROUTINE ACTIONS TO BE PERFORMED BY A GOVERNMENT IPT (Prime's Control Account Manager Counter-part) WITH EVERY IMS STATUS UPDATE:

		Done by Gov't IPT	Gov't IPT and Prime Agree
General IMS Overview			
B1	Do you have an agreed to business rhythm with your Prime counter-part to perform these routine reviews and complete the checklist - i.e., how and how often will communication on task status and issues occur between you and your counter-part. Perhaps you can have access to your counter-parts status updates given to their supervison.	☐	☐
B2	Do you understand what information the schedule information presented (such as the IMS or subset) including IMP, WBS, SOW, Dates, Taskings, Resources (if applicable) etc… - this would also include schedule layouts being understandable and appropriate for your use. Essentially, for all material presented, do you fully understand what each field/ data point within the material represents.	☐	☐
B3	The key to minimizing the need to review the entire schedule with every update is establishing an agreement with your counter-part on some type of communication (tracking mechanism) to denote changes made to tasks within your responsibility - this will allow you to key in on the new changes to ensure you concur. One important change to have identified is any further detailed planning (rolling wave actions) has taken place since the last status communication.	☐	☐
Individual IMS Task Actions (for Rolling Wave tasks) - i.e., actions for tasks that were planning packages in the previous status update			
B4	For tasks of your responsibility, ensure the correct Contract WBS was assigned to the detailed task in the IMS from the previous planning package	☐	☐
B5	For tasks of your responsibility, ensure the correct SOW was assigned to the detailed task in the IMS from the previous planning package	☐	☐
B6	For tasks of your responsibility, ensure the correct IMP was assigned to the detailed task in the IMS from the previous planning package. Remember, the IMP is broken out by Event, Accomplishment, Criteria and then remaining taskings. Taskings lead into Criteria, criteria lead into Accomplishments, and accomplishments lead into Events - therefore the IMP code means the task leads into something else all the way up to an Event so are the codes correct?	☐	☐
B7	Internal Logic: Look at each path within your WBS or responsibility and validate that the correct sequence (logic) exists for each WBS path (this can be within an IPT)	☐	☐
B8	External Logic: look at your tasks in the IMS, determine if all external logic ties (i.e., predecessor and successor from another IPT, WBS, Sub-contractor and/or Government) is present on your tasks or responsibility in the IMS	☐	☐

SECTION B (Page 2 of 4): ROUTINE ACTIONS TO BE PERFORMED BY A GOVERNMENT IPT (Prime's Control Account Manager Counter-part) WITH EVERY IMS STATUS UPDATE (cont.)

	Individual IMS Task Actions (for Rolling Wave tasks) - i.e., actions for tasks that were planning packages in the previous status update (continued)	**Done by Gov't IPT**	**Gov't IPT and Prime Agree**
B9	For each task in your responsibility, determine if the duration (i.e., the number of workdays the IMS shows the task will take) is correct for the scope of effort or work (total number of man-hours needed to perform the task) involved for the task. To do this, one must understand what resource/ resources are applied or assumed to be applied for the task, what the work schedule (calendar) is for that resource/ resources and does that match the IMS standard workday duration, and what the total number of hours effort (work) the resource/ resources have to perform to accomplish the effort (note: use the proposal's Basis Of Estimate as a starting point to familiarize yourself with the scope of the effort) - out of this process the duration in workdays can be determined. Note: Some schedules contain resource fields with data entered - this could simply contain only the name or names (persons or groups) of who will be doing the work. Some schedules go beyond this and list the hours that the individual resource will be working the effort, others go even further by time-phasing the resource hours against	☐	☐
B10	For each task in your responsibility, determine if the planned cost (BCWS in dollars; total dollars to perform the task) is correct - note that every task in the IMS has a corresponding Control Account (CA - a CA exists for every intersection of WBS and OBS in the program) capturing the planned and executed cost. Remember that CAs may correlate to only a single task in the IMS while other CAs may be made up of multiple IMS tasks. Some schedules do not contain any task cost data, while others may contain the exact task planned cost (BCWS in dollars), while others may contain only the total number of hours of task planned effort (planned work - BCWS in hours) for all the resources to complete the task.	☐	☐
B11	For each detailed task in your responsibility, determine if you agree with the EV method applied. Remember that the EV technique is directly related to how performance on the task will be measured against and statused to. So if an incorrect EV technique is applied, determining how a task is exactly performing from the data could be distorted. Note: tasks that are at the work package level - mean an Earned Value Method is assigned. Tasks in the detailed window are to have EV techniques applied. How far tasks are detailed ahead of the status date is dependant on how the Prime's system description states (sometimes the detailed window is described as the rolling wave window). Tasks outside of the detailed window (aka rolling wave window) are generally planning packages (no EV technique assigned).	☐	☐

SECTION B (Page 3 of 4): ROUTINE ACTIONS TO BE PERFORMED BY A GOVERNMENT IPT (Prime's Control Account Manager Counter-part) WITH EVERY IMS STATUS UPDATE (cont.)

	Individual IMS Task Actions for new scope tasks or Management Reserve tasks ~ i.e., tasks added as a result of new scope or due to being erroneously omitted from previous schedules but considered original scope (MR use)	**Done by Gov't IPT**	**Gov't IPT and Prime Agree**
B12	Determine if there are logical points present to gauge technical performance progress - since these points can help the engineering community in determining if the program is on course to meet the Government's needs. Note: these are not always present in an IMS, so you may need to work with your counter-part to have them at least place milestones, that you both agree to, into the IMS - otherwise, if not presetn, you will have to stay on top of the effort to report technical progress to leadership.	☐	☐
B13	Identify what of the contract SOW is your responsibility - ensure Class Desk/ Lead Engineer agrees	☐	☐
B14	Identify what of the Contractor WBS is your responsibility - ensure Class Desk/ Lead Engineer agrees	☐	☐
B15	Do you understand that no task in the IMS should have more than one SOW, one IMP code, one OBS and one WBS assigned	☐	☐
B16	Validate that all Contract WBS of your responsibility is in the Integrated Master Schedule (IMS)	☐	☐
B17	Validate that all SOW of your responsibility is in the Integrated Master Schedule (IMS)	☐	☐
B18	Internal Logic: Look at each path within your WBS or responsibility and validate that the correct sequence (logic) exists for each WBS path (this can be within an IPT)	☐	☐
B19	External Logic: look at your tasks in the IMS, determine if all external logic ties (i.e., predecessor and successor from another IPT, WBS, Sub-contractor and/or Government) is present on your tasks or responsibility in the IMS	☐	☐
B20	For each task in your responsibility, determine if the correct IMP code is assigned. Remember, the IMP is broken out by Event, Accomplishment, Criteria and then remaining taskings. Taskings lead into Criteria, criteria lead into Accomplishments, and accomplishments lead into Events - therefore the IMP code means the task leads into something else all the way up to an Event so are the codes correct?	☐	☐
B21	For each task in your responsibility, determine if the duration (i.e., the number of workdays the IMS shows the task will take) is correct for the scope of effort or work (total number of man-hours needed to perform the task) involved for the task.	☐	☐

SECTION B (Page 4 of 4): ROUTINE ACTIONS TO BE PERFORMED BY A GOVERNMENT IPT (Prime's Control Account Manager Counter-part) WITH EVERY IMS STATUS UPDATE (cont.)

	Individual IMS Task Actions for new scope tasks or Management Reserve tasks ~ i.e., tasks added as a result of new scope or due to being erroneously omitted from previous schedules but considered original scope (continued)	**Done by Gov't IPT**	**Gov't IPT and Prime Agree**
B22	For each task in your responsibility, determine if the planned cost (BCWS in dollars; total dollars to perform the task) is correct - note that every task in the IMS has a corresponding Control Account (CA - a CA exists for every intersection of WBS and OBS in the program) capturing the planned and executed cost. Remember that CAs may correlate to only a single task in the IMS while other CAs may be made up of multiple IMS tasks. Some schedules do not contain any task cost data, while others may contain the exact task planned cost (BCWS in dollars), while others may contain only the total number of hours of task planned effort (planned work - BCWS in hours) for all the resources to complete the task.	☐	☐
B23	For each detailed task in your responsibility, determine if you agree with the EV method applied. Remember that the EV technique is directly related to how performance on the task will be measured against and statused to. So if an incorrect EV technique is applied, determining how a task is exactly performing from the data could be distorted. Note: tasks that are at the work package level - mean an Earned Value Method is assigned. Tasks in the detailed window are to have EV techniques applied. How far tasks are detailed ahead of the status date is dependant on how the Prime's system description states (sometimes the detailed window is described as the rolling wave window). Tasks outside of the detailed window (aka rolling wave window) are generally planning packages (no EV technique assigned).	☐	☐