Integrated Master Plan and Integrated Master Schedule Preparation and Use Guide

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1. Introduction

This Guide provides guidance for the preparation and implementation of a program's Integrated Master Plan (IMP) and Integrated Master Schedule (IMS). The IMP and IMS are fundamental management tools that are critical to performing effective planning, scheduling, and execution of work efforts. This Guide amplifies the event-based technical approach directed by policy in the February 20, 2004, USD(AT&L) Memorandum, "Policy for Systems Engineering in DoD," and October 22, 2004, USD(AT&L) Memorandum, "Policy Addendum for Systems Engineering;" complies with the Earned Value Management (EVM) policy directed in the March 7, 2005, USD(AT&L) Memorandum, "Revision to DoD Earned Value Management Policy;" and complements the guidance provided in the *Defense Acquisition Guidebook*. The primary purpose of the IMP and its supporting detailed schedule, the IMS, is their use by the Government and contractor team as the day-to-day tools for planning, executing, and tracking program technical, schedule, and cost status, including risk mitigation efforts.

This Guide is not intended as the only source of guidance on developing an IMP and IMS or in preparing the IMP and IMS guidance to Offerors in a source selection. Each Government program team should contact its local acquisition support office during the early stages of program planning for assistance in IMP and IMS preparation. The IMP and IMS should be tailored and scaled according to the size, content, maturity, and risk of the program. Although there are multiple IMS views (e.g., event-based, Work Breakdown Structure (WBS) based, or product-based) that may be used to implement and provide status for an IMS across a variety of stakeholders, this Guide emphasizes the event-based approach consistent with current Department of Defense (DoD) policy.

The Office of the Secretary of Defense (OSD) office of primary responsibility (OPR) for this Guide is OUSD(AT&L) Defense Systems, Systems Engineering, Enterprise Development (OUSD(AT&L) DS/SE/ED). This office will develop and coordinate updates to the Guide as required, based on policy changes and customer feedback. To provide feedback to the OPR, please e-mail the office at ATL-ED@osd.mil.

1.1 Purpose of the Guide

A mutual understanding of what is required to successfully plan and execute a program is critical to the Government-industry team. This Guide was developed to:

- Provide a consistent philosophy and approach to the IMP, IMS, and their development;
- Foster improved IMP and IMS products that reflect a systematic approach;
- Allow tailoring to each program or project's specific needs and permit Offerors to build their IMP and IMS consistent with their own management and scheduling system structures and formats;
- Improve the learning curve on the use of IMP and IMS for both the Government program or project office and industry; and
- Facilitate the development of well-defined and complete plans and schedules for use in day-to-day program execution, thereby mitigating risk and increasing the probability of program success.

1.2 The Value of the IMP and IMS to the Program Manager

The IMP and IMS are business tools that enhance the management of acquisition, modification, and sustainment programs. They provide a systematic approach to program planning, scheduling, and execution. They are equally applicable to competitive and sole source procurements with industry, as well as Government in-house efforts. They provide a tool for improved day-to-day program execution and for on-going insight into program status by both Government program office personnel and contractor personnel. They help develop and support "what-if" exercises and to identify and assess candidate problem workarounds. And, finally, the use of the IMP and IMS should focus and strengthen the Government-contractor team.

A well-prepared IMP and IMS are tools with a wide range of value-added management applications. In preparing for source selection and its activities, the IMP and IMS:

- Give Offerors flexibility in performing detailed program execution planning, organization, and scheduling within any existing Request for Proposal (RFP) constraints.
- Serve as the basis for the Offeror's detailed Execution IMS of how the contractor intends to meet the RFP requirements by accurately representing the Offeror's proposed program approach, which should be executable within the cost, schedule, and risk constraints.
- Encourage the use of real integrated product development and systems integration approaches. All necessary functional disciplines should be contributing at this time and the Offeror's IMS should contain the integrated network formed by all the necessary tasks and their inter-relationships.
- Provide the Government proposal evaluation team with the information needed to assess each Offeror's approach against the RFP's requirements including Mission Capability, Proposal Risk, Performance Confidence, and Price and Cost evaluation factors.

After contract award, the Government and contractor's plans and schedule:

- Serve as the basis for ensuring mutual understanding of Government expectations and agreement on the program content, program plan, schedule, and risk.
- Provide the detailed integrated execution plan and supporting schedule, clearly identifying what has to be done and when it must be done.

During the actual program execution, the IMP and IMS provide a framework for insight into the contractor's performance for both the program or project office and for the contractor's management team. The IMP and IMS when properly integrated with EVM through a sound technical management approach as documented in the program's Systems Engineering Plan (SEP), enable the program or project office to:

- Identify and assess actual progress versus the planned progress;
- Monitor the program critical path and help develop workarounds to problem areas;
- Assess program maturity;
- Assess the status of risk management activities based on the inclusion of the program risk mitigation activities in the IMP and IMS;
- Assess the progress on selected Key Performance Parameters (KPPs) and Technical Performance Measures (TPMs);
- Provide an objective, quantitative basis for the contractor's performance assessment rating and award fee;

- Help develop and support "what-if" exercises, and to identify and assess candidate problem workarounds; and
- Provide better insight into potential follow-on efforts that were not part of the original contract award. For example, the contractor should be able to more clearly define the activities, new interfaces, and other clarifying information necessary for a potential program increment or contract option.

1.3 Contents of the Guide

This Guide outlines an approach to support program or project teams in the development of effective integrated master plans and schedules for acquisition, modification, and sustainment programs. It describes a powerful toolset which helps meet the DoD acquisition community's objective of delivering high-quality, best-value products and capabilities that meet the user's needs and effectively accommodate capabilities growth in subsequent incremental developments. The same principals outlined in this Guide apply to incremental and Family-of Systems (FoS) or System-of-Systems (SoS) programs. This Guide provides guidance on the following:

- Provides definitions for key terminology in Section 2.1;
- Defines and describes the concept of the IMP and IMS and their relationship in Section 2.2;
- Describes the linkage of an IMP and IMS to other program and technical management tools in Section 2.3;
- Provides guidance on the development of various IMP and IMS products, including examples, in Sections 3.1, 3.3, and 3.4;
- Discusses the importance of tailoring requirements in Requests for Proposals (RFPs) in Section 3.2;
- Describes how to assess a potential Offeror's IMP and IMS during proposal evaluation in Section 3.5;
- Discusses how the IMP and IMS are used during program execution in Section 3.6; and
- Supplements the information in the IMP and IMS sections of the *Defense Acquisition Guidebook* (Sections 4.5.2 and 4.5.3).

1.4 Applicable References

The documents listed below are referenced herein, and may aid in understanding the information and background provided by this Guide.

DoDD 5000.1, *The Defense Acquisition System* (http://akss.dau.mil/dag/DoD5000.asp?view=document&doc=1)
DoDI 5000.2, *Operation of the Defense Acquisition System* (http://akss.dau.mil/dag/DoD5000.asp?view=document&doc=2)
Defense Acquisition Guidebook (http://akss.dau.mil/dag/)
MIL-HDBK-881A Work Breakdown Structure Handbook (http://www.acq.osd.mil/pm/currentpolicy/wbs/MIL_HDBK-881A/MILHDBK881A/WebHelp3/MILHDBK881A.htm)
DI-MGMT-81650 Integrated Master Schedule (IMS) DID (http://www.acq.osd.mil/pm/currentpolicy/cpr_cfsr/IMS%20Final%203-30-05.pdf)
DI-MGMT-81466A Contract Performance Report (CPR) DID

(http://www.acq.osd.mil/pm/currentpolicy/cpr_cfsr/CPR%20Final%203-30-05.pdf)
Earned Value Management Implementation Guide (EVMIG) [Scroll down the page that opens to EVM System Surveillance, Risk Planning, § 1.5 to find the link to the document.] (http://guidebook.dcma.mil/79/guidebook_process.htm)

2. IMP and IMS Overview

2.1 Definitions

Integrated Master Plan (IMP): The IMP is an event-based plan consisting of a hierarchy of program events, with each event being supported by specific accomplishments, and each accomplishment associated with specific criteria to be satisfied for its completion. The IMP is normally part of the contract and thus contractually binding. The IMP is a narrative explaining the overall management of the program (see Sections 3.3 and 3.6).

Event: An event is a program assessment point that occurs at the culmination of significant program activities: accomplishments and criteria.

Accomplishment: An accomplishment is the desired result(s) prior to or at completion of an event that indicates a level of the program's progress.

Criteria: Criteria provide definitive evidence that a specific accomplishment has been completed. Entry criteria reflect what must be done to be ready to initiate a review, demonstration, or test. Exit criteria reflect what must be done to clearly ascertain the event has been successfully completed.

Task or Activity: An element of work performed during the course of a project. An activity has an expected duration, expected cost and expected resource requirements. Some systems may define tasks or activity at a level below the work package while other systems do not differentiate between the two. It is a time-phased, detailed activity (where work is accomplished and funds are expended) required to support the IMP criteria, accomplishments, and events to meet program or project requirements.

Control Account: A management control point at which budgets (resource plans) and actual costs are accumulated and compared to earned value for management and control purposes. A control account is a natural management point for planning and control since it represents the work assigned to one responsible organizational element on one program work breakdown structure element.

Work Package: Natural subdivision of control accounts. A work package is simply a task/activity or grouping of work. A work package is the point at which work is planned, progress is measured, and earned value is computed. Can be translated into different terms in different companies and functions. It can be design job, a tool design package, a build-to-package, a shop order, a part number, a purchase order, or any other definable task/activity at whatever level control is normal for program management with in the company.

Planning Package: A holding account (within a control account) for budget for future work that is not yet practicable to plan at the work package level. The planning package budget is time-phased in accordance with known schedule requirements (due dates) for resource planning, and the plans are refined as detail requirements become clearer and the time to begin

work draws nearer. A company may elect to break the work assigned to a control account into smaller groupings of tasks or activities, i.e., multiple planning packages, for internal planning and control reasons.

Level of Effort (LOE): Effort of a general or supportive nature that does not produce definite end products. It is typically measured through the passing of time.

Discrete Effort: Work packages and planning packages (or lower level tasks or activities) that are related to the completion of specific end products or services and can be directly planned and measured.

Apportioned Effort: Effort that by itself is not readily divisible into short-span work packages (or tasks or activities) but which is related in direct proportion to measured effort.

Integrated Master Schedule (IMS): The IMS is an integrated, networked schedule containing all the detailed discrete work packages and planning packages (or lower level tasks or activities) necessary to support the events, accomplishments, and criteria of the IMP (if applicable). The IMP events, accomplishments, and criteria are duplicated in the IMS. Detailed tasks are added to depict the steps required to satisfy criterion. The IMS should be directly traceable to the IMP and should include all the elements associated with development, production or modification, and delivery of the total product and program high level plan. Durations are entered for each discrete work package and planning package (or lower level task or activity), along with predecessor and successor relationships, and any constraints that control the start or finish of each work package and planning package (or lower level task or activity). The result is a fully networked "bottoms up" schedule that supports critical path analysis. It should be noted that although durations are assigned at the work package and planning package (or lower level task or activity) level, these durations will roll up to show the overall duration of any event, accomplishment, or criterion. When Level of Effort (LOE) work packages, tasks, or activities are included in the IMS, they shall be clearly identified as such. Level of Effort shall never drive the critical path(s). There are three types of schedules addressed in this Guide:

- Government Roadmap Schedule: A schedule that captures the plan for executing the acquisition strategy, including incremental approaches (see Section 3.1.1);
- Pre-Award Schedule: A schedule used to plan, coordinate, and track the progress of the Government and industry activities necessary to achieve contract award (see Section 3.1.2); and
- Execution IMS: A comprehensive IMS used to manage the program on a daily basis. It is normally provided by the contractor via a Contract Data Requirements List (CDRL) item. It is updated on a regular basis. It should contain all of the contract IMP events, accomplishments, and criteria from contract award to completion of the contract (see Sections 3.4 and 3.6).

Critical Path: A sequence of discrete work packages and planning packages (or lower level tasks or activities) in the network that has the longest total duration through an end point that is calculated by the schedule software application. Discrete work packages and planning packages (or lower level tasks or activities) along the critical path have the least amount of float or slack (scheduling flexibility) and cannot be delayed without delaying the finish time of the end point effort. Essentially 'Critical Path' has the same definition as 'Program Critical Path' with the exception that the end point can be a milestone or other point of interest in the schedule. For example, a critical path might be run to Preliminary Design Review (PDR), Critical Design

Review (CDR), and First Flight within a System Development and Demonstration (SDD) contract.

Program Critical Path: A sequence of discrete work packages and planning packages (or lower level tasks or activities) in the network that has the longest total duration through the contract or project that is calculated by the schedule software application. Discrete work packages and planning packages (or lower level tasks or activities) along the critical path have the least amount of float or slack (scheduling flexibility) and cannot be delayed without delaying the finish time of the entire work effort.

Near Critical Path: The lowest float or slack paths of discrete work packages and planning packages (or lower level tasks or activities) in the network that has the longest total duration nearest to the critical path. Using nearest paths, vice a set value, allows the near critical path to have the possibility of always ranging in different float values based on the latest status of the schedule, i.e., the float or slack values associated with the near critical paths may differ from schedule update to schedule update depending on the status of the schedule.

Periodic Analysis: A periodic analysis is a written analysis of the program execution status. The level of detail and frequency of reporting will be defined in the CDRL (DD Form 1423).

Horizontal Integration: Demonstrates that work is planned in a logical sequence considering the interdependencies among work packages and planning packages (or lower level tasks or activities), ensuring the overall schedule is rational, and provides methodology to evaluate the impact of current schedule status on subsequent work packages and planning packages (or lower level tasks or activities) and milestones. Horizontal integration depicts schedule dependencies and constraints, focusing on relationships within the same scheduling level including between different program elements such as “hand-offs” of products between IPTs.

Vertical Integration: Demonstrates the consistency of data between the various levels of schedules and consistency of data between various WBS elements and IMP or IMS elements (if applicable) within the schedules. Since upper-tiered schedules set the parameters for lower level schedules, it is imperative that lower level schedules are traceable to upper-tiered milestones to ensure program schedule integrity. This ensures all Integrated Product Teams (IPTs) are working to the same schedule information and all levels of schedules are supportive of the program schedule requirements.

Network: A schedule format in which the activities and milestones are represented along with the interdependencies between work packages and planning packages (or lower level tasks or activities). It expresses the logic (i.e., predecessors and successors) of how the program will be accomplished. Network schedules are the basis for critical path analysis, a method for identification and assessment of schedule priorities and impacts. At a minimum, all discrete work shall be included in the network.

2.2 IMP and IMS Relationship

The IMP is an event-based plan that should provide sufficient definition to allow for tracking the completion of required accomplishments for each event and to demonstrate satisfaction of the completion criteria for each accomplishment. In addition, the IMP demonstrates the maturation of the development of the product as it progresses through a

disciplined systems engineering process. The IMP events are not tied to calendar dates; each event is completed when its supporting accomplishments are completed and when this is evidenced by the satisfaction of the criteria supporting each of those accomplishments. The IMP is generally placed on contract and becomes the baseline execution plan for the program or project. Although fairly detailed, the IMP is a relatively top-level document in comparison with the IMS (see Figure 1).

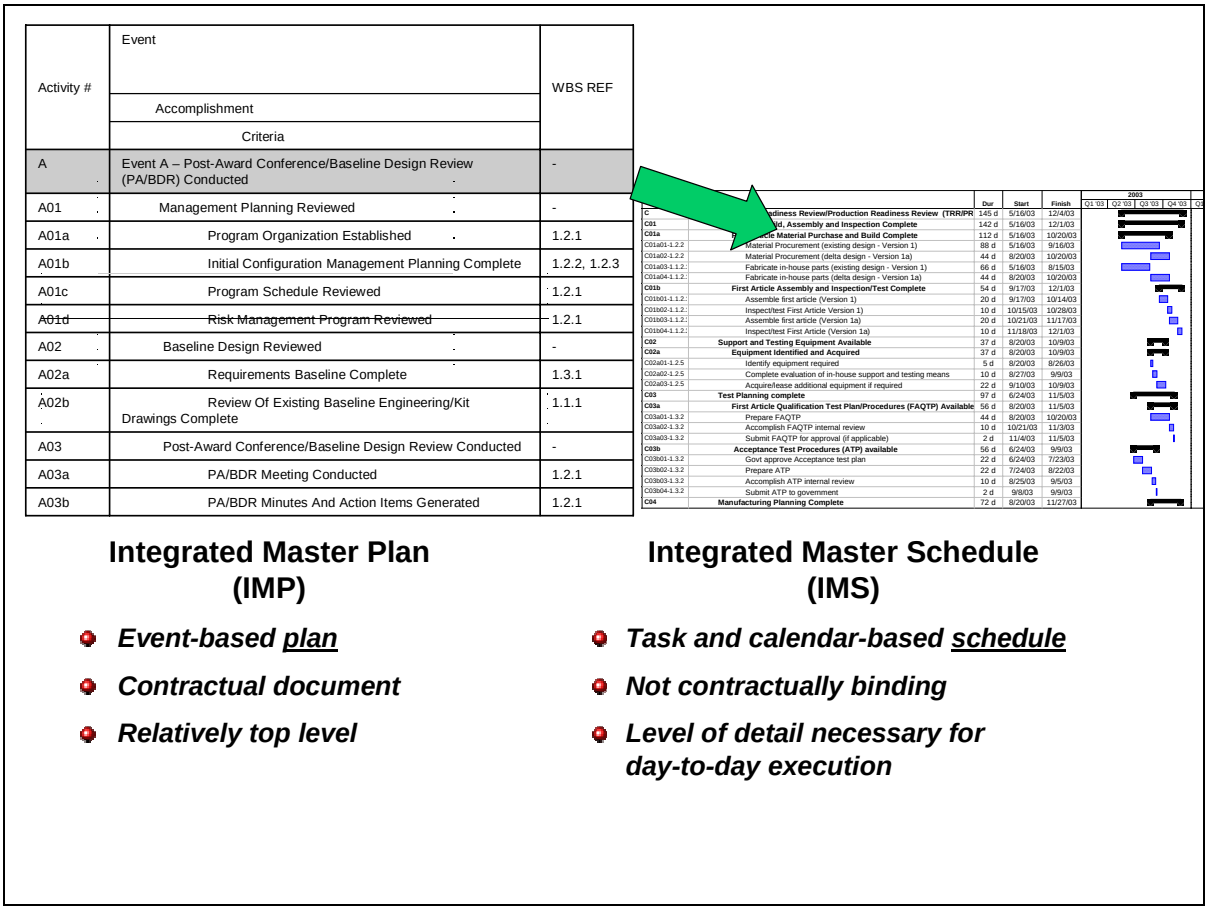


Figure 1. IMP and IMS Relationship

The IMS flows directly from the IMP and supplements it with additional levels of detail. It incorporates all of the IMP events, accomplishments, and criteria; to these activities it adds the detailed tasks necessary to support the IMP criteria along with each task's duration and its relationships with other tasks. This network of integrated tasks, when tied to the start date (e.g., contract award), creates the task and calendar-based schedule that is the IMS. The IMS should be defined to the level of detail necessary for day-to-day execution of the program or project. The IMS is required on contracts that implement EVM in accordance with the EVM policy, and the delivery requirements are placed on contract via a CDRL as a deliverable report.

The IMS is a living document that is continuously updated to reflect the progress of the program or project. The IMS should:

- Maintain consistency with the IMP;
- Illustrate the interrelationships among events, accomplishments, criteria, and tasks;

- Indicate the start and completion dates and duration for each event, accomplishment, criterion and task;
- Provide for critical path analysis;
- Provide the ability to sort schedules multiple ways (e.g., by event, by IPT, by WBS, by Earned Value Management System (EVMS), by Statement of Work (SOW), or by Contract WBS (CWBS));
- Provide schedule updates on a regular basis that indicate completed actions, schedule slips, and rescheduled actions and includes the previous schedule for reference;
- Provide the capability for the Government, contractor, or support contractors to perform "what if" schedule exercises without modifying the master program schedule;
- Maintain consistency with the work package definitions and the EVMS;
- Be traceable between the WBS items supported by each IMS task; and
- Be vertically and horizontally traceable to the cost and schedule reporting instrument (e.g., Contract Performance Report (CPR)).

The language used in every IMP and IMS can make these planning and schedule documents dramatically clearer by adopting a very simple expedient: standardizing the use of action verbs in the IMP and IMS. A best practice is to structure the IMP activities (events, accomplishments, and criteria) using past tense verbs since the IMP activities designate assessment points associated only with completed efforts (e.g., Preliminary Design Review (PDR) *Completed*; Requirements Analysis *Completed*). Once a set of sequential tasks (constituting a work package) is finished, this validates that the criterion has been satisfied. In addition, since the IMS tasks state what the team needs to do to demonstrate the criterion has been satisfied, present tense verbs are the clearest and most accurate language to use (e.g., *Develop* Specification, *Perform* Requirements Analysis). An example is shown in Figure 2.

Activity Number	Activities
A	IMP Event
A01	IMP Accomplishment
A01a	IMP Criteria
A01a01 - n	IMS Task
A	PDR Completed
A01	Requirements Analysis Completed
A01a	Avionics Requirements Analysis Completed
A01a01	Perform Avionics Requirements Analysis
A01a02	Develop Avionics Draft Specification
A01a03	Coordinate Avionics Draft Specification for Review
A01a04	Publish Avionics Specification

Figure 2. IMP and IMS Numbering System

The change in verb tense assures the relationship between IMP activities and IMS tasks is always clear. Using standard verb structures consistently emphasizes these important distinctions. In doing so, it simplifies the thinking that goes into the development of the IMP and IMS, makes the development process more fail-safe, and provides a very simple marker system that ensures continuous clarity.

2.3 IMP and IMS Linkage to Other Program Management Activities

The implementation of the IMP and IMS on a program is an integral part of the Integrated Product and Process Development (IPPD) framework for the work effort to be accomplished (see Section 10.3 and Section 11.8 of the *Defense Acquisition Guidebook* and the IPPD Handbook). The IMP and IMS should be written to align with the IPPD framework in which the IMP and IMS set forth the necessary activities to be performed by all functional disciplines. The IMP and IMS clearly communicate the expectations of the program team and should provide traceability to the management and execution of the program by IPTs. They should also provide traceability to the WBS and SOW, which defines the products and key processes associated with program accomplishment and is the basis of IPT-generated cost estimates and cost reporting.

The IMS is directly traceable back to the IMP and should also be traceable to the program's CWBS, SOW, and EVMS. Both the IMP and the IMS should be consistent with the contractor's management and scheduling system structure and format. In general, the IMP can be thought of as the top-down planning tool and the IMS as the bottom-up execution tool for those plans. The IMS should allow sorting or grouping to show tasks associated with the WBS to enable effective EVM.

Earned value management is a tool that allows both Government and contractor program managers to have visibility into technical, cost, and schedule planning, performance, and progress on their contracts (see Section 11.3.1 of the *Defense Acquisition Guidebook*). This visibility provides insight to contract performance and the necessary data points to statistically estimate probable completion costs. The implementation of an EVMS is a recognized function of program management. It ensures cost, schedule, and technical aspects of the contract are truly integrated.

The DoD has revised the EVM policy to require compliance with the industry EVM standard (ANSI/EIA-748A) on cost or incentive contracts, subcontracts, intra-government work agreements, and other agreements valued at or greater than $20M (see DoDI 5000.2, Enclosure 3, Table E3.T2). The EVM policy was modified to provide consistency in EVM application and implementation across DoD programs and to better manage the programs through improvements in DoD and industry EVM practices. The revised policy requires an IMS be prepared whenever EVM compliance is required; however, an IMS is a recognized best practice regardless of the EVM requirement. On contracts greater than or equal to $20M but less than $50M, the IMS should be tailored to require the minimum data necessary for effective management control. The Earned Value Management Implementation Guide (EVMIG) provides additional guidance on tailoring the CPR and IMS.

Program managers are required to conduct Integrated Baseline Reviews (IBRs) on contracts with EVM requirements. This review has a business focus, but should include the important technical considerations to verify there is a sound basis for cost and schedule execution of the program (see Section 4.3.2.4.2 of the *Defense Acquisition Guidebook).*

Integrated Baseline Reviews should provide a mutual understanding of risks inherent in contractor's performance plans and underlying management control systems to assess the realism of the performance measurement baseline (see The Program Managers' Guide to the Integrated Baseline Review Process for more information). One of the tools critical to achieving the IBR objectives, addressing the program risks, and providing the required baselines is the IMS. Continuous assessment of the performance measurement baseline will identify when a new IBR should be conducted.

The thread pulling the IMP, IMS, and EVMS together is a program's sound technical approach documented in a SEP. The SEP is not just a description of required activities, but it addresses the who, what, when, where, and why of the applied technical approach. An IMP and IMS should demonstrate contractual commitment to the elements of major technical reviews and their entry and exit criteria as specified in the SEP, show the organizational integration requisite for successful program execution, plan the engineering effort and work required to execute a program, and manage the interdependencies of various program efforts. This technical rigor serves as the foundation for effective technical execution and EVM, as described in the *Defense Acquisition Guidebook*, Section 2.3.7, and the OUSD(AT&L) Systems Engineering Plan (SEP) Preparation Guide.

The IMP and IMS should clearly demonstrate that the program is structured and executable within schedule and cost constraints and with an acceptable level of risk. Thus, both the IMP and IMS are key ingredients in program planning, proposal preparation, source selection, and program execution.

3. IMP and IMS Development and Implementation

This section describes how the IMP and IMS are developed and implemented in different situations. Events, accomplishments, and criteria may vary depending on the program characteristics, but the overriding objective is to use these management tools and tailor them to best serve the specific program. The same principles apply whether the program is an internal Government activity, a contracted effort, or an integrated multi-contract activity. Events, accomplishments, and criteria are specifically tied to the program where it is necessary to measure or demonstrate progress before proceeding with follow-on activities. This section is laid out chronologically, representing the sequence of a typical solicitation process.

3.1 Early Program Planning

The Government Roadmap Schedule is developed and implemented by the Government team as early in the program as possible. The Government Roadmap Schedule will provide the framework for development and implementation of an Execution IMS for an in-house effort or Pre-Award Schedule for a contracted effort. In the case of a Government-executed program or project, the Government team should proceed directly into the preparation of an IMP and Execution IMS (see Sections 3.3 and 3.4).

For competitive acquisitions, the Procuring Activity may decide to prepare and implement a Pre-Award Schedule to better plan, manage, and track the activities required to get to contract award. Based on the Government Roadmap Schedule, the procuring activity will then determine any program-unique requirements for the Execution IMS for inclusion in the RFP. The Offerors will then provide their proposed Execution IMS in their proposals in accordance with the instructions in Section L of the RFP, reflecting each one's unique approach to

fulfillment of the program and technical requirements. These products will be evaluated by the Government source selection team in accordance with the evaluation criteria detailed in Section M of the RFP.

For incremental developments, the first increment is especially important since it establishes the foundation for the delivered capability in subsequent increments. This includes the establishment of the basic framework for the entire program including physical growth capacity to achieve an affordable expansion. The IMS should have embedded criteria and tasks to define the growth and defend the growth robustness so that the capability can evolve affordably for all future increments. While each increment is essentially self-contained with its own IMS, there will likely be schedule connections due to dependencies between the increments. Thus each increment cannot be considered completely by itself. The IMS should:

- Minimize cross increment connections to minimize the potential for ripple effects due to schedule slips in the predecessor increments; when these connections are necessary, embed interface criteria in the IMP and IMS to help manage the relationships.
- Include cross-increment relationships when conducting critical path analyses on the IMS. This does bring special problems, since the automatically generated critical path is tied to the end of the last increment. Use of artificial activities or constraints may be required to assess the critical path for an individual increment.
- Establish milestones and tasks in the IMP and IMS for starting subsequent increments to include impacts on critical resources, adequate maturation of predecessor increment development.

For System-of-Systems/Family-of-Systems (SoS/FoS) critical external interfaces can result from the requirements process and the emphasis to look outside individual Services for materiel solutions to the requirements. This can lead to an increased number of stakeholders in a program, especially when considering the likely increased requirements for SoS/FoS. The IMS should:

- Serve as a tool to help manage expectations of stakeholders; and
- Embed technical and programmatic interface points in the IMS for exchange of data and delivery of products among the stakeholders in a program, including milestones or tasks to define the interfaces between the various individual program IMPs and IMSs.

3.1.1 Government Roadmap Schedule

The Government Roadmap Schedule is often prepared and maintained as a single product in Gantt-type format, showing critical activities and interfaces across the entire program, as well as critical dates that may be dictated by higher authority. The overarching Government Roadmap Schedule should capture the plan for executing the acquisition strategy, including incremental approaches.

Figure 3 shows one example of a high-level, generic Government Roadmap Schedule and high-level examples of two supporting contract Execution IMS. In the example, Contract A represents the Execution IMS for the weapon system prime contract. Contract B might be a contract through another Procuring Activity within another DoD procuring organization to a subsystem contractor, whose equipment will be integrated into the weapon system. The Government Roadmap Schedule shows how the key events (or activities) of the execution contracts (A and B) interface with and support each other and interface with and support the

completion of the events of the overarching Government Roadmap Schedule. The key activities shown for Contract B to support that integration would also be reflected in the Contract A Execution IMS.

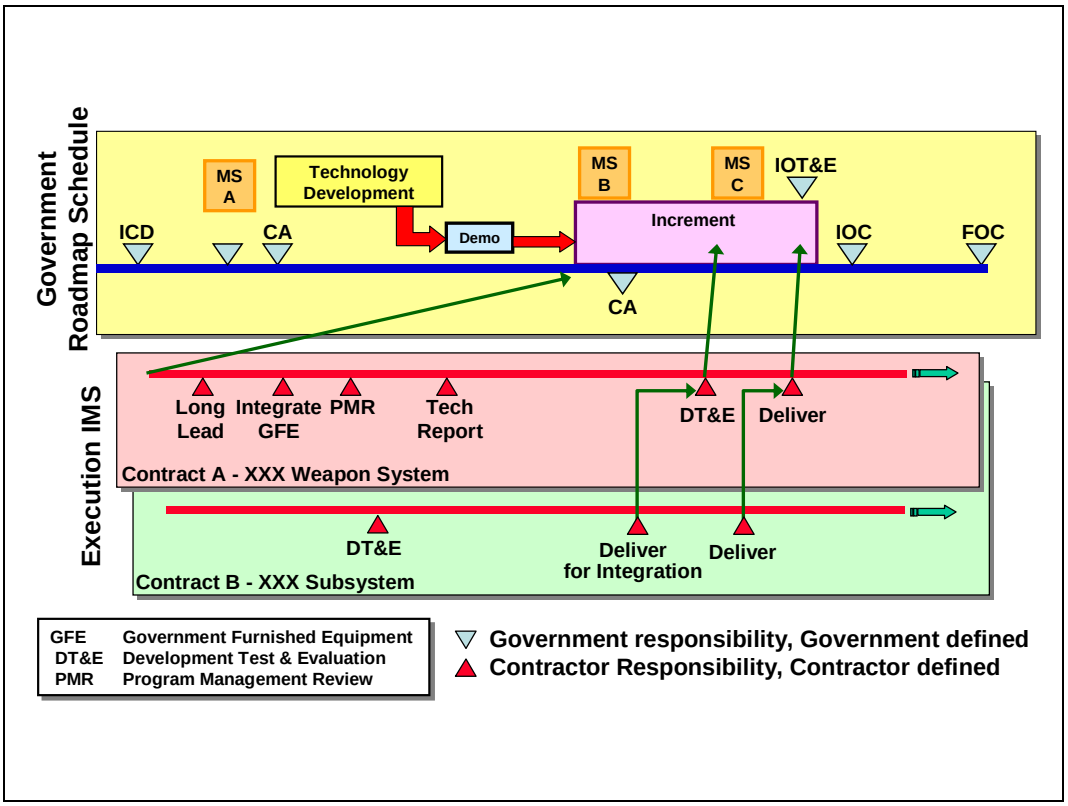


Figure 3. Example Government Roadmap Schedule

3.1.2 Pre-Award Schedule

The Pre-Award Schedule is an extremely useful document that a program office can use to plan, coordinate, and track the progress of those Government and industry activities necessary to achieve contract award. Depending on the acquisition strategy and the complexity of the source determination and contracting, each program office will decide whether or not to prepare a Pre-Award Schedule.

The Pre-Award Schedule should capture:

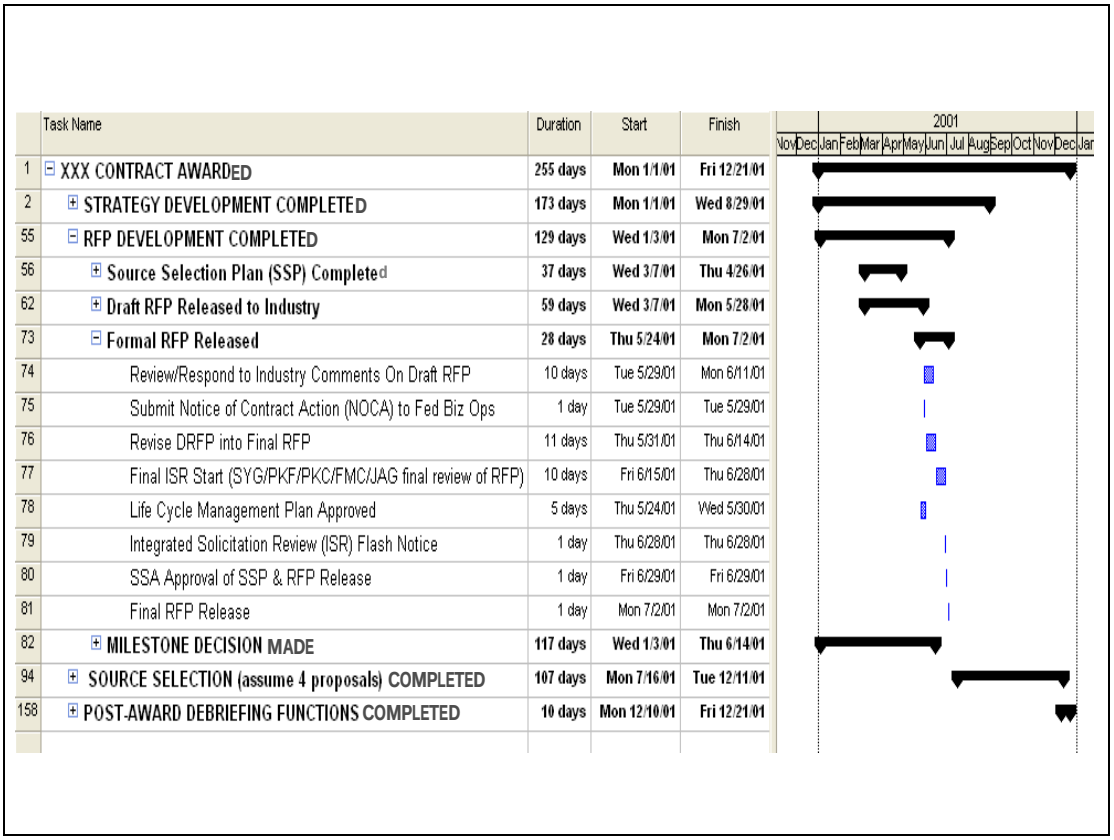
- What needs to be done and when all functional disciplines must be on contract,
- Who has to make it happen (e.g., program office, user, acquiring location, other service, other agency), and
- How it fits together to support the contract award and eventual execution of the program.

It can help track the progress of all supporting contracting efforts, regardless of their source, associated with the program. This is important since managing in a multi-agency, multi-program, multi-contract environment is becoming the norm rather than the exception.

The Pre-Award Schedule can help in cases requiring integration of externally developed, managed, or controlled products into the system or subsystem being managed. For example,

adding the next generation Joint Direct Attack Munitions (JDAM) capability, the associated mission planning capability, and the support equipment into the F-18, B-2, or B-52 weapon system.

Figure 4 gives an example of a Pre-Award Schedule. This particular example uses an Execution IMS structure, with activities that could be classified as events (e.g., Contract Awarded), accomplishments (e.g., Strategy Development Completed, RFP Development Completed), criteria (e.g., Source Selection Plan Completed, Formal RFP Released) and tasks (e.g., Revise the Draft RFP (DRFP), Prepare Executive Summary letter). The Pre-Award Schedule does not necessarily have to contain all defined levels of an IMS. In some cases, it may be appropriate to assign durations at what may be the criteria level or even the accomplishment level. The key is to tailor it to a specific application.



	Task Name	Duration	Start	Finish
1	XXX CONTRACT AWARDED	255 days	Mon 1/1/01	Fri 12/21/01
2	STRATEGY DEVELOPMENT COMPLETED	173 days	Mon 1/1/01	Wed 8/29/01
55	RFP DEVELOPMENT COMPLETED	129 days	Wed 1/3/01	Mon 7/2/01
56	Source Selection Plan (SSP) Completed	37 days	Wed 3/7/01	Thu 4/26/01
62	Draft RFP Released to Industry	59 days	Wed 3/7/01	Mon 5/28/01
73	Formal RFP Released	28 days	Thu 5/24/01	Mon 7/2/01
74	Review/Respond to Industry Comments On Draft RFP	10 days	Tue 5/29/01	Mon 6/11/01
75	Submit Notice of Contract Action (NOCA) to Fed Biz Ops	1 day	Tue 5/29/01	Tue 5/29/01
76	Revise DRFP into Final RFP	11 days	Thu 5/31/01	Thu 6/14/01
77	Final ISR Start (SYG/PKF/PKC/FMC/JAG final review of RFP)	10 days	Fri 6/15/01	Thu 6/28/01
78	Life Cycle Management Plan Approved	5 days	Thu 5/24/01	Wed 5/30/01
79	Integrated Solicitation Review (ISR) Flash Notice	1 day	Thu 6/28/01	Thu 6/28/01
80	SSA Approval of SSP & RFP Release	1 day	Fri 6/29/01	Fri 6/29/01
81	Final RFP Release	1 day	Mon 7/2/01	Mon 7/2/01
82	MILESTONE DECISION MADE	117 days	Wed 1/3/01	Thu 6/14/01
94	SOURCE SELECTION (assume 4 proposals) COMPLETED	107 days	Mon 7/16/01	Tue 12/11/01
158	POST-AWARD DEBRIEFING FUNCTIONS COMPLETED	10 days	Mon 12/10/01	Fri 12/21/01

Figure 4. Generic Pre-Award Schedule

3.2 RFP Preparation Guidance

The Government must communicate its IMP and IMS requirements to the Offerors so industry can effectively develop an IMP and IMS to reflect both the customer's requirements and its own proposed approach to executing the program. The Procuring Activity should initially communicate their requirements through Industry Days and then include them in the draft and final RFP, using this Guide as a referenced guidance document and including any program-unique tailored requirements. See the EVMIG for additional tailoring guidance.

The IMP and IMS evaluation criteria should be developed specifically to support both the planned acquisition strategy and support the overall proposal evaluation approach. Pre-RFP

activities, such as Industry meetings and draft RFP release, are opportunities to communicate, develop, and refine the IMP and IMS evaluation criteria. Whether the solicitation falls under FAR Part 12 or FAR Part 15, drafts of Section M, Evaluation Criteria, and Section L, Instructions to Offerors, should be provided to industry as early as possible to permit the maximum amount of communication.

The focus of the Section M, Evaluation Criteria, is to review the Offeror's plan for completeness, reasonableness, and realism, while also assessing the Offeror's understanding of the effort and the soundness of their approach. In developing criteria, consideration should be given to the size and complexity of the effort. Examples of complexity elements include development approach, commercial content, and a proposal approach that includes unique business arrangements such as teaming. The Section M, Evaluation Criteria, should be consistent with Section L requirements; should be consistent with other proposal inputs; and should be complete, clear, and useable throughout program execution. Generally Section M criteria should be developed before Section L and distinguish between the IMP, IMS, and linkage between them. Since the approach the Offeror proposes should be reflected throughout the IMP and IMS, mention of the IMP and IMS should be included in the specific evaluation criteria to which they apply.

3.2.1 Sample Section M Language

- Example 1:

  An evaluation will be made of the Offeror's Integrated Master Plan (IMP) and Integrated Master Schedule (IMS) as they reflect understanding of the program requirements and the soundness of approach to meeting those requirements. Evaluation is based on the extent to which the IMP details an event-based technical approach to executing the program and identifies the key program events, significant accomplishments, and associated completion criteria. Events of particular interest to the Government include event-based technical reviews, technical baseline approval, etc. Of particular interest are the identification of risks identified by the Offeror, how they will be mitigated, and their relationship to the IMS.

- Example 2:

  Technical or Product Area. Each Offeror's technical approach will be evaluated using the Offeror's proposed SEP, System/Subsystem Specification, IMP (and its correlation to the IMS), and any proposed deviations to the System Requirements Document requirements as evidence of the Offeror's understanding of the requirements specified in the RFP, of the soundness of the Offeror's approach, and of a commitment to meeting those requirements. The technical area will be evaluated based on the following three equally weighted factors below:
  Factor T.1 (Description),
  Factor T.2 (Description), and
  Factor T.3 (Description).

- Example 3:

  Evaluation is based on the extent to which the plan provides an SEP, IMP, IMS, Contract Work Breakdown Structure (CWBS), and Contract SOW that represents

consistent and achievable plans to accomplish development activities, clearly traces back to the Statement of Objectives (SOO) and Contract Data Requirements List (CDRL). The IMP should provide a subcontractor or interdivisional team member management plan that describes a well-integrated contractor team from both an administrative and technical point of view. The IMS identifies critical paths and clearly provides for slack time to accommodate unexpected program events.

- Example 4:

  An evaluation will be made of the Offeror's Integrated Master Plan (IMP) and Integrated Master Schedule (IMS) as they incorporate and reflect the Offeror's understanding of the requirements and soundness of the approaches described in the Offeror's proposal.

3.2.2 Section L Development and Sample Language

There should be a direct correlation between Section L and Section M. Consider the following when drafting Section L:

- The IMP should reflect the overarching technical architecture being proposed;
- The plan should follow the disciplined technical approach as required by the Government SEP and RFP;
- The names for events, significant accomplishments, criteria and tasks should be descriptive, concise, and specific to the program;
- The significant risks identified elsewhere in the proposal should be adequately addressed in the IMS. Consider requesting that the proposed IMS flag these critical risk mitigation efforts in a separate field to permit easy filtering or sorting to highlight them for the evaluators (see Section 3.4 on sorting the IMS);
- Level-of-Effort (LOE) type activities do not have to be included in the IMS. However, the LOE time-phased budget, should be include in the RFP Basis of Estimate (BOE) response;
- The IMS should meet the stated schedule requirements for delivery;
- The IMS should have a logical flow;
- A critical path that appears reasonable for the proposed program should be evident;
- Will a statistical Schedule Risk Assessment (SRA) be performed? Require the Offeror to provide their minimum-maximum task duration with the supporting rationale for those tasks identified as moderate or high risk; and
- If multiple priced production options are included in the RFP, consider requiring the detailed IMS to include only the first priced option to illustrate the contractor's plan and schedule approach. Based on that IMS the Government could acknowledge and accept that the Offeror is capable of planning/scheduling the other options. In the future, when the Government decides to exercise one of the future options, they then request the contractor to submit a detailed IMP and IMS for that option.

The examples below for Section L (Instructions to Offerors) of the RFP provide the major tenets that should be included in the RFP to provide the Government with the necessary information for an evaluation of the Offeror's IMP and IMS. Remember, Section L and Section M should be closely linked. Use Section L to provide the supplemental requirements and

guidance for tailoring the IMP and IMS for a specific program. The contractor should be encouraged to propose the systems they will actually use to plan and manage. Two examples of Section L language follow below:

- Example 1. One strategy is to place integrated RFP requirements across appropriate sections of the RFP. In this example, the IMP and IMS are addressed separately and, it is assumed the RFP calls for a Contracts Volume and a Technical Volume. Since the IMP will be contractually incorporated, a logical place to ask for it in Section L is the Contracts Volume.

  The Offeror shall provide the following documents in Section J as part of the Model Contract:
  Statement of Work (SOW)
  System Specification
  Integrated Master Plan (IMP)
  Contract Work Breakdown Structure (CWBS)

Then the RFP can request the IMP in the appropriate section of the Contractual Volume.

> *The Offeror shall provide an Execution IMP as part of their proposal submittal. The Offeror's proposed IMP shall be provided as an attachment (in Section J) to the Model Contract. For guidance in development of the IMP, the Offerors shall use the "Integrated Master Plan and Integrated Master Schedule Preparation and Use Guide." The Offerors shall then tailor that guidance as required for their particular approach. The following additional requirements apply to the (insert program name) IMP: (Insert additional requirements in accordance with the guidance below).*

Since the IMS represents all of the activities necessary to execute the program and illustrates how all of the activities are integrated, the logical place to ask for it in Section L is the Technical Volume, usually as an attachment.

> *The Offeror shall provide an Execution IMS as part of their proposal submittal. For guidance in development of the IMS, the Offerors shall use this the "Integrated Master Plan and Integrated Master Schedule Preparation and Use Guide." The Offerors shall then tailor that guidance as required for their particular approach. The following additional requirements apply to the (insert program name) Execution IMS: (Insert additional requirements in accordance with the guidance below).*

- Example 2. A second approach is to have the IMP and IMS instructions integrated in Section L as the following example demonstrates:

  The Offeror shall provide an Integrated Master Plan (IMP) and Integrated Master Schedule (IMS). The details of the Offeror's integrated processes shall be addressed in the IMP and IMS. The IMP and IMS shall demonstrate the Offeror's approach to the Integrated Product and Process Development framework wherein the IMP and IMS include all necessary activities performed by all functional disciplines to produce the product required by this RFP. For guidance in development of the IMP and the IMS, the Offeror shall use the "Integrated Master Plan and Integrated Master Schedule Preparation and Use

Guide." The Offeror shall then tailor that guidance as required for its particular approach.

The IMP shall be event-based, containing the events, significant accomplishments, and accomplishment criteria needed to successfully complete the program. The following major program events shall be the minimum provided in the IMP: (e.g., Preliminary Design Reviews (PDRs), Critical Design Reviews (CDRs), etc.). Other events may be included as necessary at the discretion of the Offeror. The IMP shall demonstrate that the (insert program name) program is structured to provide a balanced technical approach, to minimize and control risk, to accomplish up-front summary planning and commitment, and to provide a basis for subsequent detailed planning. The IMP shall be structured to allow measurement of progress towards (insert program name) program life cycle requirements and to provide management with in-process verification of requirements in order to make informed event decisions. The IMP shall contain the following in contractor format:

- *Events – logical points to assess the program's progress;*
- *Significant Accomplishments – Two* or more for each event, defining the desired results prior to or at completion of each event;*
- *Criteria – Two* or more for each significant accomplishment defined as measurable information that provides definitive evidence that a specific accomplishment is being completed. Completion of all of these criteria constitutes completion of the accomplishment; and*
- *Narratives (if required to further the understanding of the IMP) – Narratives may be categorized as two types: Process Narratives and Task Narratives. Each narrative should be limited to xx pages and include Statement of Objectives—what is the purpose of the process or task being addressed and how will it be tailored or implemented for this program.*
  - *The Offeror shall provide Process Narratives for the following processes: _____.*
  - *The Offeror shall provide Task Narratives to describe the approach to execute those tasks for which there may be no specific IMP accomplishments (e.g., level-of-effort tasks such as configuration management or program control).*

The IMS shall be submitted in accordance with the IMS DID, DI-MGMT-81650. The Offeror shall provide the results of a statistical Schedule Risk Analysis (SRA). The SRA data shall include a narrative describing the ground rules and assumptions used to perform the simulation and the histograms for each of the activities identified above as minimum IMP events.

*There may be instances when one is acceptable.

Offerors should also review Section B (Supplies or Services and Price/Costs), Section F (Deliveries or Performance), and the CDRL (DD Form 1423), since these sections will often provide supplemental requirements to be considered in the development of the IMP and IMS. The following are specific areas where supplemental guidance may be needed:

- Program Activities. The Government should provide a list of any minimum required activities they want addressed in the IMP and IMS. These may be events, accomplishments, or criteria, and may be derived from the Government Roadmap IMS, user operational requirements, or internal program or project office requirements. For example, the Roadmap IMS may have events for Operational Test & Evaluation (OT&E) and Initial Operational Capability (IOC), which would be appropriate events for the IMP and Execution IMS. Another example would be the user's Capabilities Development Document (CDD) or Statement of Objectives (SOO), which might define criteria for a Site Activation or for IOC. These criteria could be provided for inclusion in the IMP and IMS. Finally, the program office may desire a "Test Readiness Review (TRR)," and should include this requirement in the RFP. In this case, the Offeror could decide to include the TRR as an event, or perhaps as an accomplishment, supporting an event for a major program test.
- Date Constraints. Although the IMP is an event-driven plan, there may be some "hard date" constraints in the Government Roadmap IMS that have to be carried into the Execution IMS, such as a directed IOC date. These should be provided either in the RFP, the RFP library as part of the Government Roadmap IMS, or during Industry Day and Pre-Solicitation conferences. Great caution is required when these are defined; every proposal will show a plan that will meet the dates. It is often difficult to analyze the schedules in a time constrained source selection to successfully evaluate the realism of the proposed schedule. High-risk, concurrent acquisition strategies may be attempted and aggressive duration estimates may be used to "meet the requirement." Therefore, if any of the elements are present, the IMS should have definitive risk reduction tasks identified in the schedule to mitigate risks.
- Size. There is no "standard" size for an IMP and IMS in a proposal. The Offeror should strive to build an IMP and IMS of sufficient detail to fully describe the program for the Government's evaluation and to manage their own day-to-day execution of the program after contract award. The Offeror should succinctly describe the work required to complete the contract in sufficient detail to fully demonstrate an understanding of the scope and flow of the work. The size of the resulting IMP and IMS is dependent on numerous factors such as the length, content, and complexity of the contracted program, the amount of new development, the technical risk and associated risk mitigation activities, and the scope of required testing. Because the IMP normally becomes a contractual document defining the event-driven program approach, it should not be page or line limited.
    - The IMS is an extension of the information contained within the IMP, reflecting not only the events, accomplishments, and criteria identified in the IMP, but also tasks and subtasks subordinate to the criteria. An IMS summarized at too high a level may often result in masking critical elements of the plan to execute the program, and fail to show the risk management approaches being used. Further, it may often result in long duration tasks and artificial linkages, which will mask the true critical path. Conversely, too much detail can make it more challenging to evaluate the IMS during source selection. The critical efforts and key risk mitigation efforts can get "buried" in the details. The IMS tasks should correlate with the BOE in the cost volume; those tasks should ultimately form the basis for the EVMS work packages. The IMS need

not cover every possible program task, but should describe a realistic and supportable schedule, illustrating the plan to meet all program requirements.

- There may be times when it is necessary for the Government evaluation team to limit the initial IMS submittal size in order to better facilitate timely proposal evaluation. This situation may arise when the Procuring Activity is resource limited or plans to perform an SRA on a very complex program. If the Government believes an IMS line limit is appropriate, one-on-one discussions between the Government and Offerors should be held as early as possible (e.g., Industry Days, Bidder's Conference, etc.) to establish an appropriate IMS size limit consistent with programmatic requirements, and available source selection time and resources. In the event an IMS line or page limit is imposed, it must provide adequate lines for inclusion of sufficient detail to fully describe the schedule. It is essential the requirements of the RFP are consistent with any limits imposed on the IMS.

- Complexity. If the complexity, size, or other characteristics of the program force a relatively large IMS, the following techniques may aid the evaluators in performing a timely and effective evaluation:
  - Focus the schedule and technical analysis efforts in areas of more obvious risk, based on the Government-Industry risk workshop's risk matrix and the Offeror's risk assessment and risk mitigation plans reflected in their proposal. Consider requesting the proposed IMS flag these critical risk mitigation efforts in a separate field to permit easy filtering or sorting to highlight them for the evaluators (see Section 3.4 on sorting the IMS).
  - Focus the schedule and technical analysis on the tasks most likely to show up on the program critical path. Most SRA models include a critical path analysis for all tasks during the simulation. Run an initial assessment, and then focus the evaluator's efforts on those tasks on the critical path, e.g., more than xx% of the time from simulation runs (see Section 3.4).
  - Require the Offeror to provide their minimum-maximum task duration with the supporting rationale for those tasks identified in the above two bullets.
  - If multiple priced production options are included in the RFP, consider requiring the detailed IMS to include only the first priced option to illustrate the contractor's plan and schedule approach. Based on that IMS, the Government could acknowledge and accept that the Offeror is capable of planning and scheduling the other options. In the future, when the Government decides to exercise one of the future options, they then request the contractor to submit a detailed IMP and IMS for that option.

- Unique Program Aspects. The RFP should address any unique aspects or interrelationships of the program that may affect the IMP and IMS. For example, if the software for an aircraft subsystem such as the missile is being developed and must be delivered in time to support integration of the aircraft Operational Flight Program (OFP), that information should be provided, along with a schedule for the aircraft OFP. Another example would be modification kits that must be delivered to a logistics center to support specific aircraft going through programmed depot maintenance. Again, this type of information should be included in the RFP.

- IMP Narratives. If the Government requires IMP narratives, the RFP should specifically state what types of narratives are desired. For Process Narratives, the RFP should identify any specific processes the Government requires as a minimum set to be addressed. The RFP should also describe any particular content required in the narratives (e.g., company standard process designation). It is recommended "contractor format" be allowed for the narratives (see Section 3.3 for further guidance on the preparation of the narratives). Avoid redundancy in areas where the RFP calls for submission of a plan with the proposal. If the RFP requests a SEP be submitted with the proposal, the RFP should not also request an IMP narrative on the technical approach.

- Page Limitations. If narratives are required for the IMP, it may also be necessary to impose a page limit for the narratives. If an IMP narrative page limit is imposed, the Government team should ensure the limit is consistent with the requested information. For example, one Government RFP levied a 20-page limit for the entire IMP and at the same time provided guidance for the IMP narratives that required 15 topics to be addressed. The Offeror was being asked to provide all of this information, along with all definitions, dictionaries, events, accomplishments, criteria, and any other supporting narrative in 20 pages. The requirements and the limits in this example were obviously inconsistent.

- Submittal Requirements. The IMS shall be submitted no less frequently than monthly in accordance with the IMS DID, DI-MISC-81650. If a CPR is required, the IMS shall be statused and submitted prior to or concurrently with CPR. However, the Government team may also want a hardcopy submittal for evaluation purposes. In this case, rather than impose a boilerplate requirement in the RFP, it is recommended the Government team review with the source selection evaluators what format is actually needed for evaluation. The formats most commonly used are:

  - Gantt Charts – A graphical display of program activities that depict work activities in an integrated fashion. Activities are represented by bars showing the length of time for each activity. These are often displayed on 11"x14" or 11"x17" pages.

  - Tabular Forms – Tables containing data for each activity. These are best viewed in a landscape format (size page dependent on number of data fields requested).

  Requesting a large number of data fields in the tabular format can significantly drive both the IMS size and number of pages. Requiring submittal of both Gantt and Tabular hardcopy formats can easily drive page size and page count to an unwieldy level.

  Network diagrams are often referred to as Program Evaluation and Review Technique (PERT) charts. These are charts that show all the task relationships. However, network charts generated by automated scheduling tools may be extremely large and have to be printed on plotters. Some available "plug-in" tools make it easier to view or print network charts, but the products are still significant in size in hardcopy formats. It may be easier to use views available in the electronic submittal to view the task relationships.

  The RFP should provide instructions as to the type of electronic format desired for the IMP and IMS in accordance with the format requirements identified in the IMS DID, (DI-MISC-81650).

The RFP should address the desired format for post-award submittals of updates to the IMS. If a CDRL item is desired, then the RFP should use the IMS DID, DI-MISC-81650.

The Government team may have to dictate which automated scheduling tool it wants the Offeror to use for the IMS submittal to facilitate evaluation. However, after contract award it is important the Government use the same tool that the contractor uses for day-to-day execution of the program. If the Government cannot manage data directly from the contractor's schedule management system, the contractor can be directed to periodically generate export files for the Government's use. If the Government allows the Offeror to propose a tool that the Government team is not using, the RFP should ask the contractor to address issues such as post-award training of the Government team and software tool licenses.

- Additional Information. The Government team may want specific additional data to be included in the IMS. The reason for this additional data is frequently to support sorting of the IMS data using the different text fields as the sorting parameter. Figure 5 gives examples of additional data that might be considered for inclusion. It is recommended the Government not direct the use of specific fields for additional data since the Offeror may reserve specific fields for integration with other tools. However, the Data Dictionary defining the use of these fields and their location in the scheduling tool, including filters customized to use these fields, shall be provided.

ADDITIONAL DATA	TEXT FIELD
IMP reference/code (single numbering system)	Text xx
WBS	Text xx
SOW Reference (if not same as WBS)	Text xx
IPT	Text xx
Mission Capability Subfactor (RFP Section M)	Text xx
Risk (Medium to High)	Text xx
Contract Line Item	Text xx
Organizational / Functional Code	Text xx

Figure 5. Example of Additional Data Request for an IMS

The IMP numbering, WBS, SOW, and IPT are probably the most commonly requested data fields and provide the most value for traceability and for sorting of the data. The general nature of most RFP Section M (Evaluation Criteria) mission capability subfactors minimizes the value-added benefits of trying to trace each IMS task to a specific subfactor. The practice of identifying both a WBS and an IPT for each IMS task may make a requirement for an organizational/functional code unnecessary. The Offeror may want to trace the tasks to individual Contract Line Items (CLINs) for accounting

purposes. In summary, it is up to each Procuring Activity to decide what additional data is needed for their program. These requirements should "earn their way." Also, the proposed IMS should clearly identify which fields are used for the data.

Any other requirements that apply directly to the IMP or IMS. An example for the IMS might be a requirement to provide a rationale for all task durations greater than xx days. Caution should be taken to avoid providing conflicting guidance in the Section L (Instruction to Offerors) of the RFP and the guidance provided in the DID.

3.2.3 Sample SOW Language

Below is sample language for the SOW to assist the Offeror's teams in understanding and addressing the requirements discussed in this section.

The contractor shall manage the execution of the (insert program name) program or project using the IMP and the associated Execution IMS as day-to-day execution tools and to periodically assess progress in meeting program requirements. The IMP shall be maintained and shall be updated when it is deemed necessary to reflect changes to the ongoing program, subject to Procuring Activity approval. The contractor shall report on program or project progress in accordance with the IMP at each program management review, at selected technical reviews, and at other times at the Government's request.

The contractor shall revise the Execution IMS, where necessary, to reflect the IMP. They shall use it as a day-to-day execution tool and to periodically assess progress in meeting program requirements. The contractor shall maintain and update the Execution IMS, when necessary, to reflect Government approved changes in the IMP, or changes in the contractor's detailed execution activities or schedule. The Execution IMS shall include the activities of the prime contractor and their major subcontractors. All contractor schedule information delivered to the Government or presented at program reviews shall originate from the Execution IMS. The contractor shall perform appropriate analyses of the Execution IMS tasks and report potential or existing problem areas and recommend corrective actions to eliminate or reduce schedule impact (CDRL XXXX, DI-MISC-81650, Integrated Master Schedule).

The Government will use the IMP and IMS to evaluate the credibility and realism of the Offeror's approach to executing the proposed effort within cost and schedule constraints.

3.2.4 Sample Submittal Instructions

The Offeror shall submit an IMS in accordance with the IMS DID, DI-MISC-81650.

The IMP and IMS shall be submitted in Volume XX. The IMP and IMS are not page or line limited (with the exception of the IMP narratives stated in L.X.X.X above) and should give sufficient detail to facilitate Government assessment of schedule realism.

The IMP shall be placed on the contract as an attachment. After contract award, periodic submission of the IMS will be as a CDRL item as described in the tailored IMS DID, DI-MISC-81650.

3.3 IMP Development

The same principles apply to the development of the IMP, whether developed by a contractor or by the Government program or project office. For a Government-executed program or a sole-source contractor-executed program, the team can proceed directly from development of the Government Roadmap IMS to development of the IMP. For competitive contracted programs, the Offerors will develop the IMP for submittal with their proposal in response to the RFP. This proposed IMP will be used in source selection for evaluating the Offeror's understanding of and approach to fulfilling the Government's requirements. The successful Offeror's IMP will be included in the resulting contract for use in the execution of the program (see Section 3.6).

The IMP should be kept as one "integrated" plan that encompasses all IPTs, WBS elements, and functional disciplines. Section 3.4 provides a discussion of how to sort the electronic version of the IMS (and therefore the IMP, as all events, accomplishments, and criteria should be in the IMS) by IPT, WBS, or any other available fields.

Prior to developing the IMP, and its attendant IMS, the Government or Offeror's team must fully understand the overall system acquisition requirements. For competitive contracted proposals, these will be contained in the RFP. The team should first select the system-level events, which will serve as "progress checkpoints" and be used to indicate the readiness to move to the next group of work efforts. The next step is to identify the accomplishments and criteria to support each event. The individual IPTs should discuss and iterate these criteria and accomplishments with the "system-level" IPT to ensure all critical activities from each functional discipline for all products are reflected in the IMP. It is important that significant subcontractor activities also be included in the IMP. These in turn should be supported by the subcontractor's IMP and IMS or equivalent. The activities selected for inclusion in the IMP should not be ones expected to routinely change, since this would drive frequent contract modifications.

The typical steps in the development of an IMP are:

- Determine the IMP structure and organization;
- Identify events, accomplishments and criteria;
- Prepare the Introduction and Narrative sections (if narratives are required);
- Complete the numbering system; and
- Iterate events, accomplishments and criteria with the IPTs during IMS development.

This Guide recommends the following as a common, organizational structure for the IMP. However, this structure can be tailored as necessary to meet individual program or project needs, providing the structure is understood and useable by the entire program or project team:

- Section 1 – Introduction,
- Section 2 – IMP (Events, Accomplishments, and Criteria),
- Section 3 – IMP Narratives (if required), and
- Section 4 – Glossary.

3.3.1 Section 1, Introduction

The Introduction should include:

- Short description of the program*,
- Assumptions and Ground Rules*,
- Event and "Action Term" Dictionary* (expanded below),
- IPT Organization and responsibilities, and
- Describe any unique or different features of the IMP.

  * Minimum content

Every IMP introduction should include a dictionary with definitions of each of the events, as well as a common definition of the "action terms" used in the accomplishments and criteria descriptions (e.g., approved, drafted, submitted, verified, validated, or assembled). As the IMP becomes a contractual document, the dictionary and the definitions are critical to fostering a common understanding and avoiding conflicts after contract award, especially when commonly used terms are tailored for the program. Early discussions with the contractor are highly recommended to specifically address these items since misaligned expectations between the Government and contractor often result in both schedule and cost impacts.

In some cases, the Procuring Activity may want the IMP Event table to include expected completion dates, which would be the fallout dates from the IMS. If used, these dates may become contractual dates that must be met, and could be tied to other contractual items, such as the Award Fee. The Procuring Activity should clearly state whether the dates are intended to be contractual or simply for information. So although the IMP is generally event driven, there are some circumstances where certain dates are imposed in the plan (e.g., Initial Operational Capability). It is recommended any dates in the IMP be for information only, since any contractual dates should be created by the contract schedule, not the IMP.

3.3.2 Section 2, IMP (Events, Accomplishments, and Criteria)

Begin section 2 with a description of the numbering system used, then list (preferably in table format) program Events, Accomplishments, and Criteria. The distinction between events and accomplishments is often gray, as well as that between accomplishments and criteria. Very often the determination is a factor of the complexity, size, or length of the program or project. It is not unusual to see the same activity designated as an event in one IMP and an accomplishment in another. Similarly, an accomplishment in one program may be a criterion in another, or a criterion in one might be an accomplishment in another, or even a task in the IMS. The intent of the IMP is met as long as each activity supports the one above it, progressing from criterion to accomplishment to event.

Program event definitions can be obtained from several sources. The first source should always be the contract and its attachments, such as the Government Roadmap Schedule. For instance, the SOW may define certain activities that warrant becoming events with their associated accomplishments and criteria. Many contracts place IMP process narratives on contract. These processes may include certain definitions and their use in the IMP and IMS could enhance communication with the process owners. The term "milestone" is frequently used within the DoD community, and can lead to confusion as to the difference between an "event" and a "milestone." To avoid confusion, the only time the term "milestone" is used within this

Guide is in reference to a major milestone, such as Milestone A. This is not to preclude a major milestone being selected as an event.

Great care must be exercised in the final selection of the events framework upon which the IMP is constructed. Events should represent major points at which it is logical to measure program progress. They should be well distributed over the program or project period, and not inordinately clustered. It is not acceptable to have too long a time period pass without checking critical program progress. This can be avoided by including an event such as a "Production In-Process Review" to ensure timely program progress visibility. This is acceptable as long as there are definable accomplishments and criteria to support that event. At the same time, having too many or too frequent events poses other problems, such as spending too much time and too many resources preparing for events rather than working the program activities. Many reviews will occur as part of the Offeror's proposed processes, but every review does not need to be considered an IMP event.

Normally the entity executing the program (whether Government or contractor) selects the events. However, as discussed earlier, the Government team may specify events to be derived from the Government Roadmap Schedule or from the SEP. The execution team will then expand on the minimum set of events. For each event, there will normally be two or more accomplishments. Completion of all of these supporting accomplishments constitutes completion of the event. The execution team will then expand on that minimum set of events. These standards should be used for ideas and concepts, but should not be referenced in the contract.

Similar to event selection, the accomplishment selection should reflect, as a minimum, any requirements and activities specifically identified in the RFP or contract. The Government may determine a minimum set of required accomplishments. For each accomplishment, there will normally be two or more supporting criteria. Completion of all of the supporting criteria constitutes completion of the accomplishment. Examples of accomplishments might include "First Article Delivered," "Application modules complete," or "Commercial and applications software integrated." The execution team will then identify additional selected accomplishments in keeping with the definitions provided in Section 4 of the IMP. During this process, the team may identify additional required events or may even determine an already identified event should be deleted or replaced. There is no typical number of accomplishments for each event in the IMP. The important point is that each selected accomplishment when completed should substantially contribute to the success of the related event.

An important point must be made concerning accomplishments. The IMP accomplishments should reflect the required progress of all functional disciplines. For example, in support of a PDR event, the first accomplishments identified are almost always related to hardware and software design activities. However, it may be critical to program execution that well defined "long lead" materials or Government Furnished Equipment (GFE) be ordered by completion of the PDR so as to be available for the timely fabrication of Developmental Test and Evaluation (DT&E) test articles. It is likely that preliminary logistics support activities will need to be completed in support of the PDR (e.g., initial provisioning conferences and preliminary support equipment recommendation data submittal). In such case, it is appropriate to identify accomplishments (or criteria, at a minimum) for these activities.

As with events and accomplishments, the criteria selection should reflect requirements specifically identified from the RFP. The question that needs to be repeatedly asked when developing criteria is, "How do I know when an accomplishment has been completed?" The more definitive the IMP is, the clearer the understanding of the program will be by the entire program or project team. As with accomplishments, the team may identify additional required accomplishments and events, or may determine that an already identified accomplishment should be replaced. Again, there is no typical or required number of criteria for each accomplishment in the IMP. Generally, there should be at least two criteria to support an accomplishment, but there may be occasions when one is appropriate. The important point is that completion of the criterion should provide evidence of completion of the associated accomplishment.

In some cases, significant resources have been wasted by proceeding into a formal review, demonstration, or flight test before the contractor or Government team is ready, simply because the "scheduled date" occurs. This is prompted by a "schedule-driven" philosophy. Keep in mind the IMP is not schedule driven but event driven and the event will occur based on the completion of its supporting accomplishments and the criteria supporting those accomplishments.

To avoid this, it is appropriate to think of criteria as "entry" or "exit" criteria supporting those accomplishments, which in turn are supporting resource-intensive events, like a major review or a flight test. Entry criteria reflect what must be done to be ready to initiate a review, demonstration, or test. Exit criteria reflect what must be done to clearly ascertain the event has been successfully completed. Certain events lend themselves to the use of entry and exit criteria.

Criteria can be either quantitative or qualitative, yet must be measurable. For example, "Test plan completed and approved" is a measurable criterion, as well as "Four tests sets delivered." Conversely, "Test plan 85% complete" is difficult to assess, if at all, because the last 15 percent may include hard-to-do elements that require more effort than the first 85 percent. Criteria may include, but are not limited to:

- Completed work efforts (e.g., "All Identified Trade Studies Completed" or "Manufacturing Plan Completed");
- Activities to confirm success of meeting technical, schedule, or cost parameters (e.g., "Flight Test Report Approved");
- Internal documents that provide results of incremental verification of a TPM or risk mitigation activity (e.g., "Wind Tunnel Test Data Analysis Completed"); and
- Completion of critical process activities and products required by the Offeror's internal program plans or operating instructions (e.g., "Risk Management Plan Approved").

There may be cause for using KPPs as criteria, particularly if the accomplishment is related to a technical demonstration of some sort, but the criteria should only make reference to the applicable specification paragraph(s) or area of the technical requirements document or the system specification (e.g., "Airspeed KPP Demonstrated" or "Radar Resolution TPM Demonstrated"), and not quote the specific performance requirements. This would result in redundancy with the specifications and create the potential for contractual disconnects. The completion of internal contractor modeling, simulation, or analysis activities and associated reports used to estimate the value of a critical technical parameter might also be included as criteria.

Experience indicates there will frequently be "open items" associated with the completion of events (e.g., major review action items, deviations, waivers, or retest). Technical reviews are normally considered complete after all entry and exit criteria have been satisfied; all issues have been addressed and assessed, and the status agreed upon; an updated risk assessment has been completed; and the review minutes have been promulgated. If the open items are significant enough, the event may be deemed incomplete and the program should not be allowed to progress further. However, there will be other times when it is prudent to identify action items and their closure plans, but designate the event as completed. One possible way to achieve this flexibility and still maintain program discipline is to place a criterion in each event for the "resolution of action items" from the previous event.

3.3.3 Section 3, IMP Narratives

Section 3 of the IMP has narratives, if desired, to include: Task Narratives, Process Narratives, and others as necessary (e.g., risk discussion). These will be contractually binding, so care must be taken in opting for narratives. An option may be to rely on the SEP submittal to discuss specific process approaches. If the RFP requires IMP narratives, they should be placed in this section.

Narratives can be used to provide additional information to further the understanding of the execution plan. While there is no constraint on the types of information that can be included in the IMP narratives, they should not be used to cover material that properly belongs in the Technical Volume of the proposal. The most common narrative types are described as follows:

- Process Narratives may be used to facilitate contractor commitment to the use of critical processes and procedures and provide the Government with an understanding of the proposed critical processes and procedures prior to contract award. These process narratives would consist of concise summaries providing visibility into key management and functional processes and procedures, how they relate to the integrated product development process, and an overview of the efforts required to implement them. For example, the Government might want an explanation of the Offeror's technical approach, risk management, or software development activities if a SEP is not required.
- Task Narratives may be used to describe the approach to executing those tasks for which there may be no specific IMP accomplishments. For example, the Government might want to define contractually how level-of-effort tasks, such as configuration management or program control supporting the overall program, will be accomplished. If a task narrative describes efforts related to a specific SOW task, then it is desirable to reference the SOW paragraph number, as well as the applicable WBS, in the narrative. Task narratives would be a definite requirement if the program were to decide to use the IMP in lieu of a SOW.

There has been a great deal of discussion as to whether Process Narratives should be included in the IMP. Some organizations discourage their use, while others prefer to include them. Rather than recommend or try to impose an answer, the following "Pros" and "Cons" should be considered. The pros are that Process Narratives provide additional insight into the critical processes to be used in executing program and contractual commitment to the use of the processes in contractor-executed programs. The cons are that they can significantly increase size of the IMP and, as the IMP is contractual, change in contractor's processes may necessitate a

contract change, which decreases the contractor's flexibility to make internal process changes and inhibits continual process improvement.

In general, the narrative should address only the key elements of developing or implementing a process or procedure (i.e., what the process or procedure will be or how it will be tailored or implemented on the specific program or project). The narrative is not the forum for providing supporting information or rationale. This information should be provided in the Technical Volume of the proposal. As with Task Narratives, Process Narratives should reference a SOW paragraph number and WBS, if applicable.

The Offerors should begin by deciding which critical processes will be included in the narratives, in addition to any minimum set requested in the RFP. Each individual Process Narrative should include the following types of information:

- Reference to any governing documentation, such as the contractor's standard process, or any governing DoD or Service guidance;
- An overview of the process, including the use of process flow diagrams (see Figure 6) is highly effective and is encouraged;
- If the process is an existing one, describe how it will be tailored and implemented to the specific program or project; and
- The description of any metrics that will be used to measure the process.

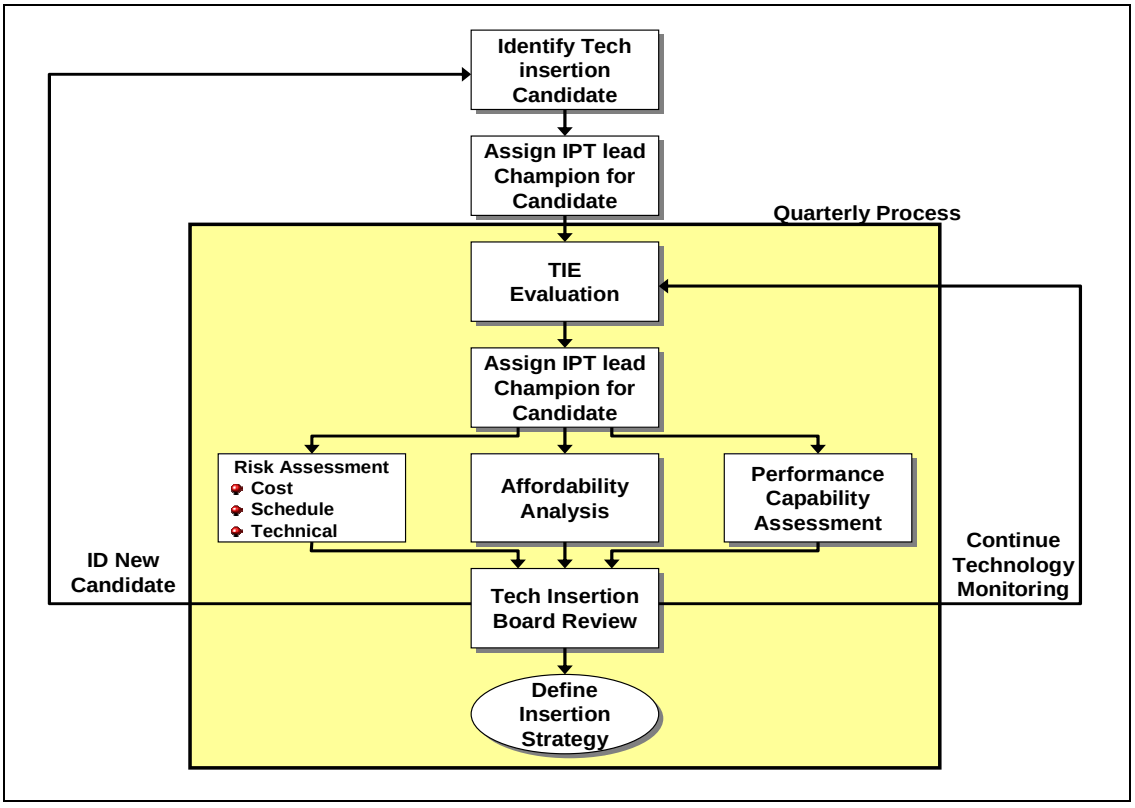


Figure 6. Process Flow Diagram Example for a Technology Insertion Process

While descriptions of LOE tasks and processes can be placed in the IMP narratives, there may be significant and specific outputs of these tasks and processes. Examples would be a Quality Assurance Plan or a System Safety Hazard Analysis. These types of outputs should be

reflected in the IMP and IMS. This is where the Offeror can provide any additional information to enhance both the Offeror's and the Government's understanding of the program.

3.3.4 Section 4, Glossary

Finally, section 4 of the IMP should have a glossary of terms and acronyms used in the IMP. Below is an example, illustrating a generic IMP for a notional "Widget" Program. In this example, the Widget program consists of taking an existing contractor's "Widget" design (Version1), modifying the design for another mission (Version 1a), and taking both the existing and modified designs through First Article Test, Initial Production, and Delivery. The sample IMP provides only an "action verb" dictionary (see Figure 7) and a table of events, accomplishments, and criteria (see Figure 8), with no IMP Narratives. The intent of these examples is not to present a "recommended" IMP, as an IMP could be created with significantly different events, accomplishments, and criteria. The intent is to illustrate the hierarchical structure and relationship of events, accomplishments, criteria and tasks.

Verb	Definition
Acquired	Procured and/or fabricated and available
Analysis/ Analyzed	The subject parameter(s) has been technically evaluated through equations, charts, simulations, prototype testing, reduced data, etc.
Approved	The subject item, data, or document has been submitted to the Government and the Government has notified the contractor that it is acceptable
Available	The subject item is in place/The subject process is operational/The subject data or document has been added to the Data Accession List
Awarded	Contract /Subcontract is authorized to begin
Completed	The item or action has been prepared or accomplished and is available for use and/or review
Concurrence	The Government has expressed its agreement with the contractors proposed design, approach, or plan as documented in either formal correspondence or meeting minutes, presentations, etc.
Conducted	Review or Meeting is held physically and minutes and action plans are generated/Test or demonstration is performed
Deficiencies corrected	New designs and/or procedures to correct documented deficiencies to requirements have been identified and incorporated into the baseline documentation. May include hardware fixes or retrofits
Defined	Identified, analyzed, and documented
Delivered	Distributed or transferred to the Government (by DD 250, if applicable)
Demonstrated	Shown to be acceptable by test and/or production/field application
Developed	Created through analysis and documented
Documented	Placed in a verifiable form (written/recorded/electronically captured)
Drafted	An initial version (usually of a document) has been created, which will require updating to finalize
Ended	Completed; over
Established	The subject item has been set and documented
Finalized	Last set of planned revisions has been made or final approval has been obtained
Generated	Required information has been placed into written form
Identified	Made known and documented
Implemented	Put in place and/or begun
Initiated	Begun
In-Place	At the physical location needed, ready to use or to perform
Obtained	Received and documented
Ordered	Purchase Orders completed
Met	Agreement reached that requirements have been satisfied
Prepared	Information placed into written form
Provided	Given to in some traceable form (paper, briefing, electronically, etc.)
Published	Distributed to team members, either formally (by CDRL), or placement on Data Accession List
Received	Shipped or delivered item is physically in possession of intended receiver
Refined	Next level of detail has been added or updates made
Reviewed	Presented for examination to determine status and discuss issues
Submitted	Formally submitted to the Government
Trained	Type I training course completed
Updated	Revisions made to documents, metrics, and cost estimates to incorporate contractor and/or Government changes
Validated	Subject item, data or document has been tested for accuracy by the contractor
Verified	Substantiated by analysis and/or test performed independently of builder/preparer
Written	Created but not yet published or submitted

Figure 7. IMP Action Verb Dictionary

Activity #	Event Accomplishment Criteria	WBS REF
A	Event A - Post Award Conference/Initial Baseline Review (PAC/IBR)	-
A01	Management Planning Reviewed	-
A01a	Program Organization Established	1.2.1
A01b	Initial Configuration Management Planning Completed	1.2.2, 1.2.3
A01c	Program Schedule Reviewed	1.2.1
A01d	Risk Management Program Reviewed	1.2.1
A02	Baseline Design Reviewed	-
A02a	Requirements Baseline Completed	1.3.1
A02b	Review of Existing Baseline Engineering/Kit Drawings Completed	1.1.1
A03	PAC/IBR Conducted	-
A03a	PAC/IBR Meeting Conducted	1.2.1
A03b	PAC/IBR Minutes and Action Items Generated	1.2.1
B	Event B - Critical Design Review (CDR)	-
B01	Design Definition Completed	-
B01a	Design Deltas To Baseline Identified	1.3.1
B01b	Drawings Completed (Baseline & Deltas)	1.1.1, 1.3.1
B02	System Performance Assessment Reviewed	-
B02a	Initial Weight Analysis Completed	1.3.1
B02b	Electrical Current Consumption Report Completed	1.3.1
B02c	Initial Reliability, Maintainability, & Availability Predictions Completed	1.3.3
B02d	System Safety Hazard Analysis Completed	1.3.4
B03	Initial Test And Manufacturing Planning Reviewed	-
B03a	Acceptance Test Plan Completed	1.3.2
B03b	Manufacturing Plan Completed	1.2.4
B04	Critical Design Review (CDR) Conducted	-
B04a	PAC/IBR Minutes and Action Item Closure Plan Finalized	1.2.1
B04b	CDR Meeting Conducted	1.3.1
B04c	CDR Minutes and Action Items Generated	1.3.1
C	Event C - Test Readiness Review/Production Readiness Review (TRR/PRR)	-
C01	First Article Build, Assembly and Inspection Completed	-
C01a	First Article Material Purchase and Build Completed	1.2.2, 1.1.2.1
C01b	First Article Assembly and Inspection/Test Completed	1.1.2.1, 1.1.2.3

Figure 8. Example IMP

3.4 IMS Development

The criteria in the IMP are then expanded in the IMS by adding the detailed tasks necessary to complete each criterion (see Figure 9). As a result, the IMS should include all the activities and elements associated with development, production or modification, and delivery of the total contract. Task durations are entered for each task in the IMS software tool, along with

predecessor and successor relationships, and any constraints that control the start or finish of each task. It should be noted although durations are only assigned at the task level, these durations should roll up to show the overall duration of any event, accomplishment, or criterion. The result is a fully networked "bottoms up" schedule (excluding LOE) that includes a critical path and supports critical path analysis.

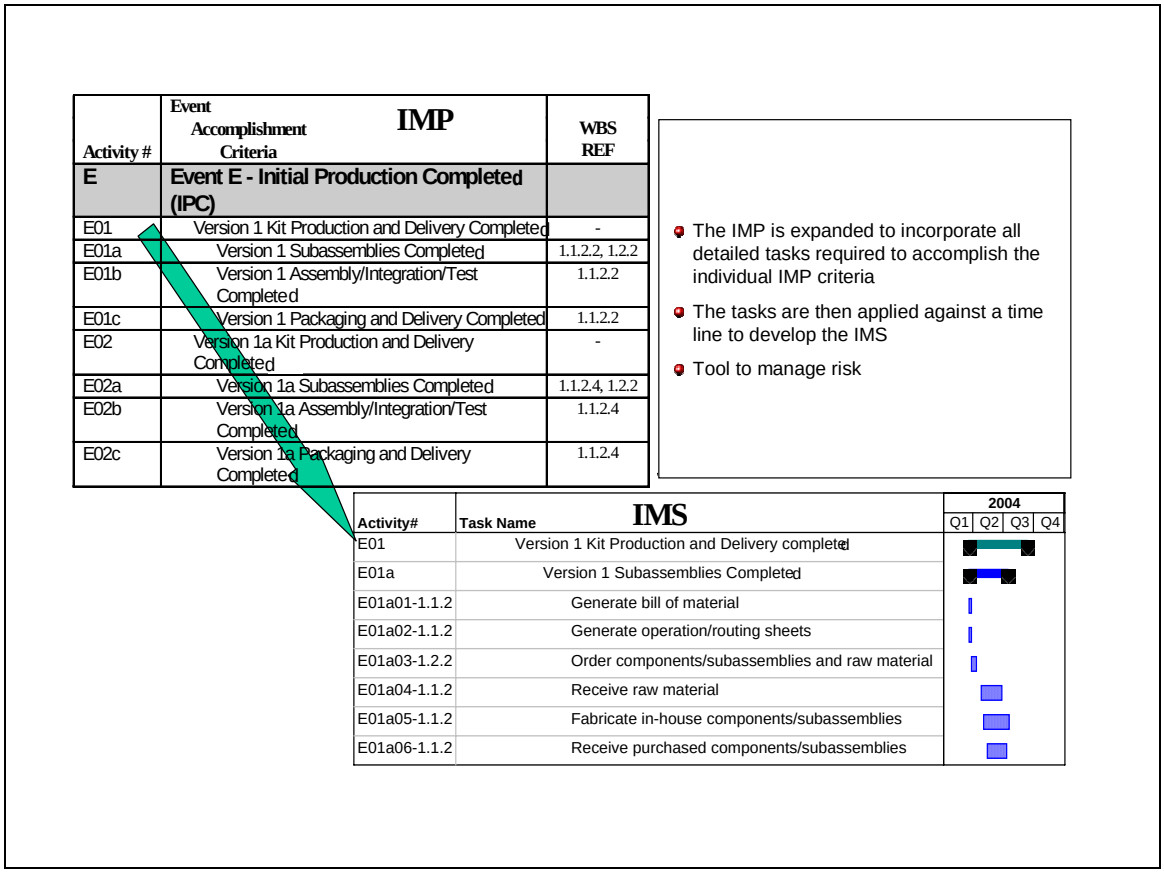


Figure 9. IMP Expanded to IMS

The IMS takes the IMP, links it together through network logic, and results in a schedule with dates assigned, showing the start date (e.g., Contract Award for a contracted effort), task durations, task relationships, and essential date constraints (e.g., funds availability tied to fiscal year). It depicts the planned dates when all events are expected to occur, as well as all the expected dates for all necessary work to be done to get to the event. Figure 9 illustrates these interrelationships. As the IMS captures all the events, accomplishments, and criteria of the IMP along with the supporting tasks and their relationships, it becomes the detailed schedule for day-to-day execution of the program or project and, thereby, an effective tool for management of the program and insight into the progress of the effort. It is used for identification of problem areas and to help define priorities for management attention and action. Because actual progress can be compared to the planned progress, the IMS is key to providing performance measurement and evaluating remaining work scope and duration.

To develop the Execution IMS, the program team will have to capture all discrete tasks that constitute the work required for successful completion of the program. These tasks are the time-phased, detailed activities required to support the IMP events, accomplishments, and

criteria. Consequently, the IMS uses the IMP as the skeletal structure for determining the detailed tasks. The detailed tasks represent the individual pieces of work effort that consume resources and are completed in support of each of the specific criteria. The descriptive labels used in the IMS should be identical to those used in the IMP. Each event, accomplishment, and criterion should be labeled with a brief descriptive title and should be numbered or coded to correlate to the IMP. Through this structure, the IMS tasks are directly traceable to the IMP.

The IMS provides the dates by which each of the IMP criteria, accomplishments, and events are planned to occur by providing the timing of all the detail of the actual work required to meet them. It is, therefore, only after developing the IMS that the expected dates for completion of the contractual IMP items can be determined. Since all IMP items are normally present in the IMS, there will be associated dates for each. These dates are naturally subject to change as the program proceeds and actual progress does not match with planned progress. As explained earlier, this is one of the reasons for not making the IMS dates contractual items. The other is that some of the tasks may change for a variety of reasons, without affecting the validity or completion of the criteria. To ensure the IMS does not drive events to be determined by schedule, the program team should insist all entry criteria be accomplished prior to conducting an event.

The typical steps (order may vary depending on circumstances) in the development of an Execution IMS are:

- Transpose the IMP events, accomplishments, and criteria into the automated tool being used;
- Program IPTs identify the detailed tasks and durations;
- Program IPTs identify the task constraints and relationships;
- Program IPTs iterate with the IMP/IMS facilitator point of contact;
- Complete and update the numbering system;
- Complete a critical path and SRA; and
- Complete the Execution IMS document.

The Execution IMS should be developed using an automated scheduling tool and will exist as an electronic file. The initial IMS will typically have four levels of indenture: events, accomplishments, criteria, and tasks. However, there may be times when less than four levels are appropriate (e.g., a criterion is a specific activity that doesn't need to be broken down further, and a duration and relationship is assigned at that level). On the other hand, it may be appropriate for the IPTs to break some IMS tasks down further in the form of subtasks.

For each proposal there is normally an IMS document created and submitted which explains the schedule approach, defines how to use the electronic file, and identifies what is in defined fields. This document is used to facilitate evaluation and allows the Offeror to provide additional information on the IMS. The following is one suggested format for the IMS. This structure can be tailored as necessary to meet individual program or project needs.

The Introduction should include:

- Short overview of the IMS;
- Assumptions and Ground Rules for the IMS (e.g., calendar used, holidays constraints, etc.) should be stated; and
- Describe any unique features of the IMS, such as:

- Numbering system description,
- Additional data fields included (identify associated text or other field), and
- Description of how the IMS and any changes to it will be managed.

Section 2 provides any supporting schedule rationale for items such as long task durations, task constraints other than "As Soon as Possible," or very long lead or lag times. Section 3 may include a hardcopy format of key elements of the approach taken by the Offeror in Gantt or Tabular format, and a discussion of the program critical path. The critical path should be easily distinguishable in report formats. This would also be an appropriate section in which to discuss any SRA performed by the Offeror. Section 4 provides a glossary of terms and acronyms used in the IMS. As required in the RFP or as determined by Offeror, section 5 includes:

- Summary Schedule (Gantt format – normally one page but could be longer for complex programs),
- Gantt format, and
- Tabular format.

Each IPT will develop its portion of the IMS by determining what tasks are necessary to support the IMP. For each task, the IPT will provide a task name (including an active verb in present tense); a duration, constraint type, and relationship with other tasks (predecessor(s) and successor(s)). This will allow the identification of the critical path for the program. Minimum and maximum durations may be required for an SRA. The IPT should also confirm the related WBS element for each task with the IMP and IMS point of contact, using the WBS Dictionary.

The building of the IMP and IMS is an iterative process. If an IPT, while building the IMS, should identify required tasks that do not logically fall under existing identified IMP criteria, they should suggest the additional criteria or accomplishments that those tasks would fall under. The desired result should always be a clear track from events to accomplishments to criteria to tasks. If a task has no logical WBS home, the WBS should be adjusted. This makes it easier for the Government and contractor to evaluate the progress and maturity of the program and ensures the program is event-driven.

In defining the tasks for the IMS, there may be a need to go to further levels of indentation, or subtasks, to capture the detail desired by the IPTs and to further define work packages. This is particularly true for higher-level tasks in the IMS describing work performed by major subcontractors. In this case, the initial prime contractor's Execution IMS may contain a task, which is further broken down into subtasks within the subcontractor's internal IMS. Depending on criticality, the breakdown to subtasks may be included in the prime's IMS. The use of subtasks is not unusual and is fully compatible with the IMP and IMS structure and philosophy. The numbering system must simply be further defined or extended (e.g., D01a02a or D01a02.1).

3.4.1 Task Durations

If the IMS has long-duration tasks (activities not equal in length to the statusing interval), the team should review these tasks to determine if further breakdown is appropriate. If not, the contractor may provide the rationale in the IMS document (see Figure 10). It is understood that during program execution these activities will need to be further defined and broken into individual elements of shorter duration. The same concern is true for tasks with long lead or lag

times (see Figure 11). Also, it may be desirable to identify moderate-to-high risk tasks. This can be done through the use of text fields in the electronic file. Specific risk mitigation activities should be reflected in the IMS.

TASK ID*	TASK NAME	DURATION	RATIONALE
A01a05	Procure / Receive Group B hardware for XXX	180d	Typical procurement time based on supplier quotes.
E01c01	Conduct DT&E flight test	170d	Length runs concurrently with flight test timeline plus time after test to complete analysis and reporting.
E01c02	Perform DT&E data reduction, analysis, and reporting as required	140d	Length runs concurrently to flight test timeline.
*Note: All task(s) will have a unique identifier by either the IMP and IMS Activity # or the scheduling tool line number.			

Figure 10. Examples of Long-duration Tasks in an IMS

TASK ID*	TASK NAME	LEAD/LAG	RATIONALE
586	Conduct aircraft thermal signature analysis	SS+110d	Does not need to begin until after a significant amount of flight test has been accomplished
727	Install avionics modernization kit on C-130H3 and deliver	SS+77d	Lag to maintain a smooth production flow and avoid starts and stops
*Note: All task(s) will have a unique identifier by either the IMP and IMS Activity # or the scheduling tool line number.			

Figure 11. Examples of Long-lead or Lag Tasks in an IMS

3.4.2 Task Constraints

In building a program schedule, it is highly desirable to have all tasks free of "hard" and "soft" constraints. However, there are instances where constraints may have to be placed on a task. The Execution IMS should not use hard constraints, such as "Must Start On," "Must Finish On," "Finish No Later Than," or "Start No Later Than," other than to perform schedule network analysis. These types of constraints do not support a credible risk assessment and will produce unreliable results in an SRA. There may be some hard constraints in the Government Roadmap Schedule, which are dictated by higher authority, but they should not be carried as hard constraints into the IMS. If soft constraints are needed, it is recommended the IMS use the following types of soft constraints:

- Start No Earlier Than:
  - Tasks not controlled by the execution team, for which the team has been given projected dates (e.g., GFE deliveries, common production line assigned dates); and
  - Tasks that may have to be scheduled in conjunction with other contractor programs for efficiency (e.g., scheduled blocks of time in a shared production facility).
- Finish No Earlier Than:
  - "Just-in-time" tasks on separate contracts (e.g., desire to hold delivery on two components until third component is available).

It is recommended the IMS provide a rationale for constraints other than those needed to enhance the understanding of all users of the IMS. Figure 12 provides examples.

TASK ID	TASK NAME	CONSTRAINT	RATIONALE
L02a01	Order XXX Group A & B production materials (Lot Y)	Start no earlier than	Represents the beginning of fiscal year, the earliest the Government can award the Production Option
No. 324	Receive GFE Support Equipment	Start no earlier than	Projected earliest delivery by Government

Figure 12. Example of IMS Constraints

To build a truly integrated schedule that accurately reflects program or project status, all interrelationships and links among and between tasks must be identified. Without accurate relationships, the planned execution phasing will be wrong, the critical path will be wrong, and any statistical schedule risk assessment will be suspect. The IPT members responsible for the tasks must determine these relationships and iterate them with other IPTs. The relationships are normally assigned to the tasks as predecessor relationships and the automated scheduling tool will normally link and generate the listing of successor tasks. Types of relationships include the following:

- Finish-to-Start (FS) – this is the standard "one task must finish before another starts" link. For example, since a test cannot begin until test procedures are written, the prerequisite for the "Conduct tests" task is "Write test procedures" with an FS relationship. This is the cleanest relationship for critical path analysis.
- Start-to-Start (SS) – this is used when one task cannot start until another starts (often involving some lag time). For example, a test is scheduled to go on for 4 weeks, but the task of gathering test results can begin 1 week after the start of the tests. Therefore, the predecessor for the "gathering results" task is "Conduct tests" with an "SS+5d" relationship.
- Finish-to-Finish (FF) – this is appropriate where only task completion (but not task start) is driven by another task. For example, the design of an air vehicle could start anytime, but cannot be completed until 1 month after wind tunnel results are available. In this case the "Conduct wind tunnel tests" task would become a predecessor for the "design the air vehicle" task with a "FF+22d" relationship.
- Start-to-Finish (SF) – this type of link is rarely used.

All discrete tasks will have a predecessor and a successor, the exceptions would be the start and end of the project.

The difficulty in printing a network (or PERT) diagram of reasonable size was discussed earlier. However, it is possible in some programs to provide a view that illustrates network relationships. Figure 13 gives an example of such a view, which shows the predecessors and successors for any selected task. The view is a "combination" view, with the top half being a "Task" view and the bottom a "Task PERT" view.

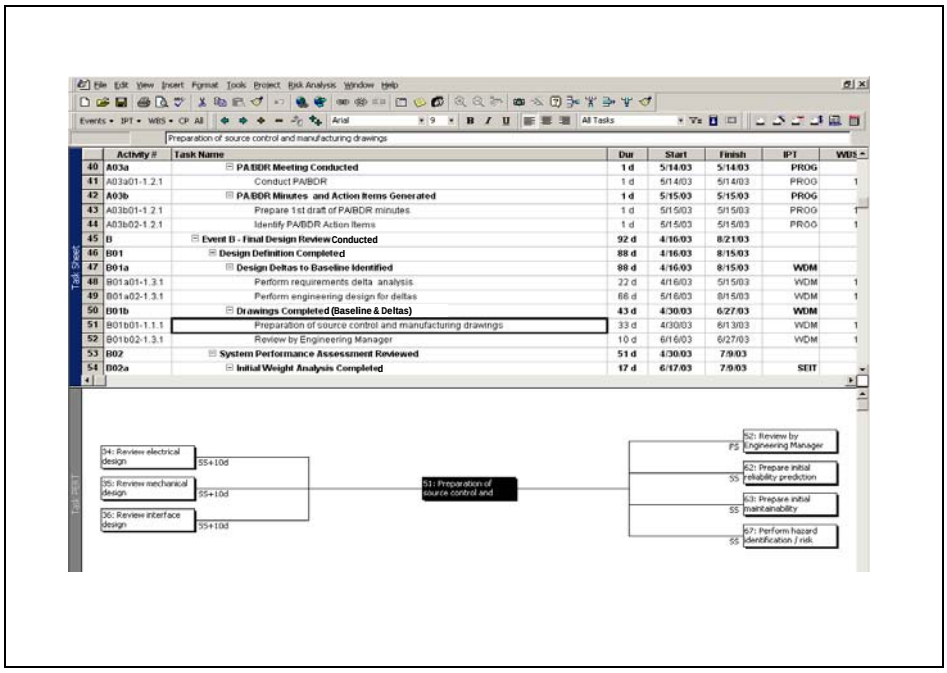


Figure 13. IMS "Combination" View with Network Relationships

The IMS should allow sorting or grouping of the IMS by IPT, WBS, and other fields. This is usually accomplished through the use of filters or groups based on information contained in data fields, using almost any data field as a sorting or grouping parameter. This permits a quick sorting or grouping capability of the IMS tasks by categories such as IPT, WBS, or event through custom tool bars with pull-down menus. Figure 14 contains an example of an IMS sorted by IPT and Figure 15 illustrates a sort by WBS.

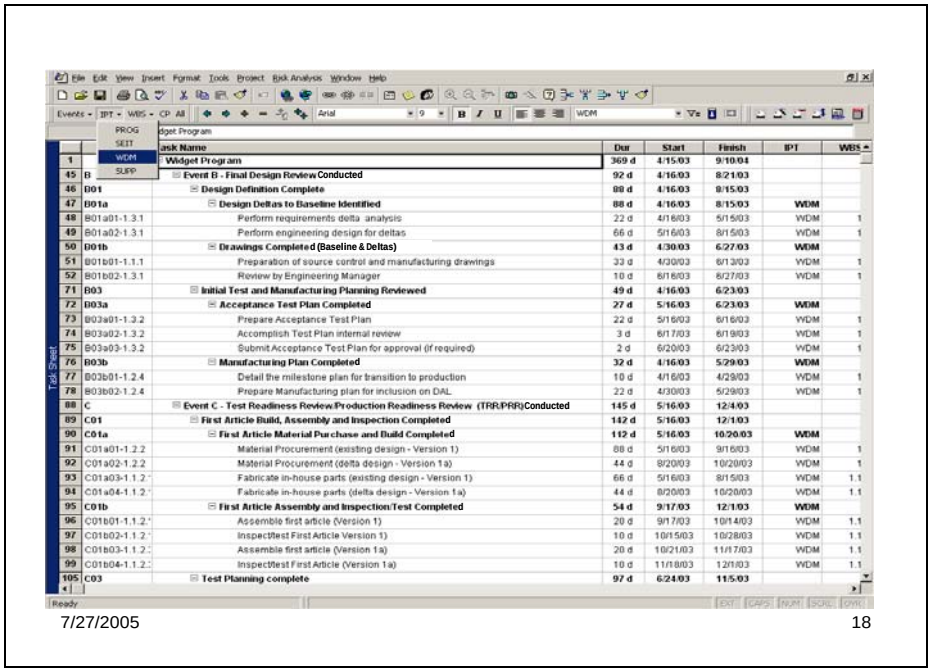


Figure 14. IMS Sorted by IPT

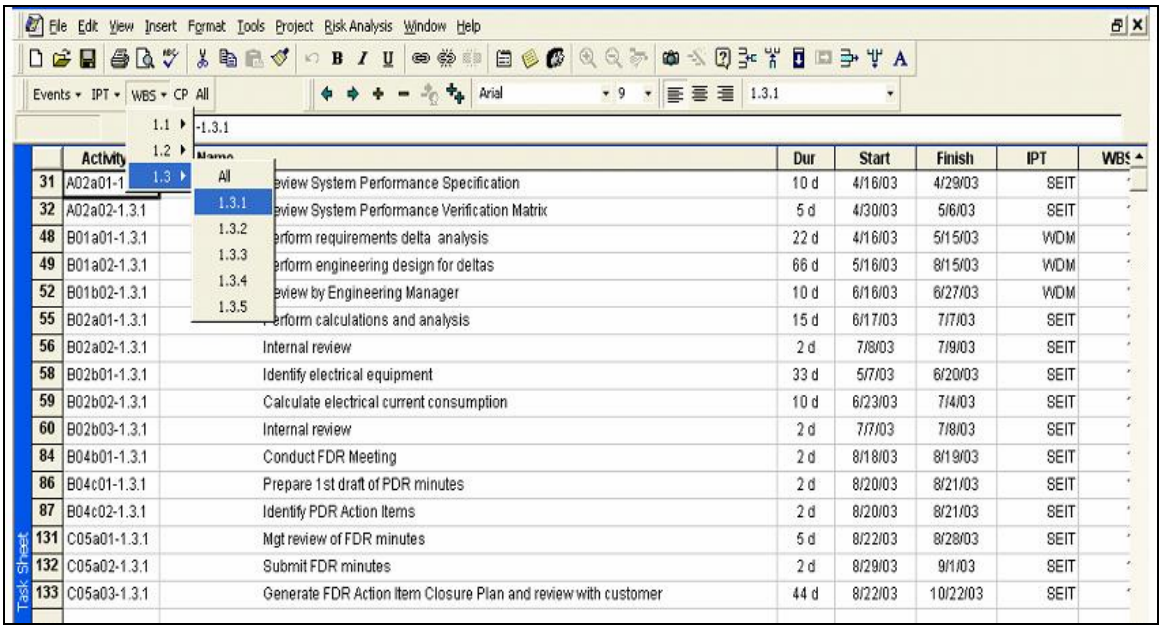


Figure 15. IMS Sorted by WBS

3.4.3 Schedule Risk Analysis

After preparation of the IMS, it is appropriate to analyze the schedule and its associated risk. In contracted efforts, the Offeror should perform an analysis and address it in the submitted IMS document. This analysis should include a discussion of the critical path. The reader should be cautioned, however, about developing "tunnel vision" focused only on the critical path activities. Activities just off the critical path must also be identified, analyzed, and tracked. These activities can become the next critical path. A continual or frequent critical path analysis is important in understanding the technical status of a program or project. There are three basic types of schedule risk analysis:

- Narrative Analysis – this should be an explanation of the overall schedule risk, normally performed by the Offeror and included in the IMS document. It would also include analysis of the critical path.
- Technical Analysis – this is a qualitative evaluation, normally performed by the Government source selection functional experts.
- Statistical Schedule Risk Assessment (SRA) – this term is a particular type of schedule risk assessment and is often used in its place, and the acronym "SRA" is used for both. This is normally a "Monte Carlo" type simulation using software programs designed for that specific purpose. The program performs simulated "runs" of the entire program many times while randomly varying the durations according to a probability distribution. The results indicate a "level of confidence" for the integrated schedule. The SRA can be performed by either or both the Procuring Activity and Offeror after assigning minimum and maximum durations for each task. The SRA can also be a valuable tool for "what-if" exercises to quantify the impacts of potential program changes.

The Government's assessment of what items are moderate or high risks may not match the Offerors' assessed risks for the proposed approach. Offerors should be allowed to identify

any appropriate areas of risk and to discuss why the Government's anticipated risk will not materialize using their approach. The potential schedule impacts of the technical risks associated with the Offeror's proposed approach is determined during the source selection process by examining the best, most likely, and worst case duration of the workflow of activities associated with the most risky aspects of that Offeror's approach.

If the Procuring Activity plans to do an SRA, the proposed IMS is typically requested in an electronic format that can be input to a schedule networking software that is compatible with the Government's software package. The schedule team loads the Offeror's proposed schedule data and then may make adjustments to the data to reflect the Government technical team's assessment of the contractor's schedule. The software uses Monte Carlo simulations for each of the activities given the range of duration, for the purpose of determining a cumulative confidence curve (see Figure 16). Some SRA programs will also do a "critical path analysis," identifying the number of times every task in the IMS shows up on the critical path during the simulation runs. This can be a great help in addressing the "tunnel vision" discussed above.

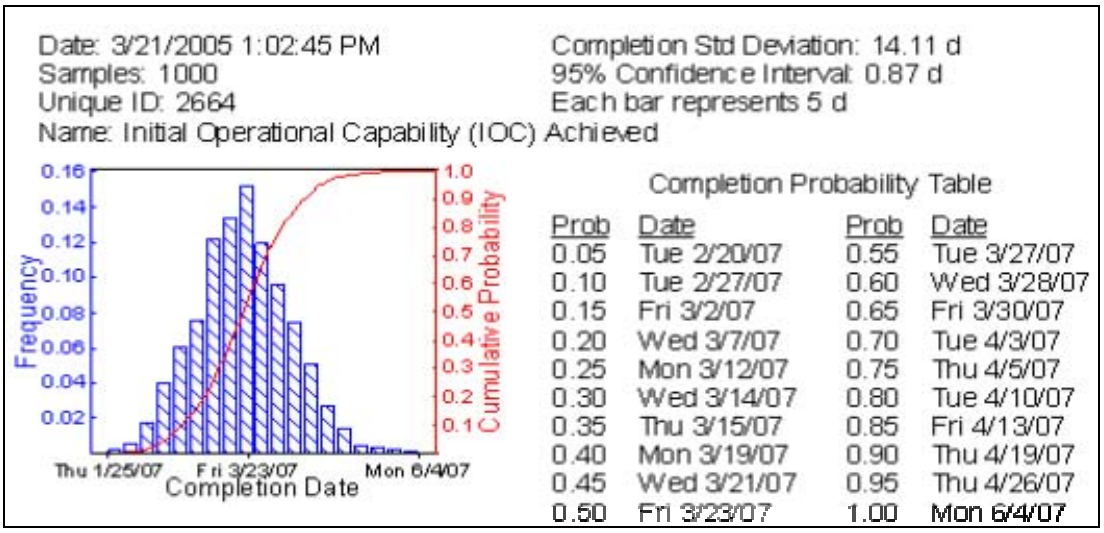


Figure 16. Sample SRA Results

When performing an SRA, it should be noted the "confidence level" of making the exact dates in the IMS would typically be very low. This is not unusual, and occurs because during the simulation all tasks can expand to their maximum duration; however, not all can shorten to their minimum duration, because other tasks will move onto the critical path in their place. The definition of a "high confidence" schedule should take this into account and set an acceptable band around the event completion dates.

It is very important to conduct a proper analysis concerning the potential causes for schedule disruption and to choose credible minimum, maximum, and most likely durations. Often this process has been used to try to force-fit the schedules, using faulty assumptions. An SRA is only as credible as the minimum and maximum durations and the predecessor and successor logic integrity. It is important to have a good critical path network with a minimum number of date constraints.

In summary, Figure 17 illustrates an example Execution IMS, providing a tabular listing of all IMS activities, along with durations, start-finish dates, and predecessors.

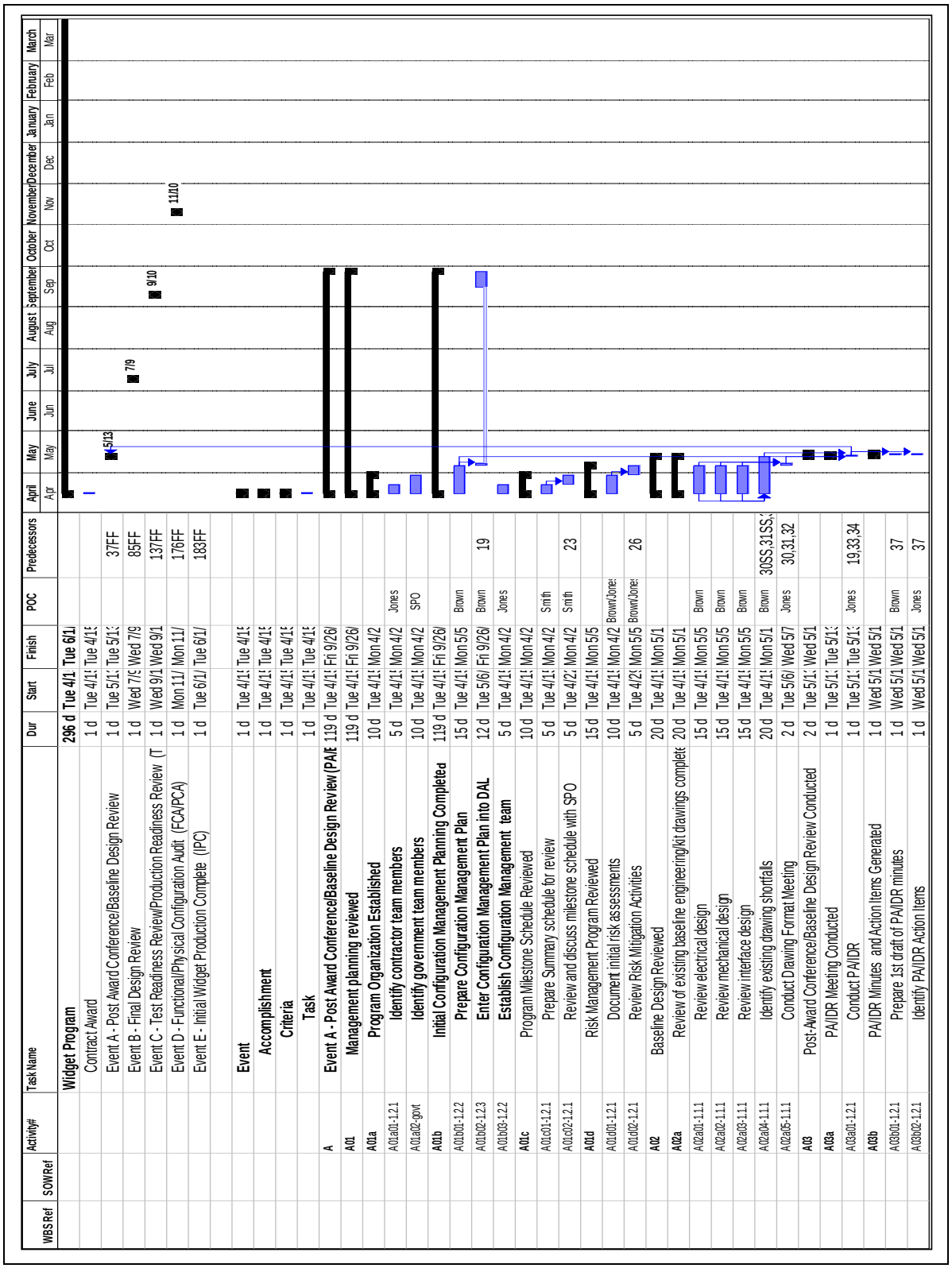
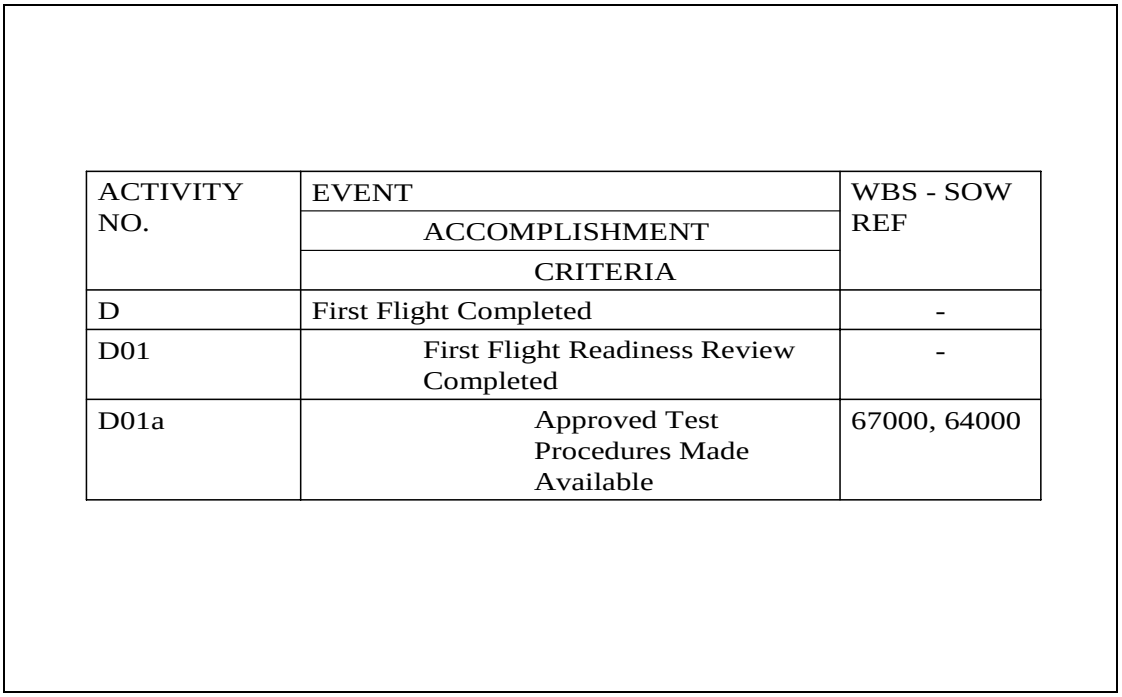


Figure 17. Example Execution IMS

The IMP and IMS must provide traceability to the contractor's WBS and SOW. This can be done by including the applicable WBS and SOW element in a separate text field at the IMS task level, where the work is actually accomplished and funds expended. The relationship of events, accomplishments, and criteria to the WBS and SOW can be determined by a roll-up of their subordinate task relationships. Therefore, it is important to add a WBS and SOW reference column to the IMP Events, Accomplishments, and Criteria Table. This makes it possible to show all the WBS and SOW elements related to each criterion in the IMP by performing a roll-up of each criterion's supporting tasks from the IMS. In our example, the assumption is that the tasks under the criterion "Approved Test Procedures Available" come under WBS and SOW 67000 (System Test & Evaluation) for preparation and under WBS and SOW 64000 (Data Management) for submittal. The roll-up is illustrated in Figure 18 with criterion D01a supporting WBS and SOW elements 67000 and 64000. Similarly, several tasks may be applied to the same WBS and SOW element, as the WBS and SOW reflects a product orientation while the IMP shows the maturation of the product over time. This traceability to the WBS, SOW, and CPR provides an important link between the IMS and the contractor's EVMS.



ACTIVITY NO.	EVENT ACCOMPLISHMENT CRITERIA	WBS - SOW REF
D	First Flight Completed	-
D01	First Flight Readiness Review Completed	-
D01a	Approved Test Procedures Made Available	67000, 64000

Figure 18. Illustration of Task Linkage to WBS and SOW

3.5 IMP and IMS Evaluation Procedures for Source Selection

Because the proposed IMP and IMS represent the Offeror's detailed plan for execution of the program, they enable the Government to effectively evaluate the Offeror's understanding of the program requirements and the soundness of the proposed approach. The contractor's performance with respect to the IMP and IMS may be used as input data for contractor performance assessments. The IMP and IMS provide an effective method for tracking the schedule progress of the program and determining the technical maturity at any point, when effectively linked with the overall technical approach and EVMS as discussed in Section 2.3.

The IMP and IMS is a multi-functional plan and schedule, respectively, and should therefore be evaluated by a multi-functional team, led by program management with the following involvement and responsibilities:

- Program management focuses on the overall program approach;
- Engineering focuses on the technical approach, including requirements, design, development, integration, producibility, and risk mitigation. Engineering also ensures the required IMS tasks are identified, with proper durations and linkages, to include requirements analyses, synthesis (design), modeling and simulation, prototyping, working groups, development testing including subassembly, assembly component, line replaceable unit subsystem (hardware, software, and hardware-software integration), and system qualification. Finally, engineering ensures interfaces are identified with Interface Control Documents or requirements and associated tasks, including external interfaces with other systems, Government tasks/products, etc.;
- Test focuses on the sub-system, system level testing, DT&E, and OT&E. Test also ensures test planning and test execution tasks are identified with proper durations and linkages;
- Logistics focuses on integrated logistics support, including all aspects of system fielding;
- Financial management focuses on translating the most probable schedule into a most probable cost, using the inputs and risk assessments from other functional experts; and
- Contract management focuses on ensuring the approach meets contractual requirements and deliverables.

Prior to actually beginning the IMP evaluation, there are several preparatory steps to familiarize the team with the RFP requirements and proposal structure. Accomplishing these steps, in the order recommended, will significantly decrease the overall assessment time. Become familiar with the Offeror's overall program approach. If there is no Executive Summary, or if the contents are too vague to provide adequate insight, scan the technical and management sections to ensure understanding of the overall program approach, i.e., major subsystems, software development, top-level integration approach, and testing approach.

Section M spells out the evaluation criteria. Become familiar with the requirements, ensuring clear understanding of both the thresholds and what would be required to exceed requirements. Section L stipulates any specific guidance on how Offerors are expected to present information to satisfy the Section M requirements. Familiarize yourself with what the contractor is being asked to present. The purpose of Section L is to request the information specifically required to satisfy the Section M requirements.

Do this familiarization before evaluating for specific details to become familiar with how the Offeror has structured their program. It will help a lot when assessing the details. There are two areas where this familiarization is most beneficial: the descriptive section structure and the IMP structure. As discussed earlier, the IMP is a summary level view of the top three levels of the IMS. The IMP review is greatly facilitated by using a scheduling software application file of the IMS.

You should first compress the IMP to Outline Level 1. This shows the "Events," the major review points throughout the program. This is the top-level program flow. They should

appear reasonable and familiar. Then, expand the IMP to Outline Level 2 to see the significant accomplishments for each event (on large programs it is easier to expand one event at a time). In each case, this Level 2 list constitutes the major inputs to the related event. They should make logical sense. Finally, expand to Outline Level 3 to see the criteria necessary for completing each significant accomplishment (on large programs it is easier to expand one significant accomplishment at a time).

At this point, the team is familiar with both the RFP requirements and proposal structure, and ready to begin the IMP and IMS evaluation, which is best accomplished using the following five steps when reviewing each:

- Compliance with Section L instructions;
- Consistency with other proposal inputs;
- Completeness, quality, and reasonableness of the schedule;
- Clarity and usability for program execution; and
- Compliance with Section M criteria.

The IMP should succinctly explain how the various program parts will be integrated into the whole. With the Descriptive Section as the foundation, the IMP should outline what the contractor is going to do to meet the Government program requirements. The Process Narratives, if applicable, should explain how the key processes are going to be tailored and integrated across multiple subcontractors. The review team should evaluate the submitted proposal for RFP compliance. This will help identify any needed Evaluation Notices (ENs) early in the process. Evaluate whether the Section L content requirements were met. Frequently Section L will specify required descriptive information, including which narratives are required and narrative discussion content. For example, is the WBS field populated and does it easily map to the cost volume and SOW?

Is the overarching program approach reflected in the IMP? Is it consistent with the technical approach documented in the SEP? For example, does it use event-based technical reviews with independent peer participation? It should detail the timing and conduct of technical reviews. Are appropriate entry criteria established for each technical review? Does it illustrate when the technical baselines are approved and who the technical authority is? Is the integration and test approach reflected in the significant accomplishments and criteria? Is it consistent with the Test and Evaluation Master Plan? Does it have a logical flow? For example, is there a test plan written prior to the CDR? Are the specific test procedures completed prior to the Test Readiness Review? Does the IMP show the build up from unit test to subsystem test to system integration? Is the software development and integration approach reflected in the significant accomplishments and criteria? Is it consistent with the Software Development Plan, if applicable? Does it have a logical flow? For example, is the Software Requirements Specification written prior to design, which precedes unit code and test? Are the significant risks identified elsewhere in the proposal adequately addressed? For example, if a specific subsystem (perhaps subcontracted out) is viewed as a technical risk, is its design and test maturation reflected as criteria or significant accomplishments to support various events?

Major program events are opportunities to gauge program status and typically are spaced no more than 4-6 months apart for a complex program. There is no set requirement for what will

be defined as an event, but the traditional major technical reviews serve as a good starting point. Interim status reviews may need to be inserted to prelude excessive time between events. Assess the Descriptive Section and IMP to determine if the events reflect logical program maturation over time (e.g., System Requirements Review (SRR) leads to PDR, which leads to CDR, which leads to TRR, etc.).

Evaluate the IMP to determine if the significant accomplishments adequately support the related events; i.e., do they represent the complete list of major entry criteria for the event? There should be enough significant accomplishments to represent progress required of each functional discipline. Each event and the subordinate significant accomplishments should be reviewed separately. As a best practice, an easy crosscheck to ensure a multi-disciplined approach is being followed is to see whether every functional discipline is significantly involved in at least one significant accomplishment for each event. If not, decide if they should be.

These criteria are the objective evidence that significant accomplishments have been satisfactorily completed. They document the claimed progress and can be seen, touched, or demonstrated using well-defined terms. Meeting all the criteria indicates completion of the significant accomplishment. The IMS should take these criteria and further break them into tasks representing the work necessary to meet the criteria. Review the criteria necessary for completing each significant accomplishment. Do these make sense, as the listing of "objective evidence" needed to provide confidence each significant accomplishment was satisfactorily completed? The criteria should be objective and measurable. Review each significant accomplishment separately. As a best practice, ensure events occur at the system level and cross multiple IPTs. Significant accomplishments may also cross multiple IPTs. Each criterion needs to directly relate to a particular IPT, which aids future accountability and reporting. Each IPT can then flesh out subordinate task definitions, durations, and linkages (i.e., below the criterion level).

Do subcontracted efforts provide the appropriate visibility? Particularly if those efforts are a major portion of the program or have higher risk, increased subcontractor detail should be contained in the IMP, e.g., requirements flow down to the specific subcontractors, specific subcontractor design reviews accomplished prior to system level design reviews, etc.

Since the IMP defines the bilateral agreement of what constitutes the event-driven plan, it's appropriate that key GFE and Government Furnished Information (GFI) items be included (probably at the criteria level).

Evaluate any Process Narratives to ensure they contain the appropriate level of detail. The intent here is not for the Offeror to restate existing company processes but to explain how these processes will be used (and tailored) to execute the particular program. Particular interest should be paid to how the IMP and IMS will be used to manage the program, including such processes as: Risk Management, Trades, System Integration, Test Planning, Logistics and Support Planning, Configuration Management, etc. As a best practice, risk management should always be discussed in a Process Narrative, tailored to include specific subcontractor processes, and each process should be limited to five pages, including:

- Statement of Objectives – describe the purpose of this process and how will it be tailored for this program.
- References – cite existing internal company procedures and systems.

- Approach – describe the primary features and flow of the process and identifies key participants within the process. It also describes how the Government interfaces with or obtains insight into the process and outputs.

Are the "names" for events, significant accomplishments, and criteria descriptive, concise, and specific to the program (or are they generic)? A best practice is that activity names (whether summary level or task level) should be stand-alone as much as possible, without relying on the context within which they appear. This facilitates later use of specialized scheduling software application filters to create unique views without losing the meaning. For example, use "LRU xxx hardware/software integration testing completed" rather than "Testing completed." Are there action verbs associated with each "name?" Ensure a dictionary is included in the Descriptive Section to establish a common understanding of what each term really means.

Is there a consistent structure for significant accomplishments and criteria from event to event (as appropriate)? Does it ensure the multi-functional considerations are included at each event? For example, does each event have significant accomplishments (or criteria under an umbrella significant accomplishment) associated with risk management, integration and test, and ILS efforts. This can be tailored to eliminate inappropriate categories from a specific event (e.g., there may not be separate criteria for ILS planning for the "System Requirements Review Accomplished" event).

Because the IMS is built from the IMP, it should be evaluated after the IMP is evaluated. The IMS should provide the Government confidence the program(s) is structured to be executable; it should be the key Government determinant as to the Offeror's ability to successfully execute the proposed program. Similar to the IMP familiarization done prior to beginning the actual evaluation, it is also important to gain familiarity with the IMS. Review Section M, Section L, and the overall IMS structure. This structure will logically follow from the IMP, so continue the evaluation process by expanding to Outline Level 4 (and below) to familiarize yourself with the tasks associated with each criterion.

Evaluate whether the Section L submittal content and format instructions are met (content, filters, views, special column entries, etc.). Ensure the requested information has been submitted. Affirmative answers to the following IMS questions will assure consistency with other proposal input.

- Is the IMS an extension of the information contained within the IMP, reflecting not only the events, significant accomplishments, and criteria identified in the IMP, but also tasks subordinate to the criteria?
- Is the overarching technical approach reflected in the IMS?
- Are the ILS elements included and consistent with the technical approach?
- Is any required production planning consistent with the rest of the proposal?
- Are the significant risks identified elsewhere in the proposal adequately addressed?
- Does the IMS include the activities identified in the risk mitigation plans for significant risks?

The IMS should be constructed to permit filtering on a specific risk, so that all associated tasks can be reviewed. Two best practices are associated with this activity. First, effective risk mitigation planning includes identification of specific actions, which reduce the likelihood of or the consequences of occurrence. In aggregate, these actions comprise the specific risk mitigation plan. These actions should be included as tasks within the IMS. The second best practice is that cost estimates must reflect the risk mitigation planning included in the proposal. If the cost estimate does not include these activities, either the efforts will not be accomplished or the program will experience cost growth associated with the unbudgeted activities.

Is the WBS field populated and does it easily map to the cost volume? If there is no grouping for WBS, create one to organize the list of tasks by WBS to enable the cost reviewers (with assistance from the technical team) to evaluate if the cost inputs are reasonable for the work scheduled in the IMS? Be aware LOE activities as well as low risk activities may not be reflected in the IMS, while they are in the WBS roll-up. Is the IMS traceable to the EVMS? There should be a direct correlation, resulting in traceability, between the information reflected in the IMS and that reported in the EVMS. If the IMS and EVMS use separate data bases, ensure WBS numbering conventions in both databases are traceable between applications to ensure consistency. If the IMS and EVMS use a common data base, ensure the accuracy of both.

Evaluate the IMS to ensure it is structured such that the flow is determined by the starting date of the network, activity duration, and the connecting activity logic. Perform some checks for overall IMS compliance with recommended norms. The following list of recommended checks is not "go/no-go," but may indicate incomplete schedule logic. These are good for a first cut, but remember the proposal IMS may deviate from these for good reason, so evaluate on the individual scheduling merits:

- There is a valid critical path. Absence of a valid critical path or one which does not seem reasonable could indicate one of several mechanical errors, such as circular logic, excessive durations, simplistic linkages, missing linkages, etc. It could also be created due to a constraint, such as "Start No Earlier Than," for an activity late in the program's life.
- All lowest-level tasks have both predecessors and successors (except the initial and final task). Filter for activities which have no predecessors or no successors. Items which fail this test are either not linked properly or unnecessary efforts. There is an exception for items such as GFE (no true predecessor) or deliverables to the customer, which are not used by the supplier (no true successor). For these exceptions, consider use of contract start as a predecessor or contract complete as a successor, to ease the analysis.
- There should be no or minimal constrained dates. Filter for "Constrained Dates" and "Constraint Type" to ascertain if constraints are used and, if so, the extent to which they are appropriate and/or drive any critical path determinations.
- There should be no excessive durations. These long tasks should generally be broken into more detail to provide adequate insight into the planning and tracking of program during execution.
- All Float or Slack should be reasonable. Excessive float or slack could indicate either there are missing successor linkages or planning well in advance of need (which may be an issue for programs with a termination liability limits).

- All lead time or lag should be reasonable. Excessive lead time could indicate either there are missing successor linkages or planning well in advance of need (which may be an issue for programs with a termination liability limits). If lags are used, are they reasonable and realistic or are they being used to drive a date as opposed to letting logic drive the schedule? Negative lags are not appropriate (this is especially true for "Start to Start Logic"), and should be explained if used. Because lags are required delays before the successor tasks can start (e.g., concrete cure time), using them to simplify a more complex schedule relationship should be avoided. Instead, the IMS logic should define what it is that drives the lag and put that in the IMS. If lags are used to represent anticipated delays (and simplify the IMS), such as document review time, these assumptions should be explained in the write-up.

Evaluate the cadence of the events in the schedule? Are they appropriately spaced? If they are too close in time (less than 3 months), should they be merged into a single gathering point, with one a significant accomplishment to the other? If they are too far apart (perhaps more than 6 months and certainly over 1 year), how will the overall progress be monitored to have an early warning of program problems? It may be appropriate to add an intermediary event such as a progress review. If they are payment milestones, what are the implications for contractor cash flow?

Are LOE-type activities included? As a best practice, LOE tasks, by their definition, cannot influence an event-driven schedule and should not be included in the IMS. However, if inclusion is desired to maintain consistency with the cost system they should be included in such a way that they do not yield an erroneous critical path or drive the dates for program reporting tasks.

Go to Outline Level 1 of the schedule and look at the Gantt chart. Review to see if there is a natural waterfall for both the start points and end points, perhaps with some overlap between events. Expand to Outline Level 2 and beyond to see if the waterfall is still in place, again with some amount of overlap. This will provide an input to determine if the tasks and higher level activities are tied to the events they are under. Ensure the proper work time calendar has been used, and that it matches the company calendar. If subcontractors have different work schedules (or Government activities) assess the adequacy of how the Offeror considers these differences.

First step back and see if the "big picture" makes sense. For example, if there is a PDR, when is it planned? Is that realistic for the technical challenge being approached? How do these dates compare to the Governments pre-RFP estimates? Does the IMS support any contractually-required dates? Then, go through a detailed review of individual tasks, looking at the logical relationships (predecessor and successor linkages) and task durations.

Do the predecessor and successor linkages accurately represent the relationship between tasks? Are the relationships consistent with sound engineering practice and company processes described in the IMP Process Narratives, or is risky concurrency being scheduled in order to meet a defined date? Asking two questions about each task will resolve this issue:

- What are the tasks which must be completed before this task can start?
- Which tasks depend on the completion of this task before they can start?

Are the task duration's relationships realistic? Review the basis of the most likely durations (if required in Section L). Key areas that are often unrealistic include: (1) Schedule

durations to fully document and review the requirements and flow-down to subsystems; (2) Software development, unit test and integration test; (3) Hardware/software integration and test; and (4) Material lead times for prototype build. Material lead time should be tied to the design process, as appropriate. There are two best practices associated with durations. First, duration rationale are referenced within the IMS (a data field) and directly traceable to the cost volume BOEs. Second, software coding, integration, and testing durations are traceable to a software model output. Whenever possible analytical tools, calibrated with actual company experience (reflected in the Past Performance Volume), should be used to evaluate tasks and determine estimated task durations.

What are the expected ranges of schedule variance for the various activities? Are they realistic, based upon risk and do they discriminate between activities? For example, is software rated as higher duration risk than the time to conduct a meeting? What distribution is used for the various activities? Typical distributions and their proper use follow.

- Triangular (lower confidence, higher risk) distribution curves should normally be used for tasks such as software development, hardware-software integration, system-level integration and testing, and transition to production. While there are always exceptions, these categories typically experience unforeseen delays.
- Normal distribution curves should typically be used for the majority of tasks, reflecting a middle of the road uncertainty assessment.
- Beta (higher confidence, lower risk) distribution curves are typically used for areas where a company has extensive experience and very high confidence in completing a task on time.
- Fixed (very high confidence, little risk) distribution curves may be used for tasks which, in and of themselves, are relatively risk free (such as meeting durations).

Are the distributions used in the IMS realistic, based upon risk and do they discriminate between activities? Once again, is software rated as higher duration risk than the time to conduct a meeting? In this example, it is really a more evenly distributed range of risk

Evaluate the degree which any RFP-imposed IMS total line limitations might have impacted the Offeror's ability to accurately portray detailed task level information. If the RFP restricted the total IMS line count, it may be more difficult to discern how the Offeror has summarized their more detailed schedule to stay with the line constraints. Figure 19 demonstrates the impact of imposing line limits on a proposal IMS.

Example of long duration impact:

ID	Task Name	Duration	Start	Finish	Predecessors
1	"Widget" LRU Integrated	195d	7/29/98	4/27/99	
2	Hardware Build Completed	127d	7/29/98	1/21/99	
3	HW Interfaces defined	60d	7/29/98	10/20/98	
4	HW Prototype Completed	22d	10/21/98	11/19/98	3
5	HW Final Version Completed	45d	11/20/98	1/21/99	4
6	Software Coding Completed	105d	10/21/98	3/16/99	
7	SW Build 1 Completed	45d	10/21/98	12/22/98	3
8	SW Build 2 Completed	60d	12/23/98	3/16/99	7
9	LRU Testing	90d	12/23/98	4/27/99	
10	Preliminary Integration Testing Completed	15d	12/23/98	1/12/99	4,7
11	Final Integration Testing Completed	30d	3/17/99	4/27/99	5,8,10
12					
13	"Widget" LRU Integrated Completed	195d	7/29/98	4/27/99	
14	Hardware Build Completed	127d	7/29/98	1/21/99	
15	Software Coding Completed	105d	10/21/98	3/16/99	14SS+60d
16	LRU Testing Completed	90d	12/23/98	4/27/99	15SS+45d
17					

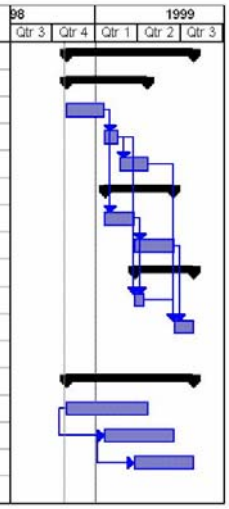


Figure 19. Example of a Constrained IMS

Continue the evaluation of the IMS by filtering for risk mitigation plans. Review them for completeness and consistency with other program inputs. Evaluate for duration and logical relationships to ensure they will accomplish the desired risk mitigation. Evaluate to determine if the level of detail is commensurate with program impact. For instance, more detail may be desired on how the subsystems are integrated into the system than on the vendor parts procurement process. The key question is: "Where does program management need the additional insight?" Often the risk mitigation activities associated with risk items rated high or moderate will also be on the critical path, because the likelihood of the risk causing a program impact is what resulted in the risk assessment.

Identification and management of the critical path tasks are very important to program success. Therefore, managing the critical path tasks provides the opportunity to take timely management actions necessary to preclude a schedule slip. For instance, if highlighted early enough, resources can be shifted from a non-critical path task to a critical path task, thereby potentially avoiding a program slip. Viewed differently, working critical path tasks ahead of schedule is the only way to complete the project ahead of schedule. The critical path analysis should focus on the IMS ability to accomplish these goals.

Critical path analysis is probably the most valuable tool available for analyzing the IMS, but it depends on having valid durations, predecessors, and successors. Filter the schedule for activities on the critical path (lowest float or slack value and the longest network path). If there is no critical path, or if the critical path appears overly simplistic, there is a high likelihood the IMS has not been properly constructed (e.g., constrained dates, long durations, improper or incomplete predecessor and successor logic, excessive lags, etc.). Assuming there is a valid

critical path, the next level of review can occur. The following critical path analyses should provide the necessary insight into the critical path:

- Does the critical path run from the first activity (probably contract award) to the final activity (probably delivery of something)?
- Are there adequate numbers of activities on the critical path, such that there is confidence it is not an overly simplistic representation (and therefore probably erroneous)?
- Are the tasks shown as being on the critical path the ones to be expected for this particular program? If an expected task is not on the critical path, review the Total Slack to determine how far off the critical path it is.
- Are the items highlighted as risk areas on the critical path (normally many of them will be)? If not, is there a logical explanation?
- For items viewed as higher risk or long duration which are not on the critical path, evaluate their logic to understand if they should be—is there improper linking, unrealistic durations, etc?

Filter the schedule for activities on the near critical path(s), (next four lowest float or slack value and the longest network paths). Particularly in complex programs, the critical path will jump around as tasks are completed, finish early, or slip. When this occurs, previously non-critical path items suddenly become the program drivers! Awareness and management of these continually-updated critical items assures a high likelihood of program success.

Uncertainty is an important ingredient in all program schedules, and it plays a particularly significant part in complex programs. Each activity has its own uncertainty risk. For example, an item which is on or near the critical path may have relatively little schedule risk (such as receipt of commercial-off-the-shelf (COTS) hardware) while other items may have substantial schedule risk (such as software development) even if they are not on or near the critical path. By statistically analyzing the schedule, it is possible to look at the impacts of predictable variations in task completion dates. This provides significant additional insight into the "near critical" path, identifying those tasks that are likely to become critical path if durations of other activities change.

Finally, aside from any Section L requirements, are there specialized views, tables, filters, and groups that facilitate such actions as improved risk management, earned value calculations, and Government insight. Having completed the evaluations of the IMP and IMS, one can now assign ratings.

The IMP and IMS evaluations are normally a distinct Management subfactor. Whether or not it is a separate subfactor, the evaluation should be accomplished in accordance with the specific source selection policies and guidance. The ratings should use the rules (color rating, adjective rating, etc) as described in the Source Selection Plan.

Assign a rating to the subfactor, depicting how well the Offeror's proposal meets the subfactor requirements in accordance with the stated explanation, within the subfactor. The rating represents the assessment of how well the stated solution meets the requirements, regardless of any risk which might be associated with the ability to achieve that solution. Assign a proposal risk rating, representing the risks identified with an Offeror's proposed approach as it

relates to the applicable subfactor. The proposal risk rating assesses the likelihood of being able to achieve the proposed solution.

3.6 Implementation of the IMP and Execution IMS

When the contract is awarded, the IMP submitted by the winning contractor becomes a part of the contract. The IMS submitted should be baselined and become the basis for updates normally submitted either as a CDRL, according to the instructions contained in the tailored IMS DID or through the Data Accession List (DAL). This regular deliverable will be provided for day-to-day execution, including the contractor's award or incentive fee performance. Changes to either the IMP or IMS during program or project execution are discussed below.

Open communications and trust are critical during program execution. This includes communication between the Government and the contractor as well as internal Government communication among the various program teams and with other Government organizations. The IMP and Execution IMS information is critical to providing the baseline for the communication and execution of the program. It is important to recognize most program events directly affect all IPTs, and there is a need to establish a communication link that ensures all interfaces are recognized and addressed. If problems are identified and addressed regularly in team meetings through IMS status reporting, mitigation plans can be formulated to minimize program disruptions and their cost and schedule impacts. In many programs, electronic data interchange is available between the Government and contractor team. In these cases, the Execution IMS could be made available to the Government team on an ongoing basis.

The Execution IMS should be established as the schedule baseline against which performance is measured. After the contract has been awarded, the Execution IMS will become the schedule baseline for the program, and management will execute the program using this plan. Sometimes realities of program execution lead to a variation between planned progress and actual progress. Workarounds will have to occur to return to the program baseline approach. When this occurs, the adjusted plan should be shown in the Execution IMS; however, the original Execution IMS should be archived for reference. These "changes," or workarounds, should follow the documented IMS change process.

The program team should determine how the IMS is updated and who is responsible for making the updates. The change control process should be clearly stated, to cover the following:

- The documented coordination and approval of IMS changes;
- The identification of the IPT responsible for performing the changes and maintaining configuration control;
- How the IMS changes are monitored and controlled; and
- How the IMS revisions are published and distributed to program personnel.

Updates to the schedule may be documented as they occur; however, a time for a "block change" of the IMS should be designated to ensure the schedule is kept current. As projected slips to the schedule become apparent, the impact to the critical path for that activity should be assessed, and work-around plans developed. If program status is being reviewed regularly in team meetings and through IMS status reporting, the formulation of mitigation plans to minimize program disruption and to avoid cost and schedule impacts should be an ongoing activity.

Work-around plans can be used at several different levels. At the program team level, the expected activities can be tracked and monitored at working group meetings (e.g., the Integrated Test Team or the Integrated Logistic Support Working Group). The Execution IMS documentation of what has to be accomplished to complete each of the activities is an invaluable tool to assess the current status and project potential problems in activity completion. To be effective, as soon as it is determined that scheduled tasks cannot be accomplished as required, management must be notified. Then the process can begin to assess the overall program impacts and formulate plans that will assure program integrity.

To illustrate how the IMP is employed, the example below uses a single event, along with only one of several supporting accomplishments and only one of several supporting criteria for that accomplishment. The respective event, accomplishment, and criterion are:

a. First Flight completed.

(1) First Flight Readiness Review completed.

(a) External stores flight clearance granted.

For example (see Figure 20), when the external stores flight clearance is granted, that criterion is satisfied. When this criterion is satisfied (along with satisfaction of all the other entry criteria that would support holding a First Flight Readiness Review (FFRR)), the review can then be held. When the review is held and satisfies its exit criteria, then the FFRR accomplishment supporting the First Flight is complete. When all the other accomplishments (e.g., actually conducting the first flight) that would normally support a first flight are complete, then the First Flight event is complete.

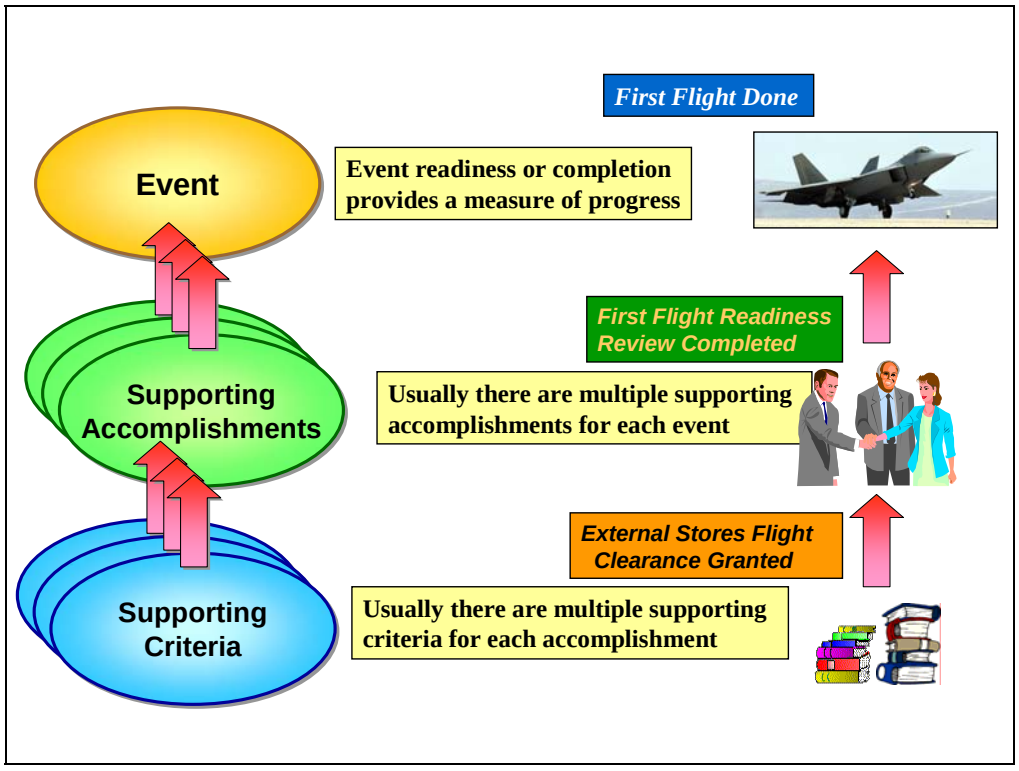


Figure 20. The Way the IMP Works

To illustrate how the IMS is implemented, the example above is expanded by adding four specific tasks that support satisfaction of that criterion.

a. First Flight completed.

1. First Flight Readiness Review completed.

(a) External stores flight clearance granted.

i. Perform Safety of Flight (SOF) analyses and tests.

ii. Prepare and submit External Stores Certification Data.

iii. Validate software and hardware interfaces in the System Integration Lab.

iv. External Stores Office provide interim flight clearance.

When the four specific tasks are successfully completed, the external stores flight clearance is granted (see Figure 21). The actual IMP and its IMS would have multiple accomplishments supporting the First Flight event with multiple criteria and each criterion supported by multiple tasks.

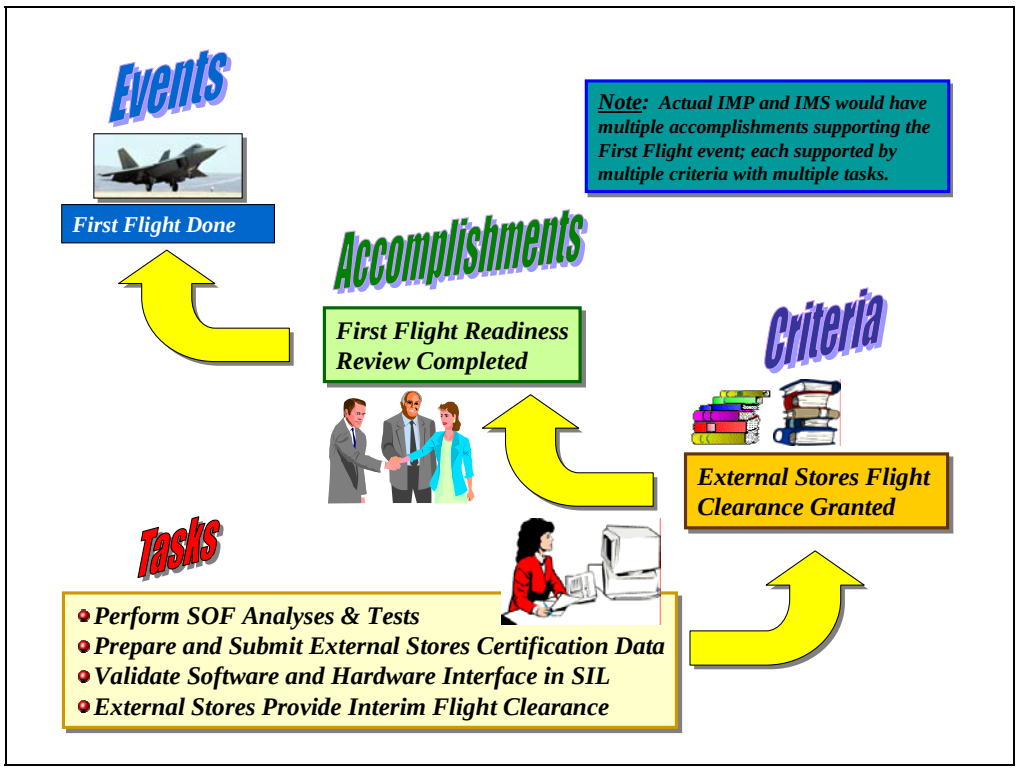


Figure 21. The Way the IMS is Implemented

From a program perspective, the IMP and the associated baseline IMS network schedule should be used as the starting point to assess and mitigate the impacts caused by program perturbations. In the case of directed budget cuts, critical path analysis can be used as a starting point to identify items for potential cut that would cause the least program impact. More importantly, after identification of the efforts to be cut, the specifically impacted program teams can be tasked to assess the impacts to determine if they are feasible. This process has the potential to provide better impact analysis than previous methods. After the team's analysis, they should be better able to execute the changes, since they helped analyze and define them, and to make them "more executable." Conversely, if the impacts are unacceptable, the IMS

information developed should help support the analysis, and lead to the identification of other options to be investigated.

A complete IMS with well-defined relationships can be responsive to "what if" exercises at varying levels. Most "what if" exercises represent significant potential changes to the program funding, content and approach. A sufficiently descriptive IMS can be an invaluable tool for examining alternatives to provide meaningful answers to the questions conveyed in "what if" exercises. Statistical risk analysis tools can be used to support these "what if" exercises.

When changes have to be made to the program, the IMP and Execution IMS must be updated to reflect the revised planning and schedule, and this must be communicated to all program participants. The program team should ensure program financial planning and the EVMS baselines, if applicable, are adjusted to reflect the new, approved baseline. Factors such as program maturity, risk status, and funding changes could drive changes to the IMP and contract modifications, if applicable.

Each program should determine the level and format for reporting program progress and problems to internal and external management. The program teams can internally track activities to any level they consider necessary, but will need to roll up those tasks to reflect the pertinent information desired at each management level. Internal program reviews may be conducted to provide senior management with the current execution status in terms of cost, schedule, and performance. The information required would be expected to be significantly less than that required by the program teams to perform comprehensive workload integration, but would be tailored to provide the information necessary for issue resolution. As guidance, the contractor should submit an electronic schedule update and a monthly report containing a summary identifying progress to date, variances to the planned schedule, causes for the variance, potential impacts and recommended corrective action to avoid schedule delays. Actual start and completion dates should be reported. The analysis should also identify potential problems and provide a continuing assessment of the network critical path.

The IMP and Execution IMS are also extremely useful sources of information that can be provided to outside organizations whose support is necessary for program continuation. These organizations may include Service Headquarters, Congress, DoD, GAO, and the other DoD services on joint programs. The IMP and Execution IMS can serve as useful tools for assessing the impact of funding cuts and other program iterations. When combined with other traditional sources of program status information such as CPRs, deliveries, and financial tracking, the IMP and Execution IMS can provide a more robust assessment, and help the program manager better understand available options when making programmatic decisions.

When the Execution IMS is used as the baseline management tool for the day-to-day execution of the contract, it can be the source for other information required to satisfy program requirements. Many contracts will have a performance assessment performed by the program office, and much of the information required to assess performance for the assessment is readily obtainable from the IMP and Execution IMS. This information can be used as justification and substantiation for the Contractor Performance Assessment Report (CPAR).

If the contract has an award or incentive fee provision, the IMP and Execution IMS information can be used to support and substantiate the program office evaluation in the same manner as within the performance assessment report. Also, successful completion of IMP and IMS events and associated accomplishments or criteria can be tied directly to award or incentive

fee criteria. In some cases, the periods of performance have been correlated with the completion of the events in the IMP and IMS. Also, the common baseline provided by the IMP and Execution IMS can be effectively used to focus work efforts that are critical to the accomplishment of the program.

4. Acronym List

BOE	Basis of Estimate	IMS	Integrated Master Schedule
CDD	Capabilities Development Document	IOC	Initial Operational Capability
CDR	Critical Design Review	IPPD	Integrated Product and Process Development
CDRL	Contract Data Requirements List	IPT	Integrated Product Team
CLIN	Contract Line Item Number	KPP	Key Performance Parameter
COTS	Commercial Off The Shelf	LOE	Level of Effort
CPAR	Contractor Performance Assessment Report	OFP	Operational Flight Program
CPR	Contract Performance Report	OSD	Office of the Secretary of Defense
CWBS	Contract Work Breakdown Structure	OT&E	Operational Test and Evaluation
DAL	Data Accession List	PCA	Physical Configuration Audit
DID	Data Item Description	PDR	Preliminary Design Review
DoD	Department of Defense	PERT	Program Evaluation and Review Technique
DRFP	Draft Request for Proposal	PRR	Production Readiness Review
DT&E	Developmental Test and Evaluation	RFP	Request for Proposal
EN	Evaluation Notice	SEP	Systems Engineering Plan
EVM	Earned Value Management	SRA	Schedule Risk Analysis Statistical Schedule Risk Analysis
EVMS	Earned Value Management System	SF	Start-to-Finish
FCA	Functional Configuration Audit	SOF	Safety of Flight
FF	Finish To Finish	SOO	Statement of Objectives
FFRR	First Flight Readiness Review	SoS	System-of-Systems
FoS	Family-of-Systems	SOW	Statement of Work
FS	Finish-to-Start	SS	Start-to-Start
GFE	Government Furnished Equipment	SVR	System Verification Review
GFI	Government Furnished Information	TPM	Technical Performance Measure
IBR	Integrated Baseline Review	TRR	Test Readiness Review
ILS	Integrated Logistics Support	WBS	Work Breakdown Structure
IMP	Integrated Master Plan		