Planning and Scheduling
DOE G 413.3-24

Project Management Programs

January 2023

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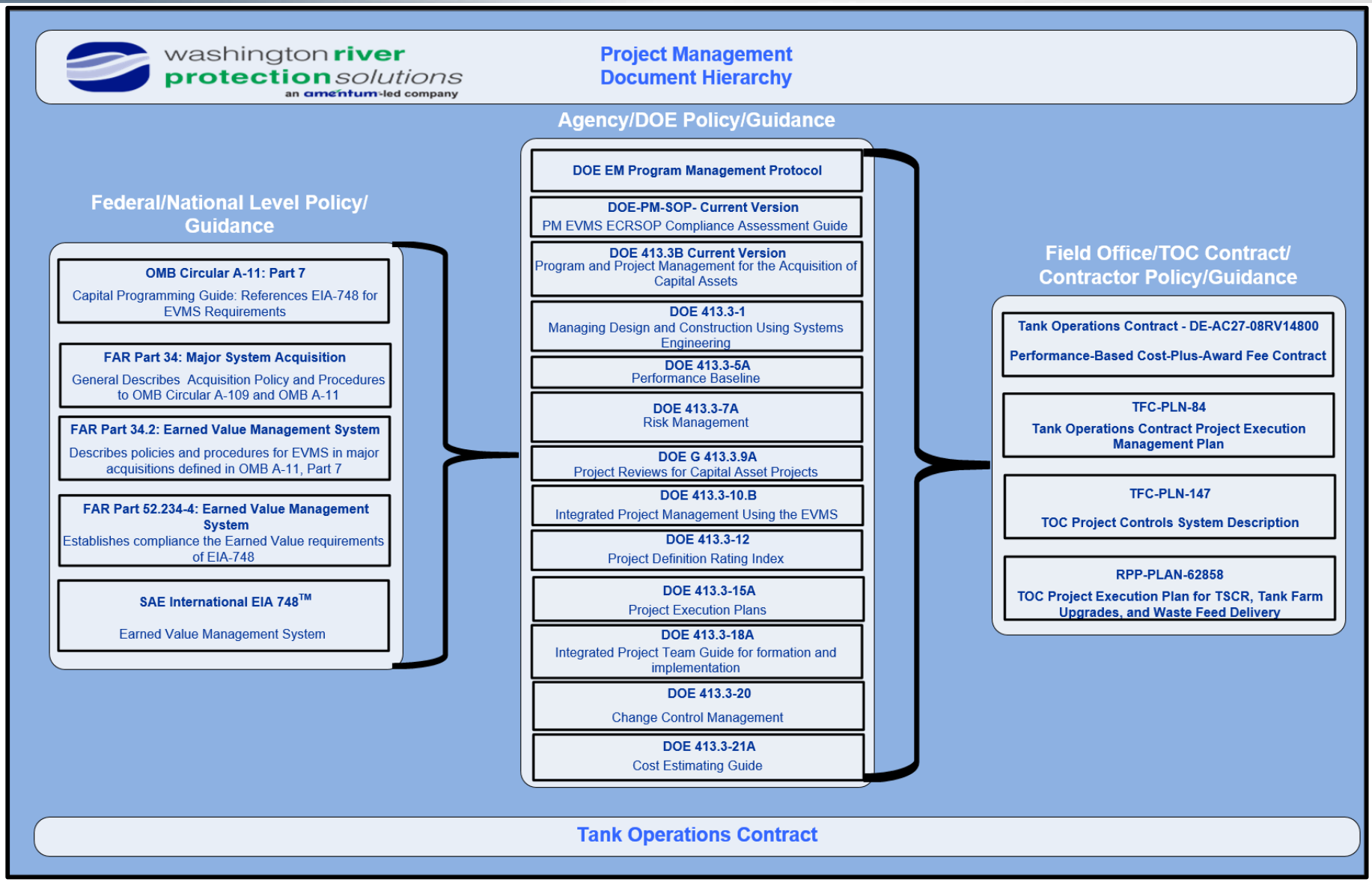

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Purpose

This guide outlines effective principles for developing and maturing project schedules at a level of detail corresponding to the critical decision process outlined in Department of Energy (DOE) Order 413.3B, Program and Project Management for the Acquisition of Capital Assets ("the Order"). It **also guides assessments of project schedules for the same purpose**. The principles addressed within this guidance pertain to acquisition of capital assets governed by DOE O 413.3B. The guide does not address strategic, program, site, operations, or sustainment planning although elements of this guide may be tailored to meet the needs of program management.

Basis

The Order requires projects to develop, maintain, and document an integrated master schedule (IMS) in a manner consistent with the methods and best practices identified in the National Defense Industrial Association (NDIA) Planning and Scheduling Excellence Guide (PASEG) and the Government Accountability Office Schedule Assessment Guide, GAO 16-89G (GAO).[1] This guide reconciles these two references within the DOE acquisition management system for capital asset projects.

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Note

Oracle Primavera P6 is a typical project management software used for planning, scheduling, and managing DOE capital asset project work. While projects may use any software, **this guide in some instances cites specific P6 terminology for terms not defined in the Order or the associated 413.3 Guide series for a common basis of discussion.** In other instances, **this guide recommends settings specific to, and includes screenshots from, P6 to demonstrate key points.** Projects may use other scheduling software with adjustments to settings, as necessary, to achieve the same functions as demonstrated.

The following considerations clarify the applicability of the PASEG to DOE:

1. Oracle Primavera **P6 (P6) uses "activity" where the PASEG uses "task"; omits** the **concepts of summaries and hammocks described in PASEG** Section 5.7; and may not function like MS Project, the basis for examples in the PASEG. **Note: P6 has LOE Hammocks which function differently than hammocks as described in the PASEG**.
2. **Discussion of work breakdown structures in the PASEG does not apply to DOE**.
3. **DOE critical decisions meet the intent of the critical design and operational readiness reviews described in PASEG Section 5.6.**
4. **Apportioned Effort is typically restricted in DOE to where time phased is consistent with the base.**
5. **Other DOE guidance meets the intent of PASEG Section 6.0.**

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6. **In relation to PASEG Section 10.2, projects may use an Acumen Fuse template that includes tests PM uses when assessing schedules.** Other DOE guidance meets the intent of PASEG Section 11.3.

8. **Of the subsections in PASEG Section 13, only Section 13.4 applies to capital asset acquisition projects.**

Prior to critical decision (CD)-1, the Order requires an approved Acquisition Strategy containing a high-level master schedule.[2] The Order requires projects above the $50M threshold to employ an earned value management system (EVMS) compliant with EIA-748 (the current version at the time of contract award) prior to CD-2, unless the project is being executed under a fixed price (FP) contract direct with DOE, or the project has an approved exemption in accordance with DOE O 413.3B.[3]

Guidelines 6 and 7 of EIA-748 describe the role of a project schedule and the planning and scheduling process for what work remains, which resources will perform the work, and by when the work would need to occur for the project to be completed by the approved CD-4 date.

A project IMS is resource loaded and shows a critical path (also known in DOE and P6 as "Longest Path").[4] A resource loaded IMS contains all costs to include unit prices and quantities as appropriate, for staff, labor, facilities, material, and equipment, to complete the required activities. For FP contracts, the schedule will include the total contract cost.[5]

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Projects list key milestones and completion dates in the IMS by estimated month and year.[6] By this same point, prior to CD-2, projects improving or constructing nuclear facilities have a current achievable IMS.[7]

Subsequent to CD-2, the Order specifies that performance data uploads into the Project Assessment and Reporting System (PARS) conform to the DOE Integrated Program Management Report (IPMR) Data Item Description (DID).[8] Report format 6 covered in Section 3.7 of the IPMR defines each of the data items required related to the IMS.

While projects may use various calendars which are identified in notes on schedule assumptions, examples and discussion in this guide assume each month has approximately 22 workdays and each week has five workdays.

[1] DOE O 413.3, current version, Appendix C, Section 16.

[2] DOE O 413.3, current version, Appendix A, Table 2.1 and Attachment 2, Definition 2.

[3] DOE O 413.3, current version, Paragraph 3.c.(3).

[4] DOE O 413.3, current version, Appendix C, Section 8 and Attachment 1, Section 6.

[5] DOE O 413.3, current version, Attachment 1, Section 6 and Attachment 2, Definition 97.

[6] DOE O 413.3, current version, Appendix A, Table 2.2.

[7] DOE O 413.3, current version, Appendix C, Section 6(a).

[8] DOE O 413.3, current version, Appendix C, Section 8 and Appendix C, Section 20(a).

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Background

Integrated planning is the process where a project translates its requirements into its scope, breaks its scope into products, identifies the activities needed to accomplish its products, and assigns sufficient resources to the activities to complete them.

GAO best practice expectations are for projects to have a scope statement, a work breakdown structure (WBS), and an integrated master plan (IMP) or similar event-based, top-level plan.

The IMP contains the project's approach for integrating and elaborating on the contents of the project's scope statement, project execution plan (PEP), and WBS as shown in Figure 1. It is recommended that the elements of the IMP or similar plan be included within or referenced in the PEP.

The IMP outlines a hierarchy of project events, including critical milestones, each supported by specific accomplishments, and each accomplishment has prerequisites, completion criteria, or both. **The IMS then extends the IMP by detailing activities, each with a duration and resource needs, which can result in the accomplishments listed in the IMP.**

The IMP and IMS also have linkage to the EVMS, risk management, and internal and external status reviews. See Section 6.2 for further description of the IMP or similar plan.

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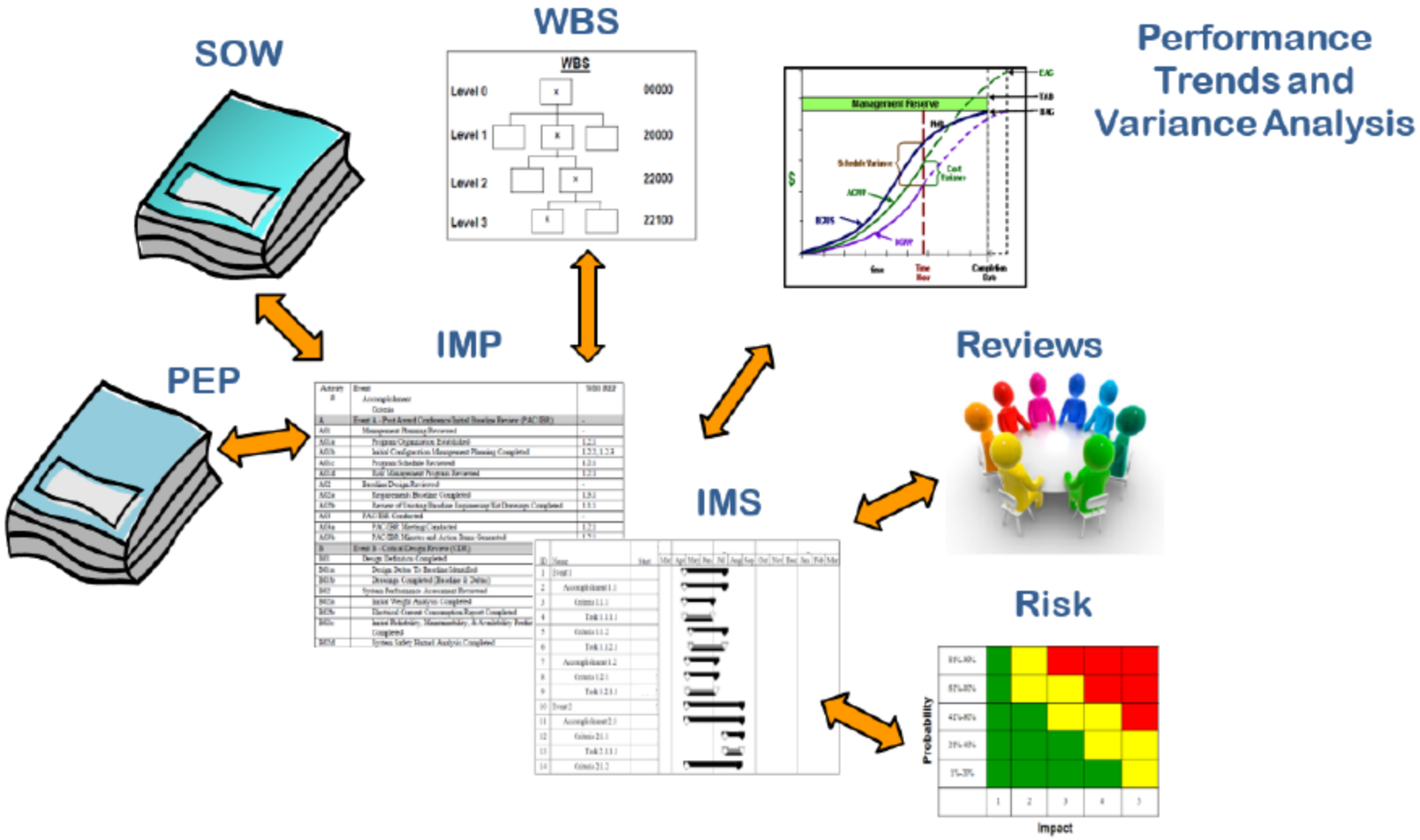
Relationship between the IMP, IMS, and other project deliverables



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A performance measurement baseline (PMB) includes an integrated, networked schedule that establishes progress goals and documents accomplishments indicative of execution of the scope of work.

The schedule communicates what work remains, which resources perform the work, and by when the work would need to occur for the project to finish by the approved CD-4 date.

Projects integrate their schedules horizontally as evidenced by networks with critical and near-critical paths and vertically as evidenced by the inclusion of all work regardless of the performing entity.

A schedule achieves horizontal traceability when the logic connecting predecessors and successors creates a logical and realistic whole. Logic includes the relationships for the sequencing of the events for a logical forward and backwards reasonable plan of execution.

A schedule achieves vertical traceability when its information rolls up logically and consistently. Horizontal and vertical traceability demonstrates realism in the schedule.

The integration of cost (budget) into the schedule ensures a viable and achievable plan but depends on verifying resource demands and funding requirements throughout the phases of a project.

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An IMS accounts for all project scope contained in planning packages (PP) and work packages (WP) included in the project IMP and WBS. The **IMS sequences all project milestones and activities contained in PP and WP, regardless of the performing entity, in a logically linked, horizontally and vertically traceable network, spanning project start to project completion.**

Network logic relationships include any constraints, leads, or lags that control the start or finish of each milestone or activity. The **logically networked and resource-loaded schedule supports the calculation of the project's critical path, near critical paths, and free and total float values to enable the analysis of the schedule's completeness, realism, and achievability.**

The project **critical path does not include activities designated as level of effort (LOE).** Furthermore, **PP and WP activity durations, based on the allocation and availability of resources and materials, roll up vertically to establish the overall duration required to complete each accomplishment.**

Resource load schedule activities after finalizing the project estimate. [9] Resources include hours, by major functional organizations, and dollars, by element of cost (EOC), aligned to the WBS, Control Account (CA), WP, and WP activities through the schedule coding structure.[10] **Loading dollars provides the basis for the budgeted cost of work scheduled (BCWS) required in an EVMS.**

[9] PASEG views resource-loading as optional.

[10] GAO distinguishes between fixed and variable resources.

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The baseline IMS reflects the most current resource-loaded, time-phased plan for accomplishing all scope in the PMB, including LOE.

Integrate the baseline IMS with a cost processor through the WBS to provide the BCWS. A project earns value (EV), or its budgeted cost of work performed (BCWP), as it completes work against BCWS. For this reason, **the actual date of completion for each activity is recorded each month in an updated and adjusted forecast IMS (mirroring the activities in the baseline IMS) enabling project management to see how actual performance impacts the following work yet to be finished.**

Use P6 filters with its group and sort functionality to customize views of the schedule to meet the needs of various audiences. Multiple schedules are not recommended in P6 for a single project.

P6 users may group and sort activities by:

1. **WBS**—to show the schedule by WBS element;
2. **Organizational Breakdown Structure (OBS)—**to show the schedule by control account manager (CAM);
3. **IMP**—to show the schedule by event, accomplishment, and criteria; or,
4. **Special**—to show a summary schedule through a custom sort.

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Roles and Responsibilities

The following are best practices adopted as typical roles and responsibilities.

FEDERAL PROJECT DIRECTORS

- **Review the project's PMB, including the schedule with key project milestone dates and contract deliverables.**
- **Ensure timely, reliable, and accurate integration of contractor performance data into the project's scheduling, accounting, and performance measurement systems, including PARS.**
- **Ensure that project performance data is loaded in the specified format into PARS and that the data reflect reality.**
- **Assess project performance monthly, including progress made against the baseline and forecast schedules including critical path.**
  - **Alert senior management** in a timely manner **when the project may realize significant schedule delays or cost overruns and then mitigate**.
  - **Communicate effectively among all project stakeholders**.
- **Ensure project initiation and completion is synchronized with program's overall operations schedule.**

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CONTRACTOR CONTROL ACCOUNT MANAGERS AND PROJECT CONTROL STAFF

- **Develop and maintain, through change control, a resource-loaded IMS**, including all activities, linked to WBS elements, needed to execute the contract requirements with a critical path, composed of discrete activities, that for cost reimbursable contracts contains labor, material, and equipment unit prices and quantities, as appropriate.
- **Include in addition to project activities all significant external milestones, regulatory commitments, and dependencies.**
- **Update the forecast schedule with actual start and finish dates and revised activity durations and relationships** necessary to realistically complete the project.
- **Update resources required to complete the work so that Estimate to Complete (ETC) can be kept up to date.**
- **Upload baseline and forecast schedule data into PARS in accordance with project performance upload requirements.**

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CONTRACTOR CONTROL ACCOUNT MANAGERS AND PROJECT CONTROL STAFF

- **Provide to the Federal Project Director (FPD) requested project information to support**:
  - Budget planning, execution, and reporting;
  - Project planning and execution;
  - Audit and evaluation; and,
  - Other performance assessment and information needs.
- **Submit requests for an over target schedule (OTS)** to the contracting officer when indicated by project performance.
- **Identify, quantify, and mitigate schedule risks throughout the life of the project.**

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SCHEDULE OF DELIVERABLES

Table below identifies the actions or deliverables associated with a project schedule through the project CD-gate life cycle.

Actions or Deliverables

PRE			POST	
Action or Deliverable	**Basis**	**CD**	**Action or Deliverable**	**Basis**
• CD-4 date range	O 413.3B	0	—	—
• CD-4 date range • High-Level Master Schedule in Acquisition Strategy	O 413.3B	1	• Include EVMS clause, with subcontractor flow down, in contract • Initiate IMS development with inclusion of master schedule in acquisition strategy	O 413.3B
• Update IMS generated CD-4 date in the PB • IMS contains the applicable construction schedule	O 413.3B	2	• IMS updates • PARS data uploads	O 413.3B
• IMS updates	O 413.3B	3	• IMS updates	O 413.3B
• PARS data uploads			• PARS data uploads	
• IMS updates • PARS data uploads	O 413.3B	4	• Project closeout (document final IMS status)	O 413.3B

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SCHEDULING CONTRACT CLAUSES

Include in cost reimbursable contracts the following clauses, provisions, and standards that support scheduling such as:

- Federal Acquisition Regulation clause 48 CFR §52.234-4, EVMS;
- DOE Strategic Integrated Procurement Enterprise System (STRIPES) corporate provision DOE-K-2001;
- STRIPES corporate clause DOE-H-2024; and,
- DOE IPMR DID, Section 3.7, concerning report Format 6, IMS.

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PLANNING FOR AN INTEGRATED MASTER

Integrated Master Schedule	
Source: DOE Order 413.3B, Appendix C, Section 16	**Applies to:**
"The IMS shall be developed, maintained, and documented in a manner consistent with methods and the best practices identified in the Planning and Scheduling Excellence Guide, published by the National Defense Industrial Association, and the GAO's Schedule Assessment Guide."	• Post-CD-1 • Pre-CD-2

An IMP, while not a specific deliverable identified in O 413.3B, is a proven successful method and best practice identified by GAO and PASEG for developing the IMS. An IMP or similar is an event-driven plan that documents significant accomplishments necessary to complete the work. It defines how the project will be organized. IMP and IMS are not equivalent, however **together they provide a systematic approach to planning, scheduling, and managing.**

The IMP or similar plan **does not contain dates but rather project events, significant accomplishments, and success criteria that serve as the foundation for the content of the IMS as shown in the figure below**. The project team produces the IMP or similar plan.

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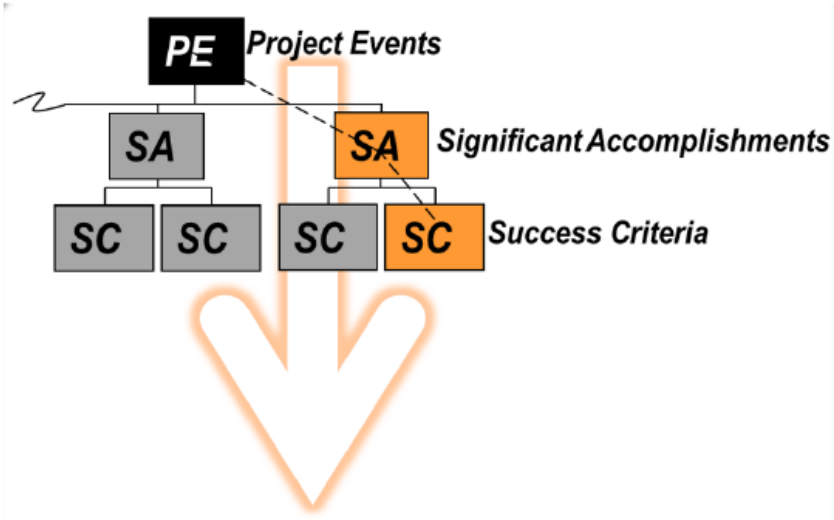
IMP Levels



Project Events identify major assessment points corresponding to primary project goals. This would be the DOE O 413.3 CD gate maturity points, **CD1-CD4**. Significant Accomplishments (1) **List desired results realized at the completion of each event indicative of the project's progress**. **Label these** accomplishments. For example, for an event like **"approve start of execution,"** then provide **"final design review approval," "external independent review (EIR) completed,"** and **"EVMS certification"** as associated accomplishments. (2) **Include, at a minimum, requirements and activities identified in the request for proposal, contract, or project scope statement.**

Success Criteria identify one or more measurable or objective and qualitative or quantitative success criteria that indicate acceptable completion of each accomplishment or preparedness for a future accomplishment. Examples appear in the table below.

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Criteria Examples

Success Criteria	Type of Success Criteria	Significant Accomplishment
Mission need statement approval	Prerequisite	Pre-conceptual Analysis
EVMS system description approval	Prerequisite	EVMS certification
Final design approval	Acceptable completion	Final design

Integration:

- **Structure the IMP in accordance with figure below**, which illustrates how the IMS integrates the IMP's project events, significant accomplishments, and success criteria, listed sequentially (i.e., vertically) in the figure below.
- **Use an integrated coding system**, combined with a disciplined approach to labeling planning elements, suitable for management.
- **Phrase IMP element titles in the past tense** because the IMP assumes the project will complete each event, accomplishment, and criteria.
- **Phrase IMS milestones and activities in the imperative**.
- **Transfer the coding structure in the IMP to the IMS**. Ensure the IMS includes all IMP elements.
- **Roll up the work and status of IMP sub-elements and IMS activities to determine the work and status for any IMP element.**

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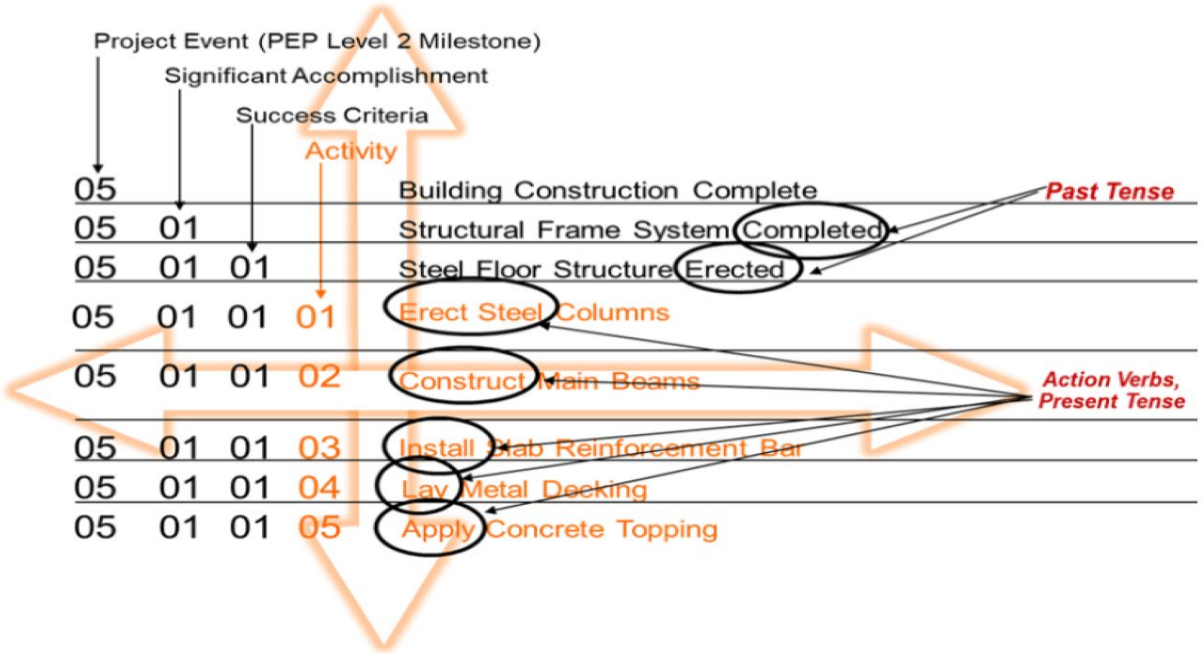
IMP Structure



MATURATION OF AN INTEGRATED MASTER SCHEDULE

Integrated Master Schedule	
Source: DOE Order 413.3B, Appendix C, Section 16	**Applies to:**
"Projects shall develop and maintain an Integrated Master Schedule (IMS)."	• Post -CD-1 through CD-4

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General Expectations

The 10 best practices for project schedules of the GAO Schedule Assessment Guide appear in the table below. **The terms "limited" and "full" refer to the level of applicability of the GAO best practice in that phase of a project.** The **guidance published by GAO and NDIA in its PASEG apply to projects for which a PMB has been established.** Therefore, the 10 best practices have no or limited applicability until prior to CD-2.Actions or Deliverables

This guide addresses four schedule evolutions:

- Prior to CD-1, a high-level Master Schedule
- Post CD-1, IMS for the selected alternative

Applicability of GAO Best Practices

GAO Best Practice (GAO 16-89G)	Prior to CD-1	Post CD-1	Prior to CD-2	Post CD-2
1—Capturing All Activities	Limited	Limited	Full	Full
2—Sequencing All Activities	Limited	Full	Full	Full
3—Assigning Resources to All Activities	Limited	Limited	Full	Full
4—Establishing the Duration of All Activities	Limited	Full	Full	Full
5—Verifying That the Schedule Can Be Traced Horizontally and Vertically	Limited	Full	Full	Full
6—Confirming That the Critical Path is Valid	Limited	Full	Full	Full
7—Ensuring Reasonable Total Float	Not applicable	Full	Full	Full
8—Conducting a Schedule Risk Analysis	Limited	Limited	Full	Full
9—Updating the Schedule Using Actual Progress and Logic	Not applicable	Limited	Full	Full
10—Maintaining a Baseline Schedule	Not applicable	Limited	Full	Full

- Prior to CD-2, baseline/forecast IMS
- Post CD-2, baseline/forecast IMS with the construction plan of execution

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Prior to CD-1, High level Master Schedule

The high-level Master Schedule prior to CD-1 addresses each viable alternative being analyzed. It is comprised of:

Scheduling Objective: Include milestones in the schedule for commitments to stakeholders, contract deliverables, critical decisions and high-level activities to create a high-level longest path.

Maturity: This phase represents the submittal and approval of a CD-1 schedule to DOE. It **does not include the maturity of the CD-1 design** as it approaches CD-2. Nonetheless, a common best practice prior to CD-1 is to further mature the preferred alternative's schedule in the form of a preliminary working IMS tailored to the conceptual approach outlined in CD-1. This enables better estimation of the cost range proposed at CD-1 while maintaining the high-level master schedule for the other alternatives considered in the Analysis of Alternatives (AoA).

Mechanics: Depicts relationships between Activities and milestones with a high-level longest path.

Risk: Depicts schedule margin between the end of the PMB and the delivery date specified in the CD 0 approval. Depicts schedule contingency between the delivery date and the high-end of the approved CD-4 date range.

Status: Prior to CD-1 approval, the schedule does not require forecasting.

Assessments: No assessments on the pre-CD-1 milestone schedule will occur.

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Post CD-1, IMS for the Selected Alternative

Scheduling Objective: The project matures in this phase from the alternative selection to the detail design.

Maturity: The schedule between CD-1 approval and CD-2 contains detailed activities as design scope is defined but may be immature with limited activities in the post CD-2 phase. From CD-1 approval to CD-2 approval, preparation of a baseline schedule begins with enough remaining project life-cycle activities to generate a high-level realistic critical path for the period post CD-2 to CD-4 consistent with the high-end estimate approved at CD-1. As the baseline matures, add detail to the baseline schedule. [GAO 16-89G best practice #1 (GAO BP #1)].

Mechanics: Define relationships for all activities [GAO BP #2]. Load each activity with the resources required to complete the work [GAO BP #3]. Load resources so that all resources tally to the high-end of the approved CD-1 cost range. It is anticipated that some WBS elements may only have high-level or summary values for resource requirements at this phase. Assign each activity a realistic duration. This includes the scope scheduled between CD-2 and CD-4 [GAO BP #4]. Add logical relationships between associated activities or milestones, resources, and durations to generate a realistic critical path through project completion [GAO BP #6]. Determine the total float of each activity and of the overall project through consideration of activity durations coupled with the identified logical dependencies [GAO BP #7]. Demonstrate vertical traceability when subcontractor and summary schedules become available. Demonstrate horizontal traceability through schedule float and schedule logical relationships [GAO BP #5].

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Risk: Maintain a risk register. Complete a schedule risk analysis (SRA), the results of which form the basis for DOE schedule contingency and contractor schedule margin (SM) calculated prior to CD-2. Per DOE Order 413.3B, analyze the risk at a confidence level between 70 and 90 percent.

Status: Show status of design accomplishments made during preliminary design in preparation for CD-2.

Assessments: Complete the assessments shown in the table below to verify the soundness of the schedule post CD-1. (The table shows GAO best practices in blue.) Find descriptions of each assessment in Appendix A.

Number	Name
1. Capturing All activities	
1	WBS Dictionary Matches IMS—Baseline
10	Hours in IMS consistent with Cost Tool Hours—Baseline
11	Risk Mitigations Included—Forecast
28	Baseline IMS Includes HDV Material
29	Critical key milestones and deliverables in IMS—Baseline
60	Risk Mitigations Included—Baseline

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2. Sequencing All activities	
2	Adequate Predecessors and Successors—Baseline
3	Limited SF Relationships—Baseline
4	Limited SS or FF Relationships—Baseline
5	Limited Leads—Baseline
6	Limited Lags Baseline
7	Minimize Merge Points—Baseline
8	Limit Hard Constraints—Baseline
9	Minimize Soft Constraints—Baseline
12	No LOE Discrete Successors—Baseline
30	Adequate Predecessors or Successors—Forecast
31	Limited SF Relationships—Forecast
32	Limited SS or FF Relationships—Forecast
33	Limited Leads—Forecast
34	Limited Lags—Forecast
35	Minimize Merge Points—Forecast
36	No LOE Discrete Successors—Forecast
37	Limit Hard Constraints—Forecast
38	Minimize Soft Constraints—Forecast

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3. Assigning Resources to All activities	
13	Adequate Resource Loading—Baseline
14	No SVTs with Resources—Baseline
16	Reasonable Resource Profile—Baseline
17	No SM Resources—Baseline
39	Reasonable Resource Profile—Forecast
40	No SVTs with Resources—Forecast
41	Adequate Resource Loading—Forecast
42	No SM Resources—Forecast
4. Establishing the Duration of All activities	
15	Minimize Duration—Baseline
21	Minimize Work Packages—Baseline
5. Verifying that the Schedule Can Be Traced Horizontally and Vertically	
24	Vertical Traceability—Baseline

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6. Confirming That the Critical Path is Valid	
18	Critical Path Push Assessment—Baseline
19	Critical Path Pull Assessment—Baseline
20	No LOE on Critical Path—Baseline
22	Critical Path Reasonably Defined—Baseline
23	Continuous Critical Path—Baseline
46	Continuous Critical Path—Forecast
47	Critical Path Reasonably Defined—Forecast
48	Critical Path Push Assessment—Forecast
49	Critical Path Pull Assessment—Forecast
50	No for LOE on Critical Path—Forecast
7. Ensuring Reasonable Total Float	
25	Reasonable Total Float—Baseline
51	Reasonable Total Float—Forecast
8. Conducting a Schedule Risk Analysis	
26	SM Linkage—Baseline
52	SM Duration Consistent with Risk—Forecast
53	SM Linkage—Forecast

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9. Updating the Schedule Using Actual Progress and Logic	
54	Physical Complete with No Actual Finish Date—Forecast
55	Statused Out of Sequence—Forecast
56	Actual Start without Physical Percent Complete—Forecast
57	Status Reliability—Forecast
58	Baseline Versus Forecast—Activity Count
59	Forecast Versus Baseline—Activity Count
10. Maintaining a Baseline Schedule	
27	Negative Total Float—Baseline

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Prior to CD-2, Baseline IMS and Forecast IMS

Scheduling Objective: The project matures in this phase, from the alternative selection to a detailed design. Prepare for an independent cost estimate (ICE) or EIR prior to CD-2 by significantly maturing the IMS. Submit to the ICE and EIR review teams the forecast IMS in place of the proposed baseline IMS. The ICE and EIR review teams will assess the realism of this forecast schedule.

Maturity: Develop an IMP. Include in the IMP events like critical decisions or other key milestones, deliverables, products, and acceptance criteria, any of which may appear in the PEP. Structure or reconcile the IMS against the IMP.

- Include in the baseline IMS the entire scope the project will submit for approval prior to CD-2. Align the baseline IMS to the basis of estimate (BOE) used to generate the contractor CD-2 cost estimate and the government ICE. Ensure PPs through the start of execution or construction have adequate maturity to support a realistic critical path through CD-4. Just like projects combining CD-2 and CD-3 should a design maturity near 100 percent, commensurately define execution and construction activities prior to a CD-2/3 [GAO BP #1]. If available, define subcontractor efforts based on subcontractor estimates received as part of planning for construction or execution.
- Use rolling wave or block planning, defined as cycles of detail planning, to develop WPs, PPs, and Summary Level Planning Packages (SLPPs). Support the baseline with WPs through near-term detail planning periods and by PPs or SLPPs throughout the remainder of the IMS.
- Include sufficient details in WPs and their associated activities to allow for execution. Use PPs or SLPPs beyond the near-term rolling wave and block planning spans as shown in the figure below. PPs have no duration limit. However, ensure WPs have shorter durations than PPs, generally less than two months. Keep the scope, schedule, and budget of both WPs and PPs integrated. Note: Neither GAO nor PASEG specify a maximum duration for activities. The related assessment counts activities with durations in excess of 44 working days.

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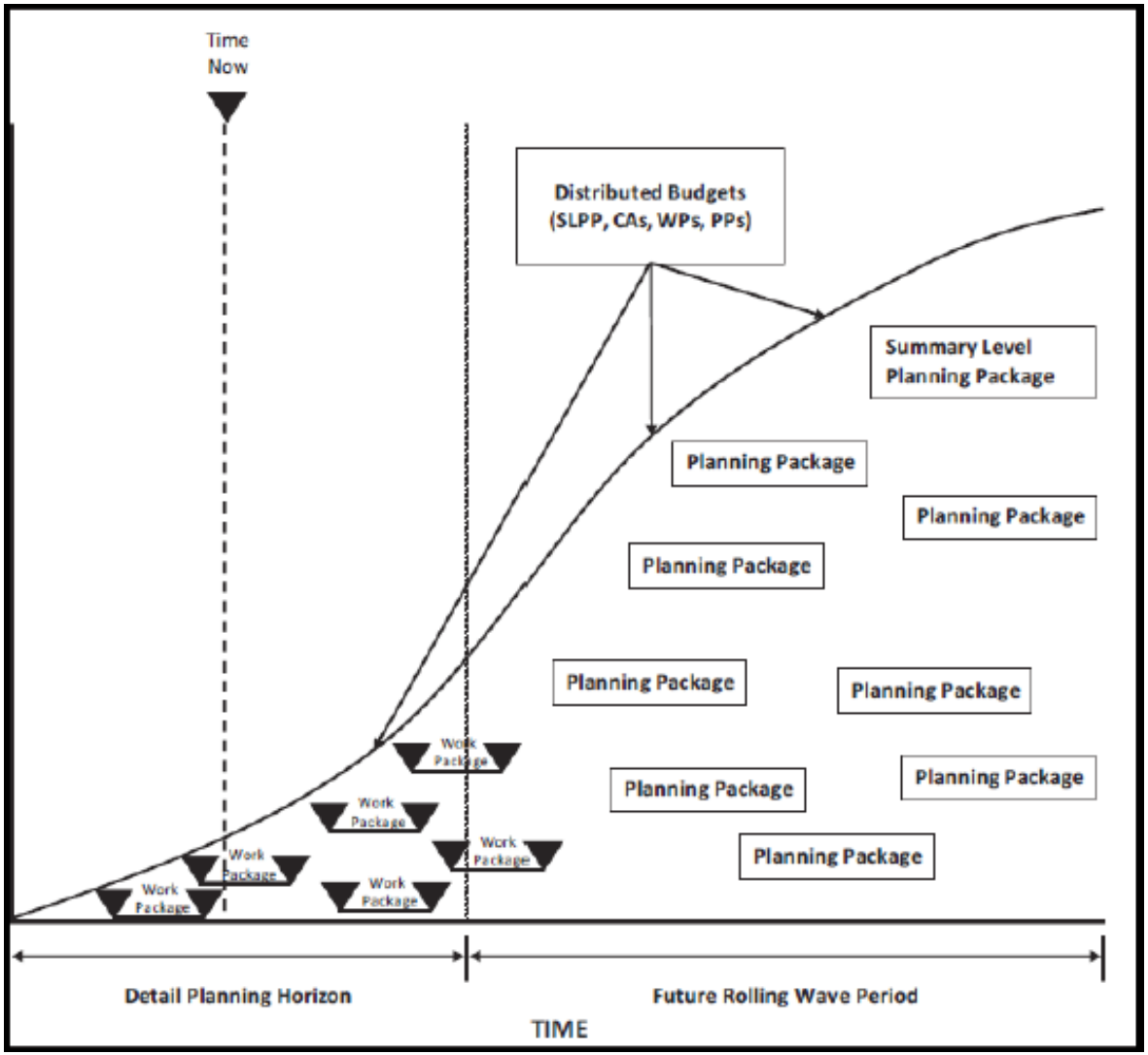
Rolling Wave Planning



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End the schedule with a CD-4 milestone and any closeout and commissioning activities necessary.

Mechanics: Define relationships for all activities [GAO BP #2]. Load each activity with the resources required to complete the associated scope [GAO BP #3]. Assign each activity a realistic duration. Buffer the schedule risk by adding SM. Limit discrete activity durations to less than two months in the absence of quantifiable backup data (QBD) [GAO BP #4]. Plan future activities beyond the detail planning period with enough detail to accurately depict the relationships, resources and durations to generate a realistic critical path through project completion [GAO BP #6]. Confirm a small percentage of incomplete activities comprise the critical path. Justify the duration and resources of activities with detailed BOEs. Calculate schedule float and determine the critical path by conducting a forward and backward pass through the schedule [GAO BP #7]. Identify subcontracted work and subcontractor schedules in the IMS to allow for horizontal and vertical traceability [GAO BP #5].

Risk: Maintain the risk register. Complete an SRA through CD-4. An SRA feeds optimistic, most likely, and pessimistic activity durations into a Monte Carlo simulation to determine the probability of completion by a specified date. Base the CD-4 date on an SRA calculated without SM or DOE schedule contingency. After analyzing the probability of achieving CD-4 at a confidence level between 70 and 90 percent, base the schedule margin and DOE contingency on the gap between the last activity and the risk adjusted CD-4 date. Baseline the schedule, deemed achievable through the risk assessment, with SM and DOE schedule contingency included to generate a CD-4 date [GAO BP #7, 8].

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Status: Summarize historical costs as "sunk costs" [GAO BP #10]. Retain the baseline IMS that supported the CD-2 approval as the baseline IMS. Use a copy of this baseline IMS as the forecast IMS for recording future status.

Assessment: Complete the assessments in table below to verify the soundness of the schedule prior to CD-2. (The table shows GAO best practices in blue.) Find descriptions of each assessment in Appendix A.

Pre CD-2 Assessment Principles

Number	Name
1. Capturing All Activities	
1	WBS Dictionary Matches IMS—Baseline
10	Hours in IMS consistent with Cost Tool Hours—Baseline
11	Risk Mitigations Included—Forecast
28	Baseline IMS Includes HDV Material
29	Critical key milestones and deliverables in IMS—Baseline
60	Risk Mitigations Included—Baseline
2. Sequencing All Activities	
2	Adequate Predecessors and Successors—Baseline
3	Limited SF Relationships—Baseline

DOE G 413.3-24 – cont'd

Number	Name
4	Limited SS or FF Relationships—Baseline
5	Limited Leads—Baseline
6	Limited Lags Baseline
7	Minimize Merge Points—Baseline
8	Limit Hard Constraints—Baseline
9	Minimize Soft Constraints—Baseline
12	No LOE Discrete Successors—Baseline
30	Adequate Predecessors or Successors—Forecast
31	Limited SF Relationships—Forecast
32	Limited SS or FF Relationships—Forecast
33	Limited Leads—Forecast
34	Limited Lags—Forecast
35	Minimize Merge Points—Forecast
36	No LOE Discrete Successors—Forecast
37	Limit Hard Constraints—Forecast
38	Minimize Soft Constraints—Forecast

DOE G 413.3-24 – cont'd

3. Assigning Resources to All Activities	
13	Adequate Resource Loading—Baseline
14	No SVTs with Resources—Baseline
16	Reasonable Resource Profile—Baseline
17	No SM Resources—Baseline
39	Reasonable Resource Profile—Forecast
40	No SVTs with Resources—Forecast
41	Adequate Resource Loading—Forecast
42	No SM Resources—Forecast
4. Establishing the Duration of All Activities	
15	Minimize Duration—Baseline
21	Minimize Work Packages—Baseline
5. Verifying That the Schedule Can be Traced Horizontally and Vertically	
18	Critical Path Push Assessment—Baseline
19	Critical Path Pull Assessment—Baseline
24	Vertical Traceability—Baseline
43	Vertical Traceability—Forecast
44	Supplemental Vertical Traceability—Forecast
45	Subcontractor Vertical Traceability—Baseline
48	Critical Path Push Assessment—Forecast
49	Critical Path Pull Assessment—Forecast

DOE G 413.3-24 – cont'd

Number	Name
6. Confirming That the Critical Path is Valid	
20	No LOE on Critical Path—Baseline
22	Critical Path Reasonably Defined—Baseline
23	Continuous Critical Path—Baseline
46	Continuous Critical Path—Forecast
47	Critical Path Reasonably Defined—Forecast
50	No LOE on the Critical Path – Forecast
7. Ensuring Reasonable Total Float	
25	Reasonable Total Float—Baseline
51	Reasonable Total Float—Forecast
8. Conducting a Schedule Risk Analysis	
26	SM Linkage—Baseline
52	SM Duration Consistent with Risk—Forecast
53	SM Linkage—Forecast
9. Updating the Schedule Using Actual Progress and Logic	
54	Physical Complete with No Actual Finish Date—Forecast
55	Statused Out of Sequence—Forecast
56	Actual Start without Physical Percent Complete—Forecast
57	Status Reliability—Forecast
58	Baseline Versus Forecast Activity Count
59	Forecast Versus Baseline Activity Count
10. Maintaining a Baseline Schedule	
27	Negative Total Float—Baseline

DOE G 413.3-24 – cont'd

Post CD-2, Baseline IMS with the Construction Plan of Execution

Document differences, if any, between schedule tools and algorithms used by subcontractors and the contractor in a manner consistent with the WBS.

Scheduling Objective: Manage the execution of the project, including long lead procurements, following the expectation for the baseline and forecast IMSs described in this section.

- Confirm the baseline and forecast schedules contain the entire scope of the project. The baselined scope, schedule, and budget remain under change control for the remaining duration of the project.
  - As the project approaches the start of construction, update the IMS to reflect the details of the construction plans including authorized long lead procurements and executed construction contracts. Use rolling wave techniques for planning. Reflect the detailed field execution, or lower level, schedules used for near term planning in the IMS.

Maturity: Reconcile scope in the IMS with the most recent changes impacting scope. Complete and reconcile work authorizations. Ensure that both the baseline and forecast schedules fully comply with GAO 16-89G and PASEG.

- After CD-2, copy the baseline IMS and designate it as the forecast IMS. Progress and track activities and update plans and schedules reflecting work performed in the forecast IMS. Follow established configuration management and change control processes when maintaining the baseline IMS. Fully integrate, and keep consistent, schedule and cost between the baseline and forecast schedules.
- Continue to use rolling wave or block planning to support the baseline with WPs through near-term planning periods and by PPs or SLPPs throughout the remainder of the IMS.

DOE G 413.3-24 – cont'd

Mechanics: Ensure activities reflect the most detailed level of planning completed. Load each activity with sufficient resources to complete the work [GAO BP #3]. Limit activity durations to two months or less [GAO BP #4]. Develop the schedule through CD-4 with enough detail to accurately depict the relationships, resources, and durations to generate a realistic critical path through project completion [GAO BP #6]. Confirm the reasonableness of schedule float, all activities have logical ties, and that the earned value technique (EVT) assigned to each WP or activity reflects how project intends to accomplish the work [GAO BPs #2, 3, 4, 6,].

- Develop the schedule through a forward pass by identifying the successor to the current activity then determining those activities' logical successors until reaching CD-4. Review and validate the schedule through a backward pass by starting at the end of the schedule and continuing back to the beginning. Confirm all activities required to complete the project appear in the IMS, each logically linked to completely defined predecessors. Ensure each activity in the baseline and forecast schedule, except for start and finish milestones, has at least one predecessor and one successor. **Justify and document exceptions.**
- Construct the schedule linking most activities with finish to start (FS) logic. Use FS logic to connect at least one successor activity to predecessors with a start to start (SS) or finish to finish (FF) relationship to prevent dangling logic. **Avoid using start to finish (SF) logic** [GAO BP #2]. Use lags sparingly. Lags delay the start of an activity. **Document and justify all lags, typically those longer than 22 working days, in a user-defined field in P6. Do not use leads, also known as negative lags** [GAO BP #2].
- Limit, and justify in P6, the use of hard constraints which override relationship logic and may make the results of float calculations difficult to understand [GAO BP #2]. **Avoid using mandatory constraints in P6.** Minimize the use of finish no earlier, finish no later, and start type constraints. Use a finish on or before constraint for CD-4.

DOE G 413.3-24 – cont'd

- Assess the schedule for activities or milestones with a large number (typically 15) of predecessors except for CD-3, CD-4, or the schedule margin activity [GAO BP #2].
- Estimate resources using historical data [GAO BP #3]. Load labor, material, and equipment costs to include unit prices and quantities on activities, excluding milestones and schedule visibility tasks (SVTs). Identify high dollar value (HDV) material with a code associated with the activity and plan the receipt dates.
- Review availability constraints placed on resources loaded on activities. CAMs determine and justify the sequence, relationships, duration, and resources estimated for activities. Confirm that the available budget can sustain resource demand peaks. Model resource availability with soft constraints such as with a start-on-or-after constraint in P6.
- Include and clearly label all LOE activities in the IMS, do not link them as predecessors to discrete work nor Contract Budget Base (CBB) completion milestone, but logically plan LOE without level loading. For discrete work, ensure CAMs estimate the loading without reserves or margin buffers [GAO BP #4].
- Maintain vertical and horizontal integration. After CD-3, align each activity to its assigned contractor. For more guidance, see section 7.3.5.3 [GAO BP #5]. Ensure that incomplete discrete and LOE WPs, PPs, and SLPPs found in the EVMS cost tool also appear in the baseline schedule and that the budget at completion (BAC) labor hours by WBS code, start dates, and end dates for incomplete WPs and PPs match. Use the IMS duration, relationships, and resources to calculate the forward and backward pass to identify the critical (longest) path with the following characteristics: continuous, non-constrained until the end, and with minimal lags [GAO BP #6].

DOE G 413.3-24 – cont'd

- Challenge activities with negative or high total float. Total float is the amount of time that a schedule activity can be delayed from its early start date without delaying the project finish date or impacting a schedule constraint. Negative total float implies an infeasibility in the schedule. An excessive amount of float may challenge the validity of the schedule. Where total float is considered high the resource profile curve can be affected possibly skewing resource-leveling scenario analyses. Review such high total float changes monthly for reasonableness and adequate justification. Conversely, investigate any negative total float which may indicate a performance issue requiring workarounds or additional management priority. [GAO BP #7].
- **Risk:** Maintain the Risk Register. Complete an SRA [GAO BP #8] prior to a long lead procurement, executing a construction contract, annually calculating a comprehensive estimate at complete (EAC), and changing the PB. Assess the likelihood of achieving the established CD-4 date based on an SRA calculated without SM or DOE schedule contingency using a confidence level between 70 and 90 percent. Find more detailed guidance on SRAs in both GAO-16-89G and PASEG.

DOE G 413.3-24 – cont'd

Status: Maintain the forecast schedule with actual start and finish dates, percent complete, and forecasted remaining durations. Ensure supplemental or detailed schedules developed by contractors remain consistent with the forecast schedule. Status the schedule and recalculate the critical path at least monthly. Review new activities for logic and completeness. For earned value, ensure that CAMs status activities consistent with the identified EVTs. Do not calculate earned value (EV) for discrete work based on the passage of time.

- Review free and total float, which communicate schedule priorities, changes, and impacts, for significant changes. Use free float to de-conflict resources or activities as its use does not impact successor activities [GAO BP#9].
- Performing activities out of sequence, or changing logic, may increase total float. Prior to executing, have the integrated project team review and validate these changes while verifying that all activities have proper predecessor and successor relationships.
- If problems arise, incorporate workarounds in the forecast schedule as soon as possible. Ensure the CAMs, with assistance from project controls, update the schedule in P6. Assign the schedule a unique identification number and archive it monthly [GAO BP #9].

DOE G 413.3-24 – cont'd

- Calculate the IMS via the retained logic option in P6 **and not the progress override.** Reconcile or correct circular errors monthly [GAO BP #9]. Hold IMS management reviews monthly. Document significant variations and workarounds. [GAO BP #9]

- Keep the baseline schedule, including original durations, relationships, resources, and EVTs, under configuration control and use it for earned value calculations. Maintain the baseline to demonstrate an executable plan and sequence for future activities [GAO BP #10].

Assessment: Complete the assessments in the table below to verify the soundness of the schedule post CD-2. (The table shows GAO best practices in blue.) Find descriptions of each assessment in Appendix A.

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Post CD-2 Assessment Principles

Number	Name
1. Capturing All Activities	
1	WBS Dictionary Matches IMS—Baseline
10	Hours in IMS consistent with Cost Tool Hours—Baseline
11	Risk Mitigations Included—Forecast
28	Baseline IMS Includes HDV Material
29	Critical key milestones and deliverables in IMS—Baseline
60	Risk Mitigations Included— Baseline
2. Sequencing All Activities	
2	Adequate Predecessors and Successors—Baseline
3	Limited SF Relationships—Baseline
4	Limited SS or FF Relationships—Baseline
5	Limited Leads—Baseline
6	Limited Lags Baseline
7	Minimize Merge Points—Baseline
8	Limit Hard Constraints—Baseline
9	Minimize Soft Constraints—Baseline
12	No LOE Discrete Successors—Baseline
30	Adequate Predecessors or Successors—Forecast
31	Limited SF Relationships—Forecast
32	Limited SS or FF Relationships—Forecast
33	Limited Leads—Forecast
34	Limited Lags—Forecast
35	Minimize Merge Points—Forecast
36	No LOE Discrete Successors—Forecast
37	Limit Hard Constraints—Forecast
38	Minimize Soft Constraints—Forecast

DOE G 413.3-24 – cont'd

3. Assigning Resources to All Activities	
13	Adequate Resource Loading—Baseline
14	No SVTs with Resources—Baseline
16	Reasonable Resource Profile—Baseline
17	No SM Resources—Baseline
39	Reasonable Resource Profile—Forecast
40	No SVTs with Resources—Forecast
41	Adequate Resource Loading—Forecast
42	No SM Resources—Forecast
4. Establishing the Duration of All Activities	
15	Minimize Duration—Baseline
21	Minimize Work Packages—Baseline
5. Verifying That the Schedule Can Be Traced Horizontally and Vertically	
18	Critical Path Push Assessment—Baseline
19	Critical Path Pull Assessment—Baseline
24	Vertical Traceability—Baseline
43	Vertical Traceability—Forecast
44	Supplemental Vertical Traceability—Forecast
45	Subcontractor Vertical Traceability—Baseline
48	Critical Path Push Assessment—Forecast
49	Critical Path Pull Assessment—Forecast

DOE G 413.3-24 – cont'd

6. Confirming That The Critical Path is Valid	
20	No LOE on Critical Path—Baseline
22	Critical Path Reasonably Defined—Baseline
23	Continuous Critical Path—Baseline
46	Continuous Critical Path—Forecast
47	Critical Path Reasonably Defined—Forecast
50	No LOE on Critical Path—Forecast
7. Ensuring Reasonable Total Float	
25	Reasonable Total Float—Baseline
51	Reasonable Total Float—Forecast
8. Conducting a Schedule Risk Analysis	
26	SM Linkage—Baseline
52	SM Duration Consistent with Risk—Forecast
53	SM Linkage—Forecast
9. Updating the Schedule Using Actual Progress and Logic	
54	Physical Complete with No Actual Finish Date—Forecast
55	Statused Out of Sequence—Forecast
56	Actual Start without Physical Percent Complete—Forecast
57	Status Reliability—Forecast
58	Baseline Versus Forecast Activity Count
59	Forecast Versus Baseline Activity Count.
10. Maintaining a Baseline Schedule	
27	Negative Total Float—Baseline

DOE G 413.3-24 – cont'd

PLANNING AND SCHEDULING SPECIAL TOPICS

This section details various unique aspects of scheduling within a DOE environment. While some of these topics (e.g. Risk Management) are covered in greater depth in other G 413.3 series guides, topical information relevant to development and use of the IMS is discussed in this guide.

INTEGRATION OF RISK MANAGEMENT INTO THE SCHEDULE

Overview: The risk management plan (RMP) identifies actions the project plans to take to mitigate realized threats and exploit realized opportunities. Although scope may incorporate risk responses without traceability to single schedule activities, plan significant risk mitigations, especially those assigned resources, as discrete activities. Use a coding structure common to both the risk register and IMS for risk mitigation activities.

Risk Management Integration Process: Include in the baseline IMS risk mitigations identified during development of the project baseline using the same identification number found in the risk management plan. **The P-6 note/text field may be used to document the rationale of chosen process/logic and historical context as well as noting risk trigger points.**

Vet unauthorized risk mitigations through the change control process prior to inclusion within the baseline IMS. Then add the same risk mitigation activities to the forecast IMS. **The freeze period does not apply to these added activities.**

For risk mitigation assigned to LOE activities, ensure that the LOE staffing and resources are adequate to address the LOE scope inclusive of the risk mitigation. Apply a risk response code from the risk register to each LOE activity intended to mitigate a risk.

List the IMS activity identification code for each risk mitigation in the risk register. Leave risk mitigation activities in the risk register and forecast IMS open until completion or cancellation of the activities has occurred.

DOE G 413.3-24 – cont'd

LEVEL OF EFFORT

Overview: Activity-based methods either cannot, or impracticably can measure the performance of LOE WPs and activities. Include all activities, both discrete and LOE, in the IMS.

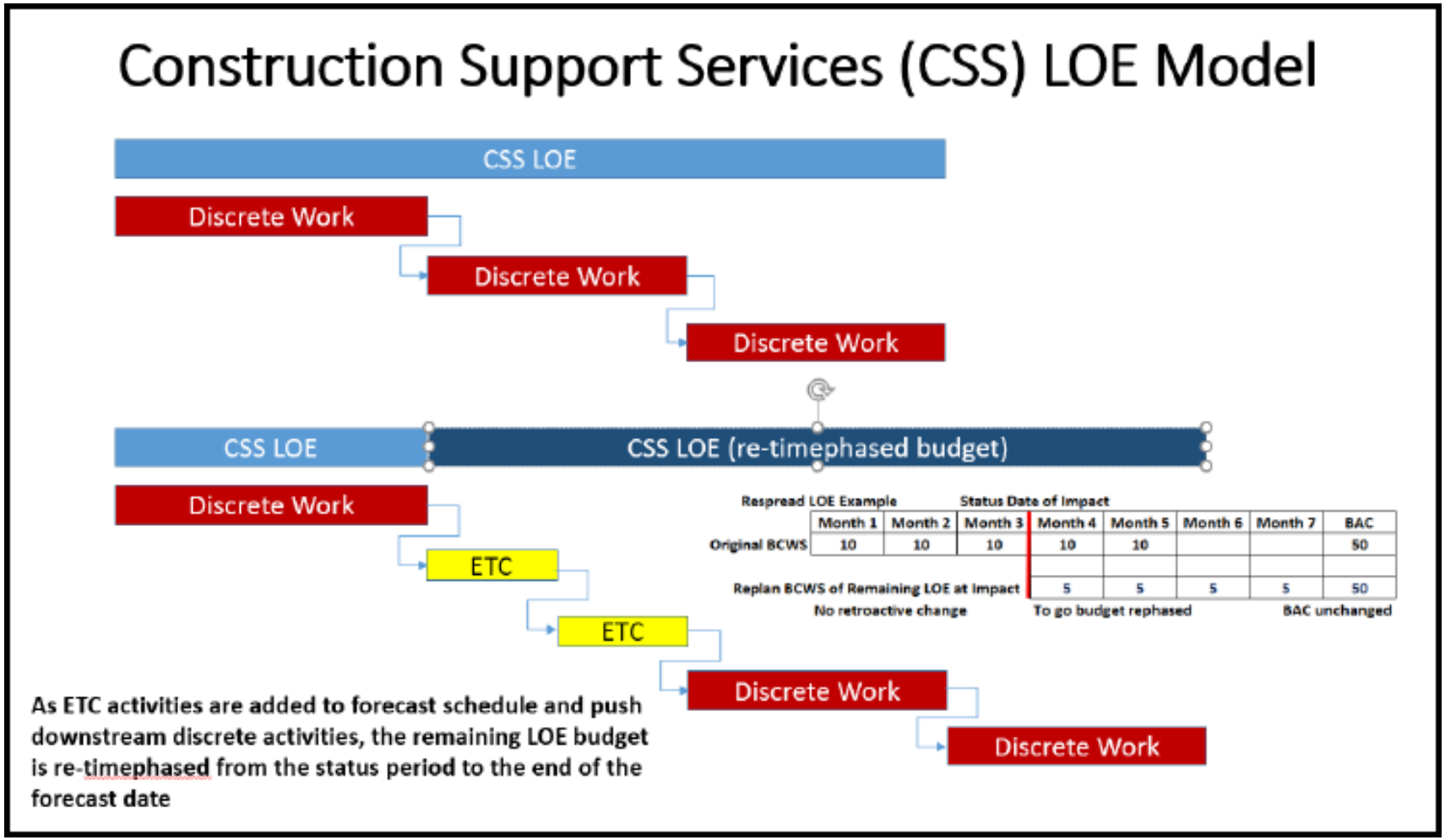
INCLUSION OF LEVEL OF EFFORT IN THE INTEGRATED MASTER SCHEDULE:

Construction Support Services (CSS) Special Consideration:

- Code CSS activities with the LOE earned value technique in the baseline IMS and forecast IMS. As technical or design issues arise during execution, add to the forecast IMS zero budget, non-resourced "ETC Only" activities sequenced using precedence logic with the impacted discrete construction work. See the figure below for an example. **The whole intent of this sub-process is to allow the EVT of LOE and allow it to impact discrete work.** This is unique to CSS. Related activity start and finish dates will slip, possibly impacting the project critical path, overall timeline, and ETC cost.
- Arrange CSS and other similar LOE activity (see the figure below, long dark blue bar) in the forecast IMS to finish on the forecasted finish date of the last discrete construction activity. Through baseline change control, re-time remaining budget in a linear fashion. Update the construction support LOE EAC. If slips occur, the EVT for CSS is changed to percent complete to allow it to finish when both the discrete work finishes and the risk of design changes is eliminated. Claim full earned value or budgeted cost of work performed (BCWP) for the LOE activity only following completion of the last discrete activity. The figure below depicts the process.

DOE G 413.3-24 – cont'd

Post CD-2 Assessment Principles



Address in the EVM system description project support services, including the threshold for adding "ETC Only" activities (aka, zero budget activities) to the forecast schedule. Planning LOE In the IMS

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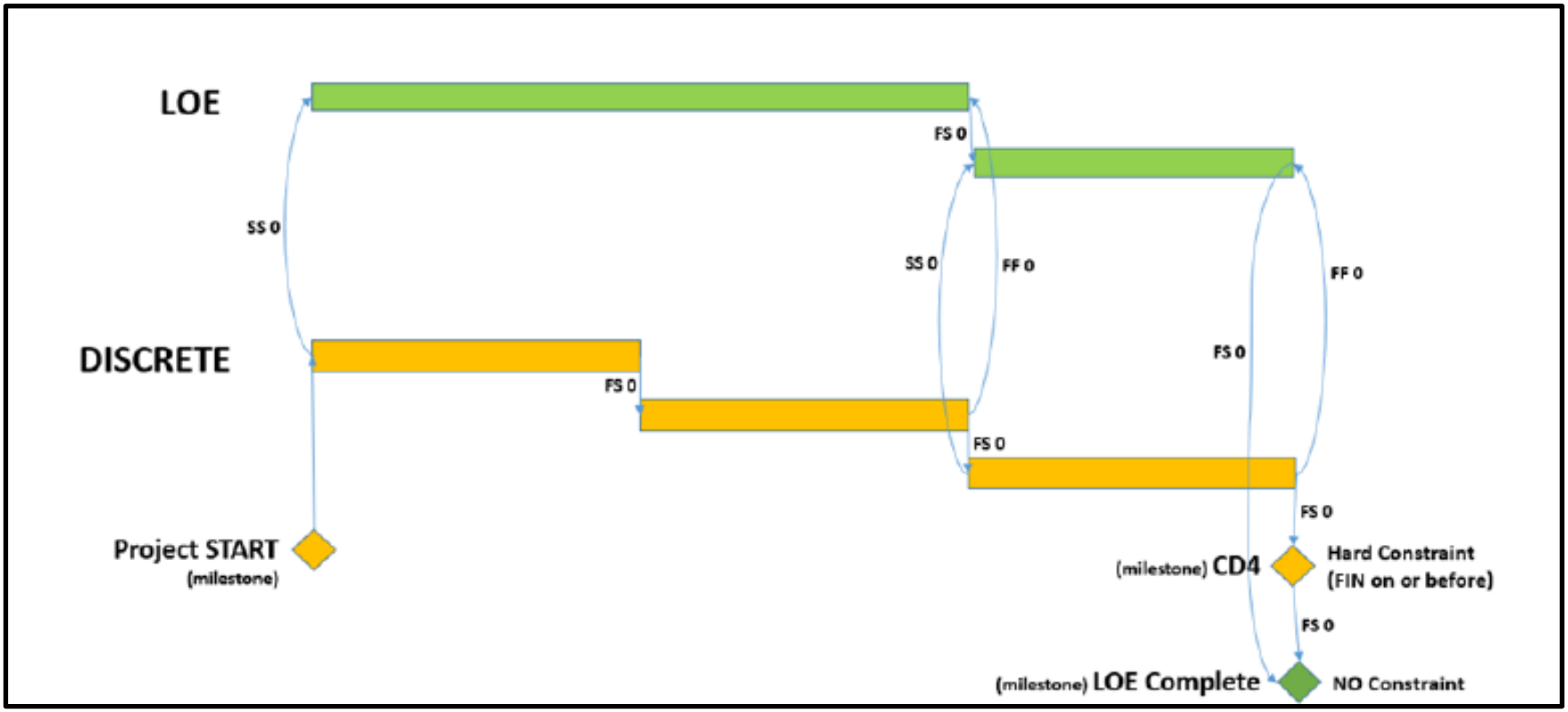
Modeling LOE in the IMS



Address in the EVM system description project support services, including the threshold for adding "ETC Only" activities (aka, zero budget activities) to the forecast schedule. Planning LOE In the IMS

DOE G 413.3-24 – cont'd

SCHEDULE DOCUMENTATION AND CODING

Prepare schedule documentation useful to new schedulers, reviewers, and auditors encompassing the following:

Data Dictionary

Describe the code fields, and options for each code field, utilized in the schedule in a data dictionary. The figure below identifies recommended codes:

IMS Codes

General Use Codes	
Control Account Manager	Integrated Master Plan ID
Planning Package / Work Package ID	Schedule Visibility Task ID
Control Account ID	Earned Value Technique
Organization Breakdown Structure ID	Quantifiable Backup Data Location
Work Breakdown Stucture ID	Subcontractor ID
Contract Line Item Number (CLIN)	Critical / Driving Path ID
Major / Toll Gate Milestone ID	Baseline Change Proposal / Request
Inter-project Logic	Key Performance Parameters
GFI / GFS ID	Zero Budget Activity ID
	ETC Only ID
Schedule Risk Analysis	
Duration Confidence	SRA Maximum Duration
SRA Minimum Duration	Risk Mitigation ID
SRA Most Likely Duration	Schedule Margin ID
Other Recommended Codes / Dictionary Elements	
High Dollar Value / Critical Material ID	High Float Justification
Lag Justification	Negative Float Justification
Constraint Justification	

Associate additional information pertinent to activities using custom code fields in the native schedule application as well as during automated reviews to more easily group, sort, and filter the schedule. Avoid including this information in activity descriptions or note fields.

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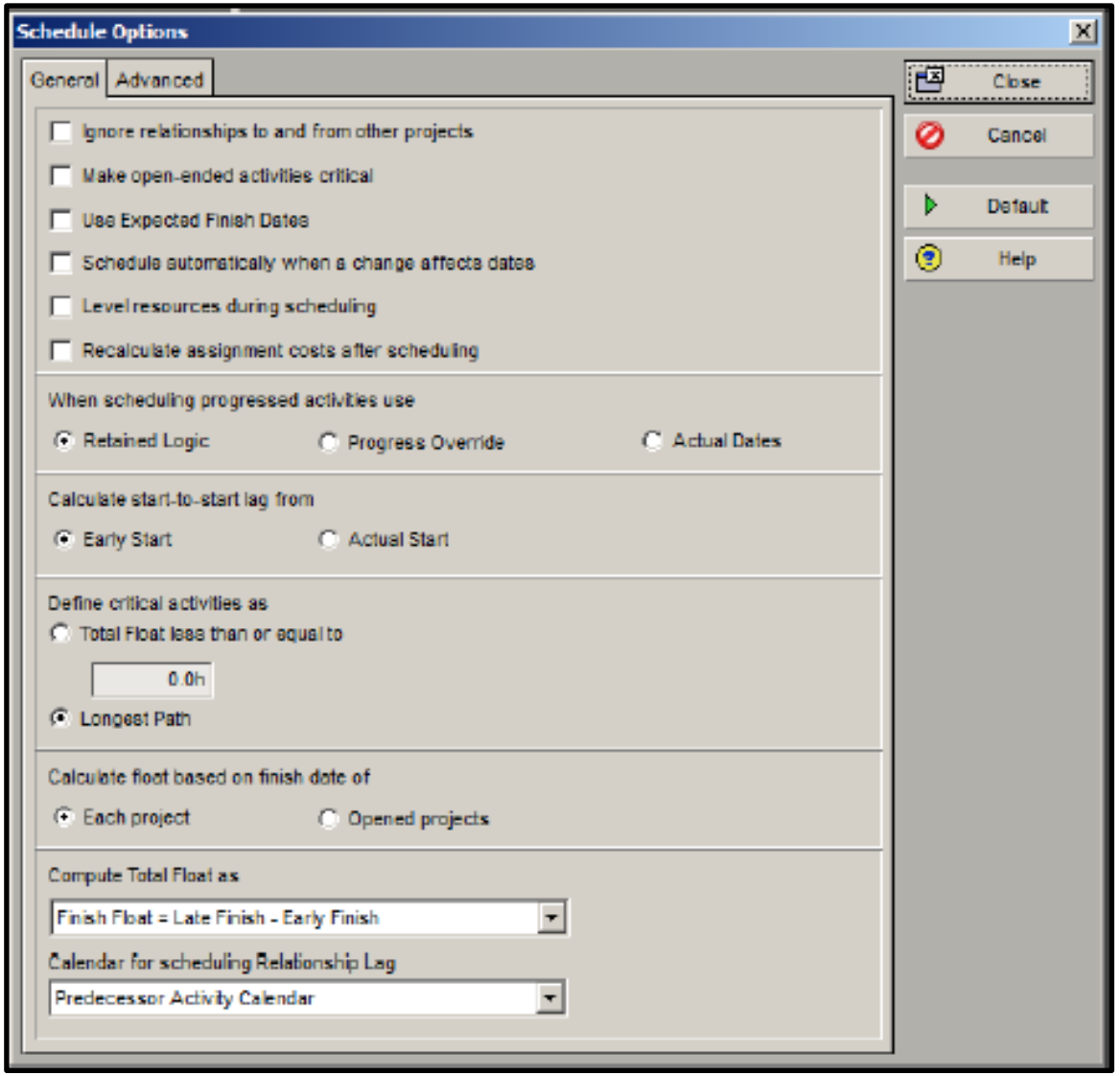
SCHEDULE CONFIGURATION OPTIONS

Address in the schedule documentation what configuration options, known in P6 as administrative preferences, to select to facilitate consistent statusing or importing schedule information. Particularly sensitive preferences include:

1. Duration units and format;
2. Resource usage profiles based on all projects or only on opened projects; and,
3. Resource assignment options.

Other options may impact total float calculations, the definition of critical activities and float paths, and out-of-sequence activities. See Figure 8 for example P6 schedule options.



DOE G 413.3-24 – cont'd

DESKTOP PROCEDURES

Include desktop procedures that address:

1. Schedule activities reoccurrence;
2. Schedule hierarchy;
3. Schedule archiving and data retention;
4. Baseline change and configuration control;
5. Schedule health assessments;
6. Schedule anomaly review and justification; and,
7. Integration of the schedule with cost estimating and other EVM tools.

DOE G 413.3-24 – cont'd

SCHEDULE MARGIN AND DOE SCHEDULE CONTINGENCY IN AN IMS

Overview

Schedule margin (SM) and DOE schedule contingency buffer the schedule against unforeseen events that could cause a delay. Use SM to mitigate realized risks impacting scope assigned to the contractor. In contrast, use DOE schedule contingency to mitigate realized risks impacting scope retained by DOE but still threaten the timely completion of the project. Initially establish SM and DOE schedule contingency in conjunction with CD-2 but updates may occur in conjunction with changes.

Establishing SM and DOE Schedule Contingency

Set the SM commensurate with the schedule risk calculated at a probability level typically between 70 and 90 percent. The SRA accounts for risk events assigned to the contractor and contractor activity duration uncertainty. Activity duration uncertainty is determined either through a three-point duration estimate or by confidence level (high, medium, or low).

Similar to SM, set the DOE schedule contingency commensurate with the schedule risk calculated at a probability level typically between 70 and 90 percent. This SRA accounts for risk events assigned to DOE and DOE activity duration uncertainty. The IMS may depict these activities as SVTs. While various techniques can be used in the SRA (including parametric and deterministic), the best practice is the Monte Carlo approach.

DOE G 413.3-24 – cont'd

Representation of SM in the IMS

Incorporate SM in the IMS as a SVT activity as defined in the EVM system description. Do not load resources on a SM activity nor assign it to a CA, WP, or PP. Include "Schedule Margin" in each related activity name and assign a specific code field to support filtering during schedule analysis.

Arrange SM activities in the IMS prior to CD-4 as follows:

1. Establish a milestone for completing all PMB scope (e.g.,"CD-4 PMB Internal Target Completion") after the last activity that accomplishes PMB scope.
2. Place a SM activity immediately after the PMB scope completion milestone. Use a finish-to-start (FS) relationship between the milestone and the SM.
3. Link the SM with a FS relationship to the internal contractor completion CD-4 milestone.

DOE G 413.3-24 – cont'd

Representation of DOE Schedule Contingency in the IMS

Include DOE schedule contingency in the IMS as directed by the FPD. When included, model it using an SVT activity defined in accordance with the contractor EVM system description. Do not load resources on a DOE schedule contingency activity nor assign it to a CA, WP, or PP. Include "DOE Schedule Contingency" in each related activity name and assign a specific code field to support filtering during schedule analysis.

Insert in each project phase a single DOE schedule contingency activity in the IMS between the contractor and DOE CD milestones. Arrange DOE schedule contingency activities in the IMS prior to CD-4 as follows:

1. Place DOE schedule contingency immediately after the CD-4 milestone corresponding to the contractor's internal CD-4 completion milestone. Use a FS relationship between the milestone and the DOE schedule contingency activity.
2. Link DOE schedule contingency to the federal CD-4 milestone, labeled "CD-4 (TPC) Congressional Commitment," with a FS relationship.
3. Apply a finish-on-or-before constraint to the CD-4 Total Project Costs (TPC) milestone.

DOE G 413.3-24 – cont'd

Drawdown of SM

Ensure the duration of each SM activity in the baseline IMS equals its counterpart in the forecast IMS at the start of a project or project phase. However, as the project or project phase progresses, the contractor may change the SM based on status or subsequent SRA for the remaining scope due to revised activity duration uncertainty or estimated impacts of residual risks. When less than 10 percent of the SM in the baseline IMS remains, review the adequacy of the SRA that generated the SM.

1. **Forecast IMS:** Only the contractor may reduce a SM activity's duration. Document forecast schedule SM consumption in the Format 5 contractor performance report (CPR) or integrated program management report (IPMR). Consumption mitigates negative total float caused by a hard-constrained CD-4 milestone. Compare the percent SM consumed to the percent complete of the project. Actual risks to the project may exceed those anticipated if the ratio exceeds one. Retain a totally consumed SM activity in the schedule with a duration of zero. While the baseline SM remains under change control, the forecast SM does not.
2. **Baseline IMS:** If a change to the baseline requires reducing the SM activity, the contractor approves the allocation of schedule margin to mitigate a realized risk before incorporating a change in the baseline IMS, then document the reason for the consumption of SM in the change control document. **Track SM drawdown in both the forecast and baseline IMS in a log.**

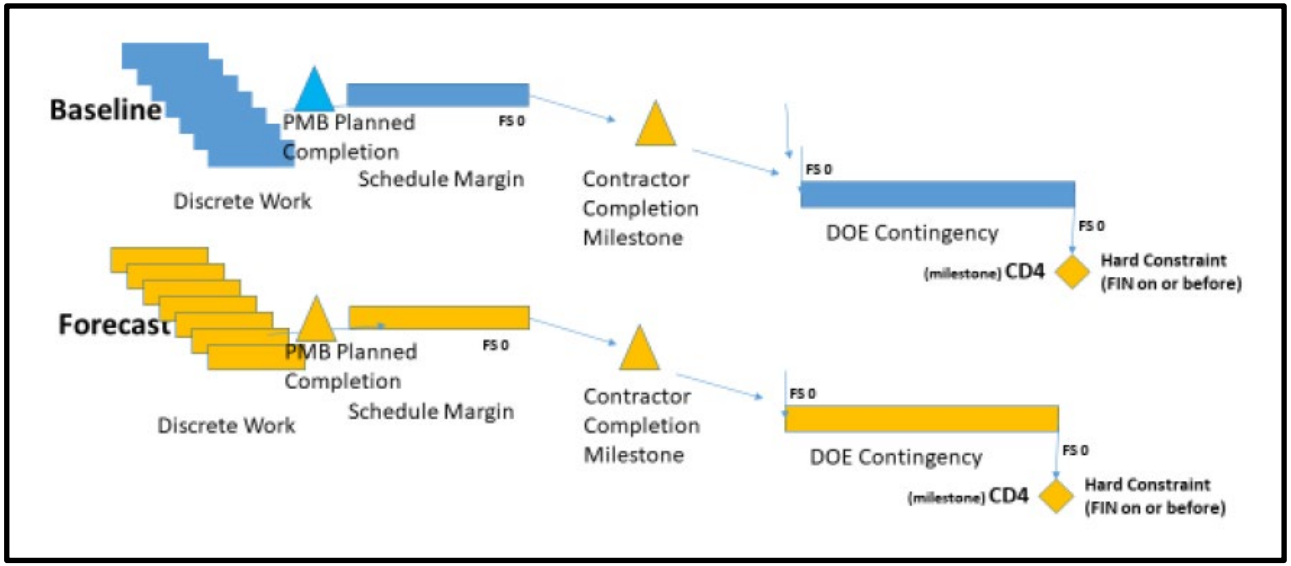
DOE G 413.3-24 – cont'd

Drawdown of DOE Schedule Contingency

Ensure at the start of a project or project phase the duration of DOE Schedule Contingency in the baseline IMS equals its counterpart in the forecast IMS (as shown in the figure below). However, as the project or project phase progresses, the FPD may change the DOE schedule contingency based on a new SRA for remaining scope based on revised activity duration uncertainty or estimated impacts of residual risks.

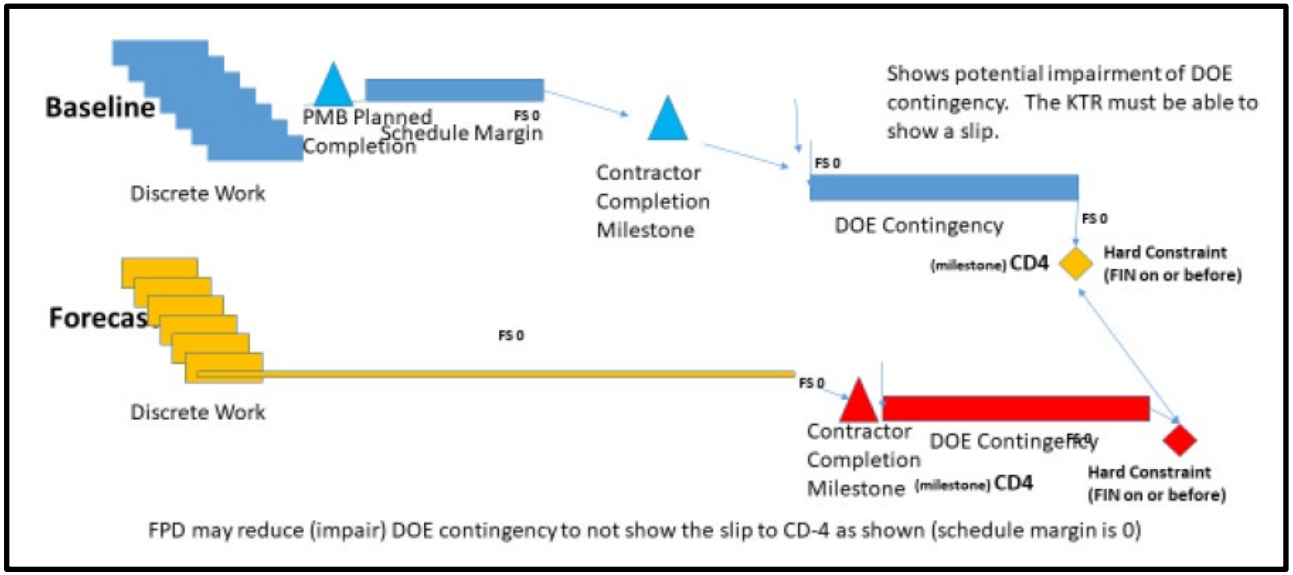
1. **Forecast IMS:** Only the FPD may direct the consumption of DOE schedule contingency in the forecast schedule to mitigate realized risks. While the DOE schedule contingency baseline remains under change control, the forecast DOE Schedule Contingency does not. Thus, the contractor may have to move the CD-4 forecast date as shown in the "Slips" figure below.
2. **Baseline IMS:** If a change to the baseline requires reducing the DOE Schedule Contingency, the FPD approves the allocation of contingency before incorporating a change in the baseline IMS, then document the reason for the consumption of DOE schedule contingency in the change control document. The consumption of DOE schedule contingency may also warrant a contract change to revise the contract CD-4 milestone. Track DOE schedule contingency drawdown in both the forecast and baseline IMS in a log.

DOE G 413.3-24 – cont'd



Planning schedule margin, Contractor completion, DOE Contingency

Slips impact on schedule margin and CD-4



DOE G 413.3-24 – cont'd

SUBCONTRACTOR INTEGRATION AND MANAGEMENT IN THE IMS

Overview

Integrate all contractor schedules for full visibility into a project's scope, schedule, and budget. Use subcontractor schedules as indicators of the progress of corresponding IMS activities. Section 7.8.7 addresses associate contractors, entities supporting DOE on a project but not as subcontractors to the prime contractor.

Types of Subcontractors

1. Integrate time and material subcontracts, mainly used for project support services, into the IMS as LOE activities.
2. Integrate schedules, including resource and cost loading, for FP subcontracts, usually under $100 million, and cost reimbursement subcontracts with an EVMS clause, usually over $100 million, at the award.

DOE G 413.3-24 – cont'd

Vertical Integration

Maintain vertical integration to allow for accurate correlation between the subcontractor schedule and the IMS schedule. Ensure contractors share a WBS and WBS dictionary so that statusing of IMS activities may rely on subcontractor schedules.
Vertically integrate subcontractor schedules and the IMS by:

1. Including the entire subcontractor schedule in the IMS;
2. Sharing a common execution logic and critical path;
3. Aligning baseline and forecast dates for the same scope;
4. Matching within a few days data dates; and,
5. Confirming consistent status and progress.

DOE G 413.3-24 – cont'd

Subcontractor Schedule Integration Methods (FP and Cost Reimbursement with EVMS clause Subcontracts)

Select one of the following three subcontractor integration methods. Methods of integrating subcontractor schedules vary with the complexity and risk of the subcontracted scope, subcontractor period of performance, and type of subcontractor.

1. **Full Schedule Method:** After inputting the subcontractor schedule into the IMS, establish relationships between the subcontractor activities and the contractor activities. Progress subcontractor activities in the IMS using the same earned percent complete and remaining durations found in the subcontractor schedule. Monitor routine minor logistical-type changes related to the availability of crews or work areas. Make related contractor-approved changes in the forecast IMS to facilitate correlations with the subcontractor forecast schedule and estimate to complete. **This method is most suitable for complex and high-risk scope.** Use the same activity identifiers in both the IMS and subcontractor schedule.

DOE G 413.3-24 – cont'd

2. **Representative Method:** Input summary activities from the subcontractor schedule into the IMS (many-to-one correlation of activities). Vertically integrate the subcontractor schedule and IMS early in the planning by assigning a common activity code shared between the subcontractor schedule and the IMS. Include in the summarized activities in the IMS:

   a. Entrance and exit criteria with finish-start relationships;

   b. Details to support a critical path analysis;

   c. A prevailing craft type performing the work;

   d. Short durations;

   e. Objective progress reporting indicators; and,

   f. Sufficient definition in the activities as if the contractor planned to self-perform the work.

   This method, most suitable for less complex and low to medium risk scope, masks routine minor changes in the IMS.

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3. **Interface Milestones Method:** Material or equipment procurement vendors and suppliers establish in the IMS with soft constraints procurement interface, or handoff, milestones that earn budget on delivery. Load one-day procurement activities with lump sum costs in the IMS. This budget represents the progress billing schedule of values in the subcontractor schedule for interim progress payment on material or equipment procurement. Use a performance-based subcontractor schedule of values to evaluate progress. This method, although easier to implement and maintain, provides less insight into the subcontractor's schedule performance.

   Manually update each interface milestone soft constraint date to reflect the latest forecasted dates from the subcontractor schedule. Instead of assigning a soft constraint, insert zero budget activities (ZBA) in between the procurement milestones. Implement this method with less complex or lower risk subcontractor scope. Code each significant HDV or equipment purchase order as a PP until contract award. Upon award, convert the PP to a WP. Revise each activity plan and delivery schedule to meet the needs of the project, taking into account the vendor's delivery schedule or agreed upon delivery dates in the contract. A DOE position paper contains limitations and restrictions on the use of the interface milestone method.

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Utilizing Subcontractor Schedule of Values for Status and Performance

Collect from subcontractors on projects with a total project cost greater than $100 million resource-loaded schedules that will serve as a schedule of values at the activity level to substantiate progress billing. Have the subcontractor submit a baseline schedule with a resource-loaded schedule of values that the contractor approves before the subcontractor's work commences.

Upon commencing work, the subcontractor statuses the schedule activities and requests progress payments according to the earned physical percent complete of each activity. Typically, the contractor records in the IMS actual dates, physical percent complete, remaining duration, and forecast dates associated with subcontractor progress. **Thus, the subcontractor schedule status provides the QBD for the IMS.** The status and performance percent complete transposition vary based on the subcontractor schedule integration method selected.

1. For the full schedule method, input the actual start, actual finish, remaining duration, and physical percent complete of each activity from the subcontractor schedule against the corresponding activity in the IMS.
2. For the representative method, input summarized actual start, actual finish, remaining duration, and weighted physical percent complete progress data from the subcontractor schedule against the corresponding activity in the IMS.

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IMS Level of Detail for Subcontractor Scope

The following criteria indicate an adequate level of detail for subcontractor activities in an IMS:

1. Activities model the complete scope;
2. Activities facilitate monitoring the execution of the plan from day-to-day or week-to-week, depending on the period of performance;
3. Activities have finish-start relationships to other activities;
4. Activities connect with valid logic to facilitate critical path analysis;
5. Activities have a single performing entity; and,
6. Activities have relatively short durations, preferably one to two months long.

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Associated Contractor Schedules

Associated contractors provide DOE with project support but not as subcontractors to a prime contractor. Develop an interface document that outlines the responsibilities of each associated contractor that addresses:

1. Sharing information and schedules at least once monthly;
2. Incorporating associated contractor milestones into the IMS;
3. Using SVTs or equivalent notations; and,
4. Resolving potential or realized scheduling conflicts.

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INCORPORATION AND TREATMENT OF WORKAROUNDS IN THE IMS

Overview

Workarounds circumvent or recover from, but do not eliminate, problems. Initially incorporate workaround activities as emerging, urgent, or recovery work in the forecast IMS as "ETC Only" activities but then incorporate these activities in the baseline IMS through change control in the following month. Designate "ETC Only" activities by including "ETC" in their titles and assigning their activity code value "ETC Only." Link associated workaround activities in the forecast IMS by assigning them the same WP and control account (CA) that the work supports. Some workarounds re-sequence or redefine the relationships between activities. Ensure revised critical, near-critical, and driving paths that incorporate workarounds remain accurate.

Workaround Plan Validity and Documentation

Do not add workaround activities to the forecast IMS to compensate for insufficient detail in the baseline IMS. Before implementing workaround plans, examine their timing for realism, the availability of their needed resources, and their downstream impacts to activities, scope, and expected performance of the delivered asset(s). **Collect input from CAMs**. Compare revised logic to the original baseline logic to verify the validity of changes. CAMs document their analyses of changes in the forecast IMS for realism in a schedule narrative recorded in CAM notebooks even though logic changes in the forecast IMS do not follow formal change control.

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Threshold of Forecast-Only (ETC Only) Activities

Workaround activities fall into two categories defined in the EVM system description: near-term and pre-baseline.

1. **Near-term workarounds:**
   a. Occur during the freeze period, the current month plus subsequent month and have short durations;
   b. Do not go into the baseline; and,
   c. May not have resources when performed by a fixed-price or indirect support contractor.
2. **Longer term workarounds:**
   a. Occur during and after the freeze period;
   b. Typically span many months;
   c. Belong in the baseline IMS through change control; and,
   d. Belong in the forecast IMS.

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Recommended Process for Integrating Workarounds

1. Define in the EVM system description a process for treating and incorporating workaround activities in the forecast IMS.
2. Re-sequence work, which may result in logic changes, or add workaround activities with resources and ETC costs, or both.
3. Establish logical relationships between the workaround activities and other activities or milestones in the IMS.
4. Have CAMs verify the realism of the workaround plan, the associated logic, and the workaround's impact on downstream activities, WPs, PPs, major project milestones, critical path, near-critical path, and driving paths, including the availability of needed resources and the preservation of scope.
5. Validate the changes by comparing the new logic to the baselined logic.
6. Document the workaround plan and changes in the form of an annotated fragmentary network diagram ("fragnet") or a schedule narrative written by a CAM identifying the changes and impacts, ideally drawn from the output of schedule analytics tools.
7. Load resources on workaround activities to estimate activity duration and cost generated by a cost-reimbursable contractor.

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8. Following CAM approval, insert workaround activities in the WP that the workaround supports in the forecast IMS during the current reporting period or thereafter to ensure the forecast schedule reflects current forecast dates and to calculate the critical path, near critical paths, and driving paths.
9. Distinguish workaround activities from original PMB IMS activities by following the coding convention described above.
10. Where Management Reserve (MR) will cover workaround costs, incorporate the workaround plan into the subsequent month baseline IMS through change control.
11. Follow the contractor's change control activity coding rules in the baseline and forecast IMS.
12. Revise coding for the workaround activities in the forecast IMS schedule to reflect their incorporation into the baseline execution plan.
13. Revise activity titles to remove workaround and "ETC Only" references.
14. Link workaround activities in the IMS to the CA and WP supported by the workaround.

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BASELINE SCHEDULE UPDATES

When to Update the Baseline Schedule

As the project progresses it may become necessary to update the baseline plan with approved changes. Exercise care to maintain schedule integrity by updating only effort outside of the freeze period. Typically, baseline schedule changes fall into two different categories—internal and external—and follow proper change control in accordance with the process identified in the contractor EVM system description or project specific procedures. To ensure that the baseline longest path is realistic, update the baseline schedule status monthly or anytime a baseline change is made such as:

1. **Internal:**
    a. Make or buy decision;
    b. Resource type or category assignment;
    c. Logic change;
    d. Execution strategy;
    e. Scope or nature of work; or,
    f. Contract control milestone.

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2. External:

a. Funding;

b. Contract control milestone; or,

c. Federal requirement.

Reprogram when the project can no longer execute the baseline IMS or when the baseline IMS no longer provides meaningful measurement. This requires the contractor and DOE to review the go-forward schedule activities for realism. Re-plan the baseline to produce an IMS that identifies all remaining efforts and major milestones and then adjust the baseline dates, resources, and logic in accordance with an approved plan to achieve an executable IMS baseline.

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Update Implementation

Do not mask historical performance or improve performance metrics when updating the baseline IMS. Include all changes made to the baseline IMS in the forecast IMS. Follow the approved change control process when changing the baseline and forecast IMSs to ensure that they contain accurate project performance information.

Incorporate the following steps in the change control process when not already included:

1. Include in documentation supporting the change:
   a. New or revised schedule activities required for each affected CA and WP, or the creation of new CA and WP as necessary;
   b. Labor hours, durations, logic relationships, resource codes, and elements of cost (EOCs) for each activity;
   c. Relevant activity coding;
   d. Material quantities or vendor quotes;
   e. Risk mitigation strategy, risk events, and mitigation actions in the project risk register related to the change;
   f. Changes to the schedule and cost following the change; and,
   g. Additional information justifying or clarifying the change.

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2. Document appropriate baseline change number and record in the baseline change log.
3. Make copies of the baseline and forecast IMSs to implement directed changes.
4. Reschedule the baseline and forecast IMSs. The baseline is statused to the original project date, or last time actuals were incorporated (a total project replan with actuals). The forecast IMS is statused to the current month end.
5. Conduct a Schedule Risk Assessment against the forecast IMS. Verify the percentage of success and adjust as necessary. An SRA is recommended whenever a significant change has been implemented within the accounting month. See the GAO schedule guide for the expectation and the NDIA PASEG for the instructions of how to conduct an SRA. Update the baseline SRA at strategic points especially to set or validate the schedule reserve and DOE Contingency.
6. Check for downstream impacts to logic, total float, milestones, and project end date.
7. Document noted impacts, mitigate them if possible, and if not possible, notify management and DOE of the anticipated impacts.
8. Gain DOE approval of changes that affect the PB or contract prior to implementation.

If DOE approves the proposed action, implement the action as approved. If DOE rejects the proposed action document, review the reason for rejection, and if addressable, revise and resubmit for approval. If not addressable, administratively closeout the change action.

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SCHEDULE VISIBILITY TASKS AND ZERO BUDGET ACTIVITIES

Overview

An IMS may include several non-resource loaded activity types. They include SVT, ZBA, and "ETC only". This section addresses SVTs and ZBAs. Sections 7.2, LOE, and 7.9, workarounds, address ETC only activities. The table below summarizes the characteristics of Non-Budgeted activities.

Types of Non-Budgeted duration activities

Name	Schedules	Use
Schedule Visibility Tasks (SVT) (GAO, PASEG, and DOE)	Baseline and Forecast	Activities or milestones not a part of the scope of the project but may potentially impact project activities. Represent schedule margin as an SVT. Assign each a unique activity code value.
Zero Budget Activities (ZBA) (PASEG and DOE)	Baseline and Forecast	Budgeted subcontractor activities included in the PMB connected to payment milestones Limited to activities that support a schedule of values. Assign each a unique activity code value of "PM" and include "Payment Milestone" in their activity descriptions.
ETC Only Activities (DOE)	Forecast Only	(1) Activities reflecting changes in LOE duration when projects may not change LOE activities in the baseline. Used to show the duration of LOE even when LOE BCWP equals BAC.
		(2) Workarounds, emerging work, urgent work, rework, recovery work, and resequencing of effort. Projects may resource load these activities. (3) Support such as re-time phased CSS support

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SVTs account for time in a schedule without using a lag, for example cure time for concrete or client reviews. Assign resources to discrete and LOE activities but not SVTs. Since others complete the work, do not include resources or costs on their behalf.

Application of SVTs and ZBAs

Omit SVTs from the WBS, WBS dictionary, and period of performance calculations involving WPs, PPs, and SLPPs. Do not treat SVTs as LOE. Include "SVT" at the beginning of each SVT activity name. Document usage of SVTs in a schedule basis or equivalent file. Since some schedule health metrics only test for SVTs while some exclude SVTs, identifying SVTs within the activity name, and through activity codes, improves schedule analysis. Either use an existing activity code that defines the type of the activity and set the code value to "SVT" or add a new activity code called "Schedule Visibility Task" to the schedule and set the code value to "Yes"

Like SVTs, ZBAs have zero budget and provide visibility. ZBAs represent subcontractor activity supporting a schedule of values that informs BCWP calculations.

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ADVERSE WEATHER PLANNING

Overview

This section addresses modeling, and displaying impacts, of adverse weather in the IMS. Contract general conditions may direct the contractor to plan for adverse weather. To plan for adverse weather, use weather calendars to avoid adjusting durations based on the time of year.

Contracts that require weather planning often include the historical data by month that the contractor should anticipate. When weather days exceed that amount, the contractor may be entitled to time extensions to their contracts. When the actual adverse weather days are less than planned, any float gained will be in accordance with the contract terms and conditions or industry standards.

Adverse Weather Planning Approach

The contractor may use historical monthly National Oceanic and Atmospheric Administration (NOAA) data if the contract does not specify a data source.

It is recommended that historical adverse weather data presented in calendar days be converted into workdays. For example, if NOAA predicts four adverse calendar days in the month of April and the project has a five-day work week, multiply the number of adverse days (4) by the ratio of work week days (5) to the number of days in a week (7) to arrive at three workdays, after rounding to the nearest whole number of days. For the first and last months of the contract, further prorate the adjusted days based on the number of actual or planned workdays there will be work. For example, if the contract begins on April 15th, halve and then round the adjusted adverse days to obtain one workday.

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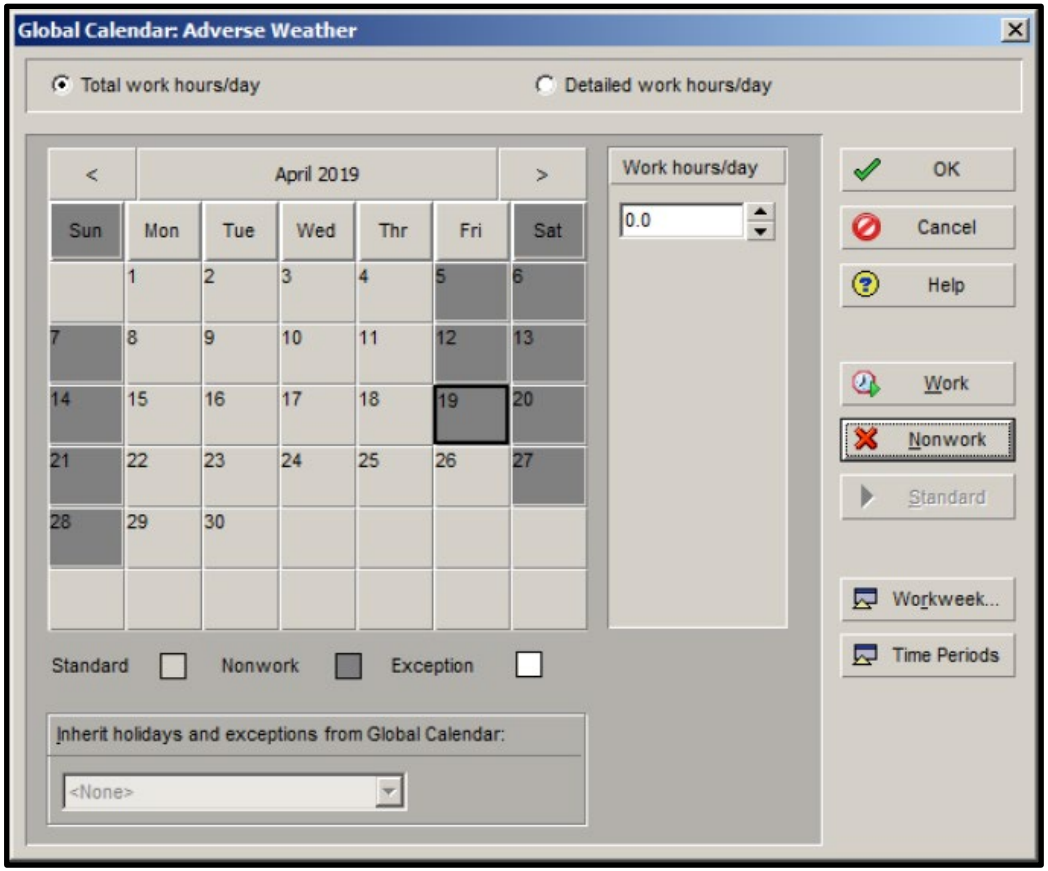
Also, a special calendar may be considered for adverse weather activities with the last workdays of each week labeled as "nonwork." In the example in the figure below, April has four calendar days predicted as adverse, prorated to 3 workdays due to the project's five day work week. Determine the activities in the schedule that adverse weather would impact. Apply the Adverse Weather calendar to the selected activities.



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Planning for Known Weather Impacts

Address in initial and updated baseline and forecast plans known weather impacts to planning. For example, due to local freezing conditions, a contractor may avoid scheduling any pouring concrete outside from December through February. Show this time of inactivity in a separate activity calendar that applies to known weather limitations.

FORCE MAJEURE EVENTS

The 2020 COVID -19 crisis has provided a unique environment for planning. It represents impacts that:

1. Are immediate
2. Are of an unknown duration
3. Involve site closures

Incorporate events with indeterminate durations that cause immediate deleterious impacts to projects, such as an unforeseeable site closure, known as force majeure, in the IMS:

1. Use formal change control processes for all baseline changes.
2. Add a new activity to the baseline IMS and forecast IMS with the title of the force majeure event. Link it as the predecessor to all impacted work.

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3. Give the force majeure activity a duration equal to the most realistic expected delay of the impact.
4. Allow negative total float in the baseline IMS and forecast IMS until the force majeure event ends to better track the impacts to both the schedule and cost of the impact to be known.
5. At the conclusion of the force majeure event, revise both the baseline IMS and forecast IMS to reflect the event's actual duration in both the baseline and forecast IMS.
6. After DOE authorizes use of schedule contingency, revise the forecast CD-4 date to eliminate the negative total float.

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CONTRACT VERSUS PROJECT

The PB for a project includes the project scope and applicable Key Performance Parameters (KPPs), CD-4 project completion date, and TPC, and represents DOE's commitment to Congress. However, the relationship is not always one prime contract per project. **The DOE O 413.3B expectation is that each project with its own PB has an individual IMS for management and reporting.** For example, three prime contracts may have responsibility for one project, whether through joint execution or hand off from one prime contractor to another based on a separable design/construct strategy or a contract recompete scenario. In such a situation, these individual contractor schedules are integrated (typically by a designated prime contractor) into a singular IMS for management and reporting at the project PB level. In other cases, one prime contract may encompass three projects, each with a unique project PB, and thus three individual project IMSs for management and reporting. In the case where a large project is tailored with smaller phased projects or subprojects each with its own unique PB, there should be individual and unique IMSs for each phased or subproject, with appropriate linkages between each and to form the holistic large project schedule.

GOVERNMENT SCHEDULES

The Government may have a separate IMS for the project including the other direct cost (ODC) and system testing. Alternately they may ask the contractor to plan their activities in the contractor IMS. If requested, the government activities would be SVTs in the contractor IMS. As noted in 7.11.1, these SVT activities are used instead of a lag to account for duration of work outside the contractor's control.