

A monthly newsletter of the Energy Facility Contractors Group's Project Delivery Working Group



Issue 63 October 2024

Planning and Scheduling — Part 2

Happy Fiscal New Year, Fellow EFCOG PDWG Practitioners!!!

all is in the air and the autumn colors continue to be magnificent. Fall also brings closure to some of our Annual Work Plan (AWP) tasks. Many thanks to our Project Controls Subgroup for supporting development of PM-30's Supplemental Guidance to CAG 2.0 "Establishment and Usage of Management Reserve (Attributes C.10 and G.1)" and completing a white paper on "Master Program Schedule Integration Methodology". Below is a summary of each.

Preface

Management Reserve (MR) is a key element of the Earned Value Management System (EVMS) to manage unforeseen, in-scope work within a project. Despite its importance, MR is often misunderstood and misused, making it essential to understand its proper establishment and allowable uses. This document aims to identify the principles and expectations for EIA-748 compliant practices on the establishment and allowable and unallowable use of MR.

A healthy project environment, which includes both tangible and intangible factors, is paramount to ensure effective EVMS implementation. The project environment significantly influences the maturity and effectiveness of EVMS implementation, correlating with better project outcomes. To promote responsible MR management and align its usage with project goals, consider the following strategies:

- **Enhance Communication**: Clearly define MR's purpose and guidelines, and regularly communicate these to all stakeholders.
- **Provide Training**: Offer training sessions for managers on MR allocation to ensure understanding of best practices.
- Cultivate Accountability: Foster a culture that emphasizes responsibility and appropriate MR use.
- **Implement Strong Oversight**: Establish a governance framework to monitor MR usage, with regular reviews and audits to ensure compliance.
- Improve Transparency: Provide managers with real-time data and reporting tools for informed MR decisions.
- **Encourage Collaboration**: Facilitate cross-departmental discussions to align interests and ensure MR allocation supports organizational goals.
- **Establish Clear Policies**: Develop and disseminate clear policies on MR usage, including approval processes and reporting requirements.
- **Utilize Risk Management**: Implement risk assessment processes to determine appropriate MR use and mitigate misuse.
- **Solicit Feedback**: Regularly gather input from managers about MR usage challenges and adjust policies accordingly.

By embracing these strategies and understanding the environmental and human factors influencing EVMS implementation, organizations can foster a project environment that promotes trust, transparency, and shared values.

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This approach reduces the risk of failing to achieve schedule, budget, and performance goals, ensuring effective MR use in compliance with EIA-748 standards.

The EFCOG PDWG, through its support and collaboration, embraces the strategy and approach presented in this PM-30 Supplemental Guidance to CAG 2.0 for Establishment and Usage of Management Reserve (Attributes C.10 and G.1).

The PM document can be found at the following two locations:

- PM EVM Clearinghouse Topics Dept of Energy-External Community (connect.gov)
- <u>EVMS Implementation Guidance</u> | <u>Department of Energy</u> (Clearinghouse Topics table)

Master Program Schedule Integration Methodology

The purpose of this white paper is to demonstrate practices related to setting up and maintaining large project/program integrated master schedules (IMS) that include subprojects that are required to be individually submitted into the DOE Project Assessment and Reporting System (PARS). Even though there are subprojects in the IMS that do not report into PARS, it is recommended that those projects consider the outlined practices as they affect the reporting criteria of the PARS subprojects.

DOE is transitioning to a new format for data upload to PARS, using JavaScript Object Notation (JSON) dataset format. The new JSON format requirement, which will replace the existing MS Access file and CSV flat files, are documented within the DOE Contractor Project Performance (CPP) Data Item Description (DID). The new JSON dataset will be required for future PARS data uploads. The latest version of the DOE CPP DID is found at the PARS DOE website.

PARS emphasis is to improve/streamline management of the scope and integration of WBS, schedule, and costs. The focus in the outlined practices is to illustrate the necessary steps required when certain DOE offices/sites maintain an IMS (enterprise site/portfolio/program) that comprise multiple inter-related PARS projects. The individual capital asset projects, each having unique PARS IDs are required to be reported separately in PARS, with each project able to stand alone in the tenets of schedule health and critical path analysis, or identification of tasks with total float less than or equal to zero, within PARS when segregated from the Program IMS. This requires that the submitted schedules must match the same information in the IMS for critical path, date and float calculations, resources, and interproject dependencies (driving and non-driving) originating from external projects included in the site/portfolio/program IMS. To accomplish this, the separated schedules must include interface milestones representing predecessor activities of external projects that link to the activities in the submitted PARS project.

The separation of the schedules for accurate reporting of stand-alone schedule files is facilitated by implementation of a process and methodology for development and maintenance of interface milestones. The standard traditional practice requires manual creation of interface milestones within the submitted PARS project. The use of interface milestones, as discussed later in this document, is necessary to facilitate the ability to create native stand-alone P6 schedule backups (e.g. XER/XML) files for importing into external P6 systems for review and analysis.

In addition to the necessary standard practice of developing and maintaining interface milestones, DOE has commissioned Oracle to develop automated capabilities in P6 to support the DOE CPP JSON DID for reporting project data into PARS.

See the entire white paper at the **EFCOG PDWG Website**.

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Continued from previous page

This month's *Practitioner* also continues with our exploration of DOE's "Planning and Scheduling" Guide DOE G 413.3-24. Hopefully you found the time to visit the Energy Facility Contractors Group (EFCOG) Project Delivery Working Group (PDWG) webpage for training material developed and provided for you and your staff's use <u>FileaFrame-Project Delivery | EFCOG.org</u>.

The information provided in DOE G 413.3-24 is important and timely because it will be used in support of a significant EFCOG PDWG AWP task to be worked in collaboration with the PM-30 site reviews. Recent history gathered through PM-30 site reviews identified repeat schedule issues that can be mitigated through advance project peer reviews conducted by an EFCOG PDWG Scheduling Subject Matter Expert (SME) Task Team. This effort will commence once the PM-30 Site Review schedule is finalized and received by the PDWG. So given the additional context, here is where we left off with the guide in the previous *Practitioner*.

This guide addresses four schedule evolutions:

- ✓ Prior to CD-1, a high-level Master Schedule
- ✓ **Post CD-1**, IMS for the selected alternative
- ✓ Prior to CD-2. baseline/forecast IMS
- ✓ Post CD-2, baseline/forecast IMS with the construction plan of execution

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.

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,

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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].

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. ¹³ 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 in Table 4 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.

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 external independent review (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 Project Execution Plan. **Structure or reconcile the IMS against the integrated master plan (IMP)**.

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Table 4. Post CD-1 to Pre CD-2 Assessments

Number	Name
	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

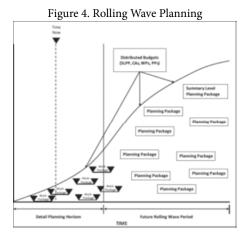
¹³ Schedule contingency described in GAO 16-89G, current version, includes both DOE schedule contingency and contractor SM.

30 Adequate Predecessors or Successors—Forecast 31 Limited SF Relationships—Forecast 32 Limited SS or FF Relationships—Forecast 33 Limited Leads—Forecast 34 Limited Leads—Forecast	
32 Limited SS or FF Relationships—Forecast 33 Limited Leads—Forecast 34 Limited Lags—Forecast	
33 Limited Leads—Forecast 34 Limited Lags—Forecast	
34 Limited Lags—Forecast	
21 Emmed English Collection	
35 Minimize Merge Points—Forecast	
36 No LOE Discrete Successors—Forecast	
37 Limit Hard Constraints—Forecast	
38 Minimize Soft Constraints—Forecast	
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	
Verifying that the Schedule Can Be Traced Horizontally and Verticall	y
24 Vertical Traceability—Baseline	
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	

Number	Name
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
	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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- 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 planning packages (PP) 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 IGAO 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 work packages (WP), planning packages (PP),
 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.



- ¹⁴ Neither GAO nor PASEG specify a maximum duration for activities. The related assessment counts activities with durations in excess of 44 working days.
- 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 Figure 4. PPs have no duration limit. However, ensure WPs have shorter durations than PPs, generally less than two months. ¹⁴ Keep the scope, schedule, and budget of both WPs and PPs integrated.

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].

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 5 (next page) 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.

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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.

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

Table 5. Pre CD-2 Assessment Principles

1ab	ie 5. Pre CD-2 Assessment Principles
Number	Name
	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 60	Critical key milestones and deliverables in IMS—Baseline
00	Risk Mitigations Included—Baseline 2. Sequencing All Activities
2	2. Sequencing All Activities Adequate Predecessors and Successors—Baseline
3	Limited SF Relationships—Baseline
Number	Name
4	Limited SS or FF Relationships—Baseline
5	Limited Leads—Baseline
7	Limited Lags Baseline 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
	Assigning Resources to All Activities
13	Adequate Resource Loading—Baseline
14	No SVTs with Resources—Baseline
16 17	Reasonable Resource Profile—Baseline
39	No SM Resources—Baseline Reasonable Resource Profile—Forecast
40	No SVTs with Resources—Forecast
41	Adequate Resource Loading—Forecast
42	No SM Resources—Forecast
- 15	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
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

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
	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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dangling logic. Avoid using start to finish (SF) logic [GAO BP #2].15 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 P6.16 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-4.¹⁷.

- 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].¹⁸
- 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-orafter constraint in P6.¹⁹
- 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].

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.

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¹⁵ GAO "discourages" using this relationship. PASEG says to "avoid" its use.

¹⁶ Neither GAO nor PASEG specify an acceptable maximum number of days per lag.

¹⁷ Neither GAO nor PASEG supports including hard constraints in the schedule.

¹⁸ Neither GAO nor PASEG specify an acceptable maximum number of predecessors.

¹⁹ PASEG addresses the availability of resources.

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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 deconflict 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 #g].
- 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].

Table 6. Post CD-2 Assessment Principles

Coputing All Activities		Name
1		Capturing All Activities
10 Hours in IMS Consistent with Cost Tool Hours—Baseline 11 Risk Mingations Included—Forecast 28 Baseline IMS Includes HDV Material 29 Critical key milestones and deliverables in IMS—Baseline 60 Risk Mingations Included—Baseline 2 Sequencing All Activities 2 Adequate Predecessors and Successors—Baseline 3 Limited 18 Relationships—Baseline 4 Limited SS or IF Relationships—Baseline 5 Limited Lags Bajeline 6 Limited Lags Bajeline 7 Minimize Merge Points—Baseline 8 Limit Hard Constraints—Baseline 9 Minimize Soft Octatatints—Baseline 12 No LOE Discrete Successors—Baseline 13 No LOE Discrete Successors—Baseline 14 Limited SS or IF Relationships—Forecast 15 Limited SS or IF Relationships—Forecast 16 Limited SS or IF Relationships—Forecast 17 Limited SS or IF Relationships—Forecast 18 Limited SS or IF Relationships—Forecast 19 Limited SS or IF Relationships—Forecast 10 Limited SS or IF Relationships—Forecast 11 Limited Lags—Forecast 12 Limited SS or IF Relationships—Forecast 13 Limited Lags—Forecast 14 Limited Lags—Forecast 15 Minimize Merge Points—Forecast 16 Minimize Merge Points—Forecast 17 Limited Lags—Forecast 18 Minimize Morge Points—Forecast 18 Minimize Morge Points—Forecast 19 Minimize Morge Points—Forecast 10 No LOE Discrete Successors—Forecast 11 Limited Lags—Forecast 12 Limited Lags—Forecast 13 Limited Lags—Forecast 14 No SVI's with Resources—Baseline 15 Minimize Morge Points—Baseline 16 Resonable Resource Profits—Baseline 17 No SVI Resources—Baseline 18 Resonable Resource Profits—Baseline 19 Resonable Resource Profits—Baseline 10 No SVI's with Resources—Baseline 11 Adequate Resources—Baseline 12 Minimize Duration—Baseline 13 Minimize Duration—Baseline 14 Adequate Resources—Baseline 15 Minimize Duration—Baseline 16 Resonable Resources—Baseline 17 No SVI Resources—Baseline 18 Critical Path Pult Assessment—Baseline 19 Critical Path Pult Assessment—Baseline 10 Critical Path Pult Assessment—Baseline 11 Adequate Resources—Gorecast 12 Vertical Traceability—Forecast 13 Subleonation Vertical Traceability—Forecast 14	I1	WBS Dictionary Matches IMS—Baseline
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30 No LOE Discrete Successors—Forecast 31 Limit Hard Constraints—Forecast 32 Minimize Soft Constraints—Forecast 33 Assigning Resources to All Activities 33 Assigning Resources to All Activities 44 No SVTs with Resources—Baseline 45 Resonable Resource Profits—Baseline 46 Resonable Resource Profits—Baseline 47 No SVR Resources—Baseline 48 Profits—Baseline 49 No SVTs with Resources—Forecast 40 No SVTs with Resources—Forecast 41 Adequate Resource Loading—Forecast 42 No SM Resources—Forecast 43 Establishing the Duration of All Activities 44 No SMR Resources—Forecast 45 Minimize Duration—Baseline 46 Minimize Duration—Baseline 47 Minimize Duration—Baseline 48 Critical Path Pulh Assessment—Baseline 49 Vertical Traceability—Baseline 40 Vertical Traceability—Forecast 41 Supplemental Vertical Traceability—Forecast 42 Vertical Traceability—Baseline 43 Vertical Traceability—Baseline 44 Supplemental Vertical Traceability—Baseline 45 Critical Path Pulh Assessment—Forecast 46 Critical Path Pulh Assessment—Forecast 47 Critical Path Pulh Assessment—Forecast 48 Critical Path Pulh Assessment—Forecast 49 Critical Path Pulh Assessment—Forecast 40 Critical Path Pulh Assessment—Forecast 41 Critical Path Pulh Assessment—Forecast 42 Critical Path Pulh Assessment—Forecast 43 Critical Path Pulh Assessment—Forecast 44 Critical Path Pulh Assessment—Forecast 45 Critical Path Pulh Assessment—Forecast 46 Critical Path Pulh Assessment—Forecast 47 Critical Path Resonably Defined—Baseline 48 Critical Path Resonably Defined—Baseline 49 Critical Path Resonably Defined—Baseline 40 Critical Path Resonably Defined—Baseline 51 Resonable Total Float—Baseline 52 Schandber Total Float—Baseline 53 Salumental Path—Forecast 54 Resonable Total Float—Baseline 55 Salumental Path—Forecast 56 SM Linkage—Baseline 57 Linuary Resonable Total Float—Forecast 58 SM Linkage—Forecast 59 Lydating the Schedule Using Actual Progress and Logic 50 Forecast Versus Baseline Versus Forecast Activity Count 50 Forecast Versus Baseline Actual Finish Date—Forecast 51 Salumental Path		Minimize Merge Points—Forecast
38 Minimize Soft Constraints—Forecast 3. Assigning Resources to All Activities 3. Assigning Resources to All Activities 3. Assigning Resources to All Activities 4. No SVTs with Resources—Baseline 6. Reasonable Resource Profits—Baseline 7. No SM Resources—Baseline 8. Reasonable Resource Profits—Baseline 9. Reasonable Resource Forecast 40. No SVTs with Resources—Forecast 41. Adequate Resource Loading—Forecast 42. No SM Resources—Forecast 43. Mo SM Resources—Forecast 44. Letablishme the Duration of All Activities 15. Minimize Duration—Baseline 21. Minimize Duration—Baseline 22. Verifying That the Schedule Can Be Traced Horizontally and Vertically 18. Critical Path Pub Assessment—Baseline 24. Vertical Traceability—Baseline 24. Vertical Traceability—Baseline 24. Vertical Traceability—Baseline 24. Vertical Traceability—Forecast 45. Subcontractor Vertical Traceability—Baseline 46. Continuous Critical Path—Baseline 47. Critical Path Pub Assessment—Forecast 48. Critical Path Pub Assessment—Forecast 49. Critical Path Pub Assessment—Forecast 40. Continuous Critical Path—Baseline 21. Continuous Critical Path—Baseline 22. Critical Path Reasonably Defined—Baseline 23. Continuous Critical Path—Baseline 24. Critical Path Reasonably Defined—Baseline 25. Reasonable Total Float—Baseline 26. Continuous Critical Path—Baseline 27. Ensuring Reasonably Defined—Baseline 28. Continuous Critical Path—Baseline 29. No LOE on Critical Path—Baseline 20. No LOE on Critical Path—Baseline 30. No LOE on Critical Path—Baseline 31. Reasonable Total Float—Baseline 32. Reasonable Total Float—Baseline 33. SM Linkage—Baseline 34. Updating the Schedule Using Actual Progress and Logic 35. Pub Authon Consistent with Nisk—Forecast 36. SM Linkage—Forecast 37. Shatural Galoudiny—Forecast 38. Shatural Galoudiny—Forecast 39. Updating the Schedule Valing Actual Progress and Logic 40. Physical Complete with No Actual Finish Date—Forecast 41. Status Galoudiny—Forecast 42. Critical Path Path Condition of the Proce	36	No LOE Discrete Successors—Forecast
Adequate Resource Loading—Baseline Adequate Resource Loading—Baseline Reasonable Resource Profile—Baseline Reasonable Resource Profile—Baseline Reasonable Resource Profile—Baseline Reasonable Resource Profile—Baseline Reasonable Resource Profile—Forecast Adequate Resource Profile—Forecast Adequate Resource Profile—Forecast Adequate Resource Loading—Forecast Adequate Resource Loading—Forecast A Establishing the Duration of All Activities A Establishing the Duration of All Activities Similarize Work Packages—Baseline Similarize Work Packages—Baseline Similarize Work Packages—Baseline Critical Path Push Assessment—Baseline Critical Path Push Assessment—Forecast Supplemental Vertical Traceability—Forecast Critical Path Push Assessment—Forecast Critical Path Push Assessment—Forecast Critical Path Push Assessment—Forecast Critical Path Push Assessment—Forecast Continuous Critical Path—Baseline Continuous Critical Path—Baseline Critical Path Reasonably Defined—Baseline Critical Path Reasonably Defined—Baseline Critical Path Reasonably Defined—Baseline Critical Path Reasonably Defined—Forecast T. Ensuring Reasonable Total Float—Baseline Critical Path Reasonably Defined—Forecast Critical Path Reasonably Defined—Forecast South Markage—Baseline Eschedule Risk Analysis SM Linkage—Baseline Loading Resonable Total Float—Forecast SM Dariston Consistent with Risk—Forecast SM Dariston Consistent with Risk—Forecast Status Relability—Forecast Status Relability—Forecast Status Relability—Forecast Status Relability—Forecast Forecast Versus Baseline Activity Count		
13 Adequate Resource Loading—Baseline 14 No SVTs with Resources—Baseline 16 Reasonable Resources—Baseline 17 No SM Resources—Baseline 18 Reasonable Resources—Forciat 19 Reasonable Resources—Forciat 10 No SVTs with Resources—Forciat 11 Adequate Resource Loading—Forciat 12 No SVTs with Resources—Forciat 12 No SM Resources—Forciat 13 Adequate Resource Loading—Forciat 14 Adequate Resource Loading—Forciat 15 Minimizer Duration—Baseline 16 Minimizer Duration—Baseline 17 Minimizer Work Packages—Baseline 18 Critical Path Path Assessment—Baseline 19 Critical Path Path Assessment—Baseline 19 Critical Path Path Assessment—Baseline 19 Critical Path Path Assessment—Baseline 10 Critical Path Path Assessment—Baseline 11 Vertical Traceability—Forciat 12 Supplemental Vertical Traceability—Forciat 13 Vertical Traceability—Forciat 14 Supplemental Vertical Traceability—Forciat 15 Subcontractor Vertical Traceability—Forciat 16 Critical Path Path Assessment—Forciat 17 Critical Path Path Assessment—Forciat 18 Critical Path Path Assessment—Forciat 19 Critical Path Path Assessment—Forciat 10 Continuous Critical Path—Baseline 10 Critical Path—Baseline 11 Critical Path—Forciat 12 Critical Path Path—Baseline 13 Continuous Critical Path—Baseline 14 Critical Path Path—Baseline 15 Continuous Critical Path—Forciat 16 Continuous Critical Path—Forciat 17 Critical Path Path—Forciat 18 Reasonable Total Folat—Forciat 19 Reasonable Total Folat—Forciat 19 Reasonable Total Folat—Forciat 10 Mainting a Baseline Schedule Vising Actual Propress and Logic 19 Patrical Complete with No Actual Finish Date—Forciat 19 Lydating the Schedule Vising Actual Propress and Logic 19 Patrical Out of Sequence—Forciat 10 Mainting a Baseline Schedule 10 Resonable Total Folat—Forciat 10 Mainting a Baseline Schedule 10 Resonable Total Folat—Forciat 10 Mainting a Baseline Schedule	38	
14 No SVTs with Resources—Baseline 16 Reasonable Resource Profile—Baseline 17 No SM Resources—Baseline 18 Reasonable Resource Profile—Forecast 19 Reasonable Resource Profile—Forecast 10 No SVTs with Resources—Forecast 11 Adequate Resource Loading—Forecast 12 No SM Resources—Forecast 13 Minimize Duration—Baseline 15 Minimize Duration—Baseline 16 SVerifying That the Schedule Can Be Traced Horizontally and Vertically 18 Critical Path Pull Assessment—Baseline 19 Critical Path Pull Assessment—Baseline 19 Critical Path Pull Assessment—Baseline 10 Critical Path Pull Assessment—Baseline 10 Vertical Traceablity—Baseline 11 Vertical Traceablity—Baseline 12 Vertical Traceablity—Forecast 13 Subcontractor Vertical Traceablity—Baseline 14 Supplemental Vertical Traceablity—Baseline 15 Critical Path Pull Assessment—Forecast 16 Critical Path Pull Assessment—Forecast 17 Critical Path Pull Assessment—Forecast 18 Critical Path Pull Assessment—Forecast 19 Critical Path Pull Assessment—Forecast 10 Critical Path Pull Assessment—Forecast 10 Critical Path Pull Assessment—Forecast 11 Critical Path Pull Assessment—Forecast 12 Critical Path Pull Assessment—Forecast 18 Critical Path Pull Assessment—Forecast 19 Critical Path Pull Assessment—Forecast 10 Critical Path Pull Assessment—Forecast 10 Critical Path Pull Assessment—Forecast 11 Critical Path Pull Assessment—Forecast 12 Critical Path Pull Assessment 12 Critical Path—Baseline 13 Critical Path—Baseline 14 Critical Path Pull Assessment 15 Reasonable Total Float—Baseline 16 Continuous Critical Path—Baseline 17 Fasturing Reasonable Total Float—Baseline 18 Reasonable Total Float—Baseline 19 Reasonable Total Float—Forecast 20 Mull Reasonable Total Float—Forecast 21 Critical Path—Forecast 22 Critical Path—Forecast 23 Continuous Critical Path—Forecast 24 Path Status Reliablity—Forecast 25 Reasonable Total Float—Forecast 26 SM Linkage—Forecast 27 Pull Path Path Path Path Path Path Path Path		
16 Reasonable Resource Profile—Baseline 17 No SM Resources—Baseline 18 Reasonable Resource Profile—Forecast 40 No SVTs with Resources—Forecast 41 Adequate Resource Loading—Forecast 42 No SM Resources—Forecast 42 No SM Resources—Forecast 43 Ageingt Resource Loading—Forecast 44 Exhibition the Duration of All Activities 15 Minimize Duration—Baseline 16 Minimize Duration—Baseline 17 Minimize Work Packages—Baseline 18 Critical Path Pluh Assessment—Baseline 19 Critical Path Pluh Assessment—Baseline 19 Critical Path Pluh Assessment—Baseline 14 Vertical Traceablity—Baseline 14 Vertical Traceablity—Forecast 14 Supplemental Vertical Traceablity—Forecast 15 Subcontractor Vertical Traceablity—Forecast 16 Critical Path Pluh Assessment—Forecast 17 Critical Path Pluh Assessment—Forecast 18 Critical Path Pluh Assessment—Forecast 19 Critical Path Pluh Assessment—Forecast 10 No LOE on Critical Path—Baseline 10 No LOE on Critical Path—Baseline 11 Critical Path Pluh Assessment—Forecast 12 Critical Path Pluh Assessment—Forecast 13 Continuous Critical Path—Baseline 14 Critical Path Pluh Assessment—Forecast 15 Continuous Critical Path—Baseline 16 Continuous Critical Path—Baseline 17 Critical Path Reasonably Defined—Forecast 18 Continuous Critical Path—Forecast 19 No LOE on Critical Path—Forecast 19 Reasonable Total Folat—Forecast 10 No LOE on Critical Path—Forecast 11 Reasonable Total Folat—Forecast 12 Reasonable Total Folat—Forecast 13 SM Linkage—Baseline 14 Path Call Folat—Forecast 15 SM Duration Consistent with Risk—Forecast 15 SM Duration Consistent with Risk—Forecast 15 SM Linkage—Forecast 16 Actual Start without Physical Percent Complete—Forecast 17 Status Reliablity—Forecast 18 Baseline Percent Complete—Forecast 19 Critical Path Percent Activity Count 10 Maintaining a Baseline Schedule 10 Forecast Versus Baseline Schedule		
17 No SM Resource—Baseline 39 Reasonable Resource Froftle—Forecast 40 No SVTs with Resource Loading—Forecast 41 Adequate Resource Loading—Forecast 42 No SM Resources—Forecast 4. Establishing the Duration of All Activities 15 Minimize Duration—Baseline 21 Minimize Duration—Baseline 22 Veritying That the Schedule Can Be Traced Horizontally and Vertically 18 Critical Path Pluk Assessment—Baseline 29 Vertical Traceability—Baseline 20 Vertical Traceability—Baseline 20 Vertical Traceability—Forecast 41 Supplemental Vertical Traceability—Forecast 42 Subcontractor Vertical Traceability—Forecast 43 Subcontractor Vertical Traceability—Baseline 44 Critical Path Pulk Assessment—Forecast 45 Subcontractor Vertical Traceability—Baseline 46 Critical Path Pulk Assessment—Forecast 47 Critical Path Pulk Assessment—Forecast 48 Critical Path Pulk Assessment—Forecast 49 Critical Path Pulk Assessment—Forecast 40 Continuing That The Critical Path is Valid 20 No LOE on Critical Path—Baseline 21 Continuous Critical Path—Baseline 22 Continuous Critical Path—Baseline 34 Critical Path Pulk Assessment 45 Continuous Critical Path—Baseline 46 Continuous Critical Path—Baseline 47 Critical Path Reasonably Defined—Baseline 48 Critical Path Reasonably Defined—Forecast 49 Critical Path—Baseline 50 No LOE on Critical Path—Forecast 51 Reasonable Total Float—Baseline 52 Reasonable Total Float—Baseline 53 Reasonable Total Float—Baseline 54 Reasonable Total Float—Baseline 55 Satural Relability—Forecast 66 SM Linkage—Baseline 67 SM Linkage—Forecast 68 SM Linkage—Forecast 69 Lydaning the Stechdule Using Actual Progress and Logic 69 Physical Complete with No Actual Finish Date—Forecast 60 Actual Start without Physical Percent Complete—Forecast 61 Status Relabilative—Forecast 62 Status Relabilative—Forecast 63 Satus Relabilative—Forecast 64 Actual Start without Physical Percent Complete—Forecast 65 Actual Start without Physical Percent Complete—Forecast 66 Actual Start without Physical Percent Complete—Forec		
39 Reasonable Resource Profile—Forecast 40 No SVTs with Resources—Forecast 41 Adequate Resource Loading—Forecast 42 No SM Resources—Forecast 42 No SM Resources—Forecast 43 Adequate Resource Loading—Forecast 44 Establishing the Duration of All Activities 15 Minimize Duration—Baseline 16 Minimize Work Packages—Baseline 17 September 18 Critical Path Puth Assessment—Baseline 18 Critical Path Puth Assessment—Baseline 19 Critical Path Puth Assessment—Baseline 14 Vertical Traceablity—Forecast 14 Vertical Traceablity—Forecast 15 Supplemental Vertical Traceablity—Forecast 16 Supplemental Vertical Traceablity—Forecast 17 Critical Path Puth Assessment—Forecast 18 Critical Path Puth Assessment—Forecast 19 Critical Path Puth Assessment—Forecast 10 Confirming That The Critical Path is Valid 10 No LoE on Critical Path—Baseline 11 Critical Path Passeline 12 Critical Path Passeline 13 Continuous Critical Path—Forecast 14 Critical Path Reasonably Defined—Baseline 15 Continuous Critical Path—Forecast 16 Critical Path Reasonable Total Float—Saseline 17 Ensurant Path—Forecast 18 Critical Path Path—Forecast 19 Critical Path—Forecast 20 Reasonable Total Float—Forecast 21 Reasonable Total Float—Forecast 22 Reasonable Total Float—Forecast 23 Reasonable Total Float—Forecast 24 Reasonable Total Float—Forecast 25 Reasonable Total Float—Forecast 26 SM Linkage—Baseline 27 SM Darinton Consistent with Risk—Forecast 28 SM Darinton Consistent with Risk—Forecast 29 Updating the Schedule Using Actual Firstsh Date—Forecast 29 Status Reliablity—Forecast 20 Status Reliablity—Forecast 21 Status Reliablity—Forecast 22 Status Reliablity—Forecast 23 Status Reliablity—Forecast 24 Status Reliablity—Forecast 25 Status Reliablity—Forecast 26 Status Reliablity—Forecast 27 Status Reliablity—Forecast 28 Status Reliablity—Forecast 29 Forecast Versus Baseline Activity Count 20 Forecast Versus Baseline Activity Count 20 Forecast Versus Baseline Activity Count 20 Forecast Versus Baseline Activity Count		
40 No SVTs with Resources—Forecast 41 Adequate Resource Loading—Forecast 42 No SM Resources—Forecast 43 No SM Resources—Forecast 44 Establishing the Duration of All Activities 45 Minimize Duration—Baseline 46 Simple Part of Part o		
41 Adequate Resource Loading—Forecast 42 No SM Resources—Forecast 4 Establishme the Duration of All Activities 15 Minimize Duration—Baseline 21 Minimize Duration—Baseline 22 International State of Stat		
42 No SM Resources—Forecast 4 Establishing the Darasino 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 Push Assessment—Baseline 24 Vertical Traceability—Baseline 24 Vertical Traceability—Baseline 25 Subcontractor Vertical Traceability—Forecast 26 Supplemental Vertical Traceability—Forecast 27 Critical Path Push Assessment—Forecast 28 Critical Path Push Assessment—Forecast 29 Critical Path Push Assessment—Forecast 20 No LOE on Critical Path—Baseline 20 No LOE on Critical Path—Baseline 21 Continuous Critical Path—Baseline 22 Critical Path Pash—Baseline 23 Continuous Critical Path—Forecast 24 Critical Path Path—Forecast 25 Continuous Critical Path—Forecast 26 Continuous Critical Path—Forecast 27 Critical Path Path—Forecast 28 Reasonable Total Float—Baseline 29 Reasonable Total Float—Baseline 20 SM Linkage—Baseline 21 Reasonable Total Float—Forecast 22 Sincanable Total Float—Forecast 23 SM Duration Consistent with Risk—Forecast 24 Sincanable Total Float—Forecast 25 SM Duration Consistent with Risk—Forecast 26 SM Linkage—Baseline 27 Shatus Reliability—Forecast 28 SM Linkage—Forecast 29 Updating the Schedule Using Actual Progress and Logic 29 Physical Complete with No Actual Finish Date—Forecast 29 Status Reliability—Forecast 20 Status Reliability—Forecast 21 Status Reliability—Forecast Activity Count 20 Forecast Versus Baseline Actual Finish Date—Forecast 20 Forecast Versus Baseline Actual Finish Date—Forecast 21 Status Reliability—Forecast 22 Status Reliability—Forecast 23 Status Reliability—Forecast 24 Status Reliability—Forecast 25 Status Reliability—Forecast 26 Forecast Versus Baseline Activity Count 27 Forecast Versus Baseline Activity Count 28 Forecast Versus Baseline Activity Count 29 Forecast Versus Baseline Activity Count		
Batablishing the Duration of All Activities Minimizer Duration—Baseline	42	
21 Minimize Work Packages—Baseline 5. Verifying That the Schoulte Can Bet Traced Horizontally and Vertically 18 Critical Path Path Assessment—Baseline 19 Critical Path Path Assessment—Baseline 24 Vertical Traceablity—Baseline 43 Vertical Traceablity—Baseline 44 Suphemental Vertical Traceablity—Forecast 45 Subcontractor Vertical Traceablity—Baseline 46 Critical Path Path Assessment—Forecast 47 Critical Path Path Assessment—Forecast 48 Critical Path Path Assessment—Forecast 49 Critical Path Path Assessment—Forecast 40 Critical Path Path Assessment—Forecast 41 Critical Path Path Assessment—Forecast 42 Critical Path Path Path Easteline 43 Continuous Critical Path—Baseline 44 Critical Path Reasonabby Defined—Baseline 45 Continuous Critical Path—Baseline 46 Continuous Critical Path—Baseline 47 Critical Path Reasonabby Defined—Forecast 48 Reasonable Total Float—Forecast 49 No LOE on Critical Path—Baseline 20 No LOE on Critical Path—Baseline 21 Reasonable Total Float—Forecast 22 Reasonable Total Float—Forecast 23 Reasonable Total Float—Forecast 24 Reasonable Total Float—Forecast 25 Reasonable Total Float—Forecast 26 SM Linkage—Baseline 27 SM Linkage—Baseline 28 SM Linkage—Forecast 29 Updating the Steedule Using Actual Progress and Logic 29 Physical Complete with No Actual Finish Date—Forecast 29 SM Status Reliabolity—Forecast 20 Status Reliabolity—Forecast 21 Status Reliabolity—Forecast 22 Status Reliabolity—Forecast 23 Sabeline Versus Forecast Activity Count 24 Forecast Versus Baseline Schedule		Establishing the Duration of All Activities
S. Verifying That the Schedule Can Be Traced Horizontally and Vertically 18 Critical Path Publi Assessment—Baseline 24 Vertical Traceability—Baseline 24 Vertical Traceability—Forecast 45 Vertical Traceability—Forecast 46 Supplemental Vertical Traceability—Baseline 47 Vertical Traceability—Forecast 48 Supplemental Vertical Traceability—Baseline 49 Critical Path Publi Assessment—Forecast 40 Critical Path Publi Assessment—Forecast 40 Critical Path Publi Assessment—Forecast 41 Critical Path Publi Assessment—Forecast 42 Critical Path Publi Assessment—Forecast 43 No LoE on Critical Path—Baseline 44 Continuous Critical Path—Baseline 45 Continuous Critical Path—Forecast 46 Continuous Critical Path—Forecast 47 Critical Path Reasonably Defined—Forecast 48 No LoE on Critical Path—Forecast 49 Tensionable Total Float—Baseline 40 September 10 Tensional Path—Forecast 40 September 10 Tensional Path—Forecast 41 Critical Path Reasonable Total Float—Forecast 42 September 10 Tensional Path—Forecast 43 Reasonable Total Float—Forecast 44 September 10 Tensional Path—Forecast 45 September 10 Tensional Path—Forecast 46 September 10 Tensional Path—Forecast 47 Critical Path Reasonable Total Float—Forecast 48 September 10 Tensional Path—Forecast 49 September 10 Tensional Path—Forecast 50 Status Reasonable Total Float—Forecast 51 Status Reasonable Total Float—Forecast 52 Status Reasonable Total Float—Forecast 53 Status Reasonable Total Float—Forecast 54 Physical Complete with No Actual Finish Date—Forecast 55 Status Reasonable—Forecast 56 Actual Status without Physical Percent Complete—Forecast 57 Status Reasonable—Forecast 58 Baseline Versus Forecast Activity Count 59 Forecast Versus Baseline Activity Count 50 Forecast Versus Baseline Activity Count 50 Forecast Versus Baseline Activity Count 50 Forecast Versus Baseline Activity Count 51 Status Reasonable Total Float—Forecast		
18 Critical Path Plank Assessment—Baseline 19 Critical Path Plank Assessment—Baseline 24 Vertical Traceability—Baseline 43 Vertical Traceability—Forecast 44 Supplemental Vertical Traceability—Forecast 45 Subcontractor Vertical Traceability—Forecast 46 Critical Path Plank Assessment—Forecast 47 Critical Path Pull Assessment—Forecast 48 Critical Path Pull Assessment—Forecast 49 Critical Path Pull Assessment—Forecast 40 Continual Path Pull Assessment—Forecast 40 No LOE on Critical Path—Baseline 41 Critical Path Path—Baseline 42 Critical Path Path—Baseline 43 Continuous Critical Path—Baseline 44 Critical Path Reasonably Defined—Baseline 45 Continuous Critical Path—Baseline 46 Continuous Critical Path—Baseline 47 Critical Path Reasonably Defined—Forecast 48 Critical Path—Baseline 49 No LOE on Critical Path—Forecast 40 No LOE on Critical Path—Forecast 41 Reasonable Total Float—Baseline 41 Reasonable Total Float—Baseline 42 Reasonable Total Float—Baseline 43 Reasonable Total Float—Baseline 44 Substance Baseline 45 SM Linkage—Baseline 46 SM Linkage—Baseline 47 Sin Linkage—Baseline 48 SM Linkage—Forecast 49 Lydaning the Schedule Using Actual Progress and Logic 40 Physical Complete with No Actual Finish Date—Forecast 41 Status Reliability—Forecast 42 Status Reliability—Forecast 43 Satus Reliability—Forecast 44 Substance Versis Forecast Activity Count 45 Forecast Versis Baseline Activity Count 46 Forecast Versis Baseline Activity Count 47 Forecast Versis Baseline Activity Count 48 Path Status Reliability—Forecast 48 Satus Reliability—Forecast 49 Forecast Versis Baseline Activity Count 40 Forecast Versis Baseline Activity Count 40 Forecast Versis Baseline Activity Count 41 Path Status Path Path Status Pat		
19 Critical Path Path Assessment—Baseline 24 Vertical Traceability—Baseline 35 Vertical Traceability—Forecast 46 Supplemental Vertical Traceability—Forecast 47 Supplemental Vertical Traceability—Baseline 48 Critical Path Path Assessment—Forecast 49 Critical Path Path Assessment—Forecast 6 Confirming That The Critical Path is Valid 20 No LOE on Critical Path—Baseline 21 Critical Path Reasonably Defined—Baseline 22 Critical Path Reasonably Defined—Baseline 23 Continuous Critical Path—Baseline 24 Continuous Critical Path—Forecast 25 No LOE on Critical Path—Forecast 26 Critical Path Reasonably Defined—Forecast 27 Critical Path Reasonably Defined—Forecast 28 Reasonable Total Float—Baseline 29 Reasonable Total Float—Gorecast 19 Reasonable Total Float—Gorecast 10 Reasonable Total Float—Gorecast 10 SM Linkage—Baseline 20 SM Linkage—Baseline 21 SM Linkage—Forecast 22 SM Duration Consistent with Risk—Forecast 23 SM Linkage—Forecast 24 Physical Complete with No Actual Finish Date—Forecast 25 Status Realishity—Forecast 26 Actual Start without Physical Percent Complete—Forecast 27 Status Realishity—Forecast 28 Baseline Versus Forecast Activity Count 29 Forecast Versus Baseline Actual Finish Date—Forecast 38 Baseline Versus Forecast Activity Count 39 Forecast Versus Baseline Activity Count		
24 Vertical Traceability—Forecast 43 Vertical Traceability—Forecast 44 Supplemental Vertical Traceability—Forecast 45 Subcountactor Vertical Traceability—Baseline 46 Critical Path Publ Assessment—Forecast 49 Critical Path Publ Assessment—Forecast 40 Critical Path Publ Assessment—Forecast 40 No LOE on Critical Path—Baseline 41 Critical Path Path—Baseline 42 Critical Path Path—Baseline 43 Continuous Critical Path—Baseline 44 Critical Path Resonably Defined—Baseline 45 Continuous Critical Path—Forecast 46 Continuous Critical Path—Forecast 47 Critical Path Resonably Defined—Forecast 48 Resonable Total Float—Baseline 49 Resonable Total Float—Baseline 40 Resonable Total Float—Baseline 41 Resonable Total Float—Borecast 42 Resonable Total Float—Borecast 43 SM Linkage—Baseline 44 SM Linkage—Baseline 45 SM Linkage—Baseline 46 SM Linkage—Baseline 47 Physical Complete with No Actual Finish Date—Forecast 48 Physical Complete with No Actual Finish Date—Forecast 49 Physical Complete with No Actual Finish Date—Forecast 40 Actual Start without Physical Percent Complete—Forecast 41 Status Reliability—Forecast 42 Status Reliability—Forecast 43 Status Reliability—Forecast 44 Status Reliability—Forecast 45 Status Reliability—Forecast 46 Status Reliability—Forecast 47 Status Reliability—Forecast 48 Status Reliability—Forecast 49 Forecast Versus Baseline Activity Count 40 Forecast Versus Baseline Activity Count 40 Forecast Versus Baseline Activity Count 41 Dissimilaring a Baseline Schedule		
44 Supplemental Vertical Traceability—Baseline 45 Subcontractor Vertical Traceability—Baseline 46 Critical Path Publ Assessment—Forecast 49 Critical Path Publ Assessment—Forecast 40 Continual Path Publ Assessment—Forecast 40 No LOE on Critical Path—Baseline 41 Critical Path Publ Assessment—Forecast 42 Critical Path Resonably Defined—Baseline 43 Continuous Critical Path—Baseline 44 Critical Path Resonably Defined—Forecast 45 Continuous Critical Path—Forecast 46 Continuous Critical Path—Forecast 47 Critical Path Resonably Defined—Forecast 48 Resonable Total Float—Forecast 49 Resonable Total Float—Baseline 40 SM Linkage—Baseline 41 Resonable Total Float—Forecast 42 SM Linkage—Baseline 43 SM Duration Consistent with Risk—Forecast 44 SM Linkage—Forecast 45 SM Linkage—Forecast 46 Physical Complete with No Actual Finish Date—Forecast 47 Physical Complete with No Actual Finish Date—Forecast 48 SM Linkage—Forecast 49 Status Reliability—Forecast 40 Status Reliability—Forecast 41 Status Reliability—Forecast 41 Status Reliability—Forecast 42 Status Reliability—Forecast 43 Status Reliability—Forecast 44 Status Reliability—Forecast 45 Status Reliability—Forecast 46 Status Reliability—Forecast 47 Status Reliability—Forecast 48 Status Reliability—Forecast 49 Forecast Versus Baseline Activity Count 40 Forecast Versus Baseline Activity Count 40 Forecast Versus Baseline Activity Count 41 Dissimilaring a Status Reliability—Forecast 41 Status Reliability—Forecast 42 Status Reliability—Forecast 43 Status Reliability—Forecast 44 Status Status Reliability—Forecast Sta	18	Critical Path Push Assessment—Baseline
45 Subcontractor Vertical Traceability—Baseline 48 Critical Path Pubh Assessment—Forecast 49 Critical Path Pubh Assessment—Forecast 60 Continual Path Pubh Assessment—Forecast 61 Confirming That The Critical Path is Valid 62 No LOE on Critical Path—Baseline 62 Critical Path Reasonably Defined—Baseline 63 Continuous Critical Path—Baseline 64 Continuous Critical Path—Baseline 65 Continuous Critical Path—Baseline 66 Continuous Critical Path—Forecast 67 Critical Path Reasonably Defined—Forecast 68 No LOE on Critical Path—Forecast 69 No LOE on Critical Path—Forecast 70 Reasonable Total Float—Baseline 61 Reasonable Total Float—Baseline 62 Reasonable Total Float—Forecast 63 SM Linkage—Baseline 64 SM Linkage—Baseline 65 SM Linkage—Forecast 65 SM Linkage—Forecast 66 Paysical Complete with No Actual Finish Date—Forecast 66 Paysical Complete with No Actual Finish Date—Forecast 67 Status Reliability—Forecast 68 Baseline Versus Forecast Activity Count 69 Forecast Versus Baseline Asseline Staeline Versus Forecast Activity Count 61 Forecast Versus Baseline Asseline Schedule	18 19	Critical Path Push Assessment—Baseline Critical Path Pull Assessment—Baseline
48 Critical Path Path Assessment—Forecast 49 Critical Path Path Assessment—Forecast Confirming That The Critical Path is Valid 20 No LoE on Critical Path—Baseline 21 Critical Path Resonably Defined—Baseline 22 Critical Path Resonably Defined—Baseline 23 Continuous Critical Path—Baseline 24 Continuous Critical Path—Baseline 25 Continuous Critical Path—Forecast 26 No LoE on Critical Path—Forecast 27 Ensuring Resonable Total Float—Baseline 27 Resonable Total Float—Baseline 28 Resonable Total Float—Baseline 29 SM Linkage—Baseline 20 SM Linkage—Baseline 20 SM Linkage—Baseline 21 SM Daration Consistent with Risk—Forecast 23 SM Linkage—Forecast 24 Physical Complete with No Actual Finish Date—Forecast 25 Status Reliability—Forecast 26 Status Reliability—Forecast 27 Status Reliability—Forecast 28 Baseline Versus Forecast Activity Count 29 Forecast Versus Baseline Asseline Versus Forecast Activity Count 29 Forecast Versus Baseline Activity Count 20 Forecast Versus Baseline Activity Count 20 Status Reliability—Forecast 21 Salesine Versus Forecast Activity Count 21 Salesine Activity Count 21 Salesine Activity Count 21 Salesine Activity Count 22 Salesine Activity Count 23 Salesine Activity Count	18 19 24 43	Critical Path Push Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast
Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Breecast Critical Path Reasonably Defined—Forecast No LOE on Critical Path—Forecast Reasonable Total Float—Baseline Reasonable Total Float—Baseline Secondable Total Float—Baseline Reasonable Total Float—Baseline Reasonable Total Float—Forecast Reasonable Total Float—Forecast Scondacting a Schedule Risk Analysis Sha Linkage—Baseline Sha Linkage—Baseline—Forecast Sha Linkage—Baseline—Fo	18 19 24 43 44	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast
Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Breecast Critical Path Reasonably Defined—Forecast No LOE on Critical Path—Forecast Reasonable Total Float—Baseline Reasonable Total Float—Baseline Secondable Total Float—Baseline Reasonable Total Float—Baseline Reasonable Total Float—Forecast Reasonable Total Float—Forecast Scondacting a Schedule Risk Analysis Sha Linkage—Baseline Sha Linkage—Baseline—Forecast Sha Linkage—Baseline—Fo	18 19 24 43 44 45	Critical Path Puth Assessment—Baseline Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline
20 No LOE on Critical Path—Baseline 22 Critical Path Resonably Defined—Baseline 23 Continuous Critical Path—Baseline 46 Continuous Critical Path—Baseline 47 Critical Path Resonably Defined—Forecast 50 No LOE on Critical Path—Forecast 7. Ensuring Reasonable Total Float 25 Reasonable Total Float—Baseline 51 Reasonable Total Float—Baseline 52 Reasonable Total Float—Borecast 53 SM Linkage—Baseline 54 SM Linkage—Baseline 55 SM Duration Consistent with Risk—Forecast 56 SM Linkage—Forecast 57 Updating the Schedule Using Actual Progress and Logic 58 Physical Complete with No Actual Finish Date—Forecast 59 Status Out of Sequence—Forecast 50 Actual Start without Physical Percent Complete—Forecast 51 Status Reliability—Forecast 52 Status Reliability—Forecast 53 Baseline Versus Forecast Activity Count 54 Forecast Versus Baseline Actual Finish Date—Forecast 55 Baseline Versus Forecast Activity Count 56 Forecast Versus Baseline Activity Count 57 Forecast Versus Baseline Activity Count 58 Forecast Versus Baseline Activity Count	18 19 24 43 44 45 48	Critical Path Puth Assessment—Baseline Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline
22 Critical Path Reasonably Defined—Baseline 23 Continuous Critical Path—Baseline 46 Continuous Critical Path—Baseline 47 Critical Path Reasonably Defined—Forecast 48 Continuous Critical Path—Forecast 50 No LOE on Critical Path—Forecast 7. Ensuring Reasonable Total Float— 25 Reasonable Total Float—Baseline 26 Reasonable Total Float—Forecast 8. Conducting a Schedule Risk Analysis 26 SM Linkage—Baseline 27 SM Duration Consistent with Risk—Forecast 28 SM Duration Consistent with Risk—Forecast 29 SM Duration Consistent with Risk—Forecast 29 Updating the Schedule Using Actual Progress and Logic 29 Physical Complete with No Actual Finish Date—Forecast 29 Status Reasonable—Forecast 29 Status Reasonable—Forecast 29 Status Reasonable—Forecast 20 Status Reasonable—Forecast 20 Status Reasonable—Forecast 20 Status Reasonable—Forecast 20 Status Reasonable—Forecast 21 Status Reasonable—Forecast 22 Status Reasonable—Forecast 23 Baseline Versus Forecast Activity Count 24 Forecast Versus Baseline Activity Count 25 Forecast Versus Baseline Activity Count 26 Status Reasonable—Forecast 27 Status Reasonable—Forecast 28 Baseline Versus Forecast Activity Count 29 Forecast Versus Baseline Activity Count	18 19 24 43 44 45 48	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast
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47 Critical Path Reasonably Defined—Forecast 50 No LOE on Critical Path—Forecast 7. Ensuring Reasonable Total Float 25 Reasonable Total Float—Baseline 15 Reasonable Total Float—Baseline 16 Reasonable Total Float—Forecast 8. Conducting a Schedule Risk Analysis 26 SM Linkage—Baseline 27 SM Duration Consistent with Risk—Forecast 28 SM Duration Consistent with Risk—Forecast 29 Updating the Schedule Using Actual Progress and Logic 40 Physical Complete with No Actual Finish Date—Forecast 55 Statused Out of Sequence—Forecast 56 Actual Start without Physical Percent Complete—Forecast 57 Status Reability—Forecast 58 Baseline Versus Forecast Activity Count 59 Forecast Versus Baseline Activity Count 10 Maintaining a Baseline Schedule	18 19 24 43 44 45 48 49	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Suplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast Critical Path Path Forecast Critical Path Path Forecast No LOG on Critical Path—Baseline
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7. Ensuring Reasonable Total Float 25 Reasonable Total Float—Saseline 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 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 Realishity—Forecast 58 Baseline Versus Forecast Activity Count 59 Forecast Versus Baseline Activity Count 10 Maintaining a Baseline Schedule	18 19 24 43 44 45 48 49 20 22 23 46	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast 6. Confirming That The Critical Path Baseline Critical Path Path Assessment—Forecast No LOB on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Forecast
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51 Reasonable Total Float—Forecast 8. Conducting a Schedule Risk Analysis 26 SM Linkage—Baschien 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 Baschine Versus Forecast Activity Count 59 Forecast Versus Baschine Activity Count 10 Maintaining a Baschine Schedule	18 19 24 43 44 45 48 49 20 22 23 46 47	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Pull Assessment—Forecast Critical Path Pull Assessment—Forecast Onical Path Pull Assessment—Forecast Critical Path Reaconably Defined—Baseline Critical Path Reaconably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Forecast Critical Path Reaconably Defined—Forecast No LOE on Critical Path—Forecast Critical Path Reaconably Defined—Forecast No LOE on Critical Path—Forecast
S. Conducting a Schedule Risk Analysis SM Linkage—Baseline SM Duration Consistent with Risk—Forecast SM Duration Experiment of the State of the	18 19 24 43 44 45 48 49 20 22 23 46 47 50	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast 6. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Forecast Critical Path Reasonably Defined—Baseline Continuous Critical Path—Forecast Critical Path Reasonably Defined—Forecast 7. Ensuring Reasonable Total Floor 7. Ensuring Reasonable Total Floor
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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 Relability—Forecast 58 Baseline Versus Forecast Activity Count 59 Forecast Versus Baseline Activity Count 10. Maintaining a Baseline Schedule	18 19 24 43 44 45 48 49 20 22 23 46 47 50	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Suplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Pull Assessment—Forecast 6. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Forecast Critical Path Reasonably Defined—Forecast No LOE on Critical Path—Forecast 7. Ensuring Reasonable Total Float Reasonable Total Float—Baseline Reasonable Total Float—Baseline Reasonable Total Float—Forecast Path Reasonable Total Float Reasonable Total Float—Forecast Reasonable Total Float—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	18 19 24 43 44 45 48 49 20 22 22 23 46 47 50	Critical Path Puth Assessment—Baseline Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Suplemental Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast 6. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Resonably Defined—Baseline Continuous Critical Path—Baseline Total Path—Forecast 7. Ensuring Reasonable Total Float Reasonable Total Float—Forecast Reasonable Total Float—Forecast S. Conducting a Schedule Risk Analysis
9. Updating the Schedule Using Actual Prospess 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	18 19 24 43 44 45 48 49 20 22 23 34 46 47 50	Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast O. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Forecast Critical Path Reasonably Defined—Forecast On LOE on Critical Path—Forecast 7. Ensuring Reasonable Total Float Reasonable Total Float—Forecast 8. Conducting a Schedule Risk Analysis SM Linkage—Baseline
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	18 19 24 43 44 45 48 49 20 22 23 46 47 50 25 51	Critical Path Puth Assessment—Baseline Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast 6. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Puth—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Romanuble Total Flow—Forecast 7. Ensuring Reasonable Total Flow—Forecast Reasonable Total Flow—Forecast 8. Conducting a Schedule Risk Analysis SM Linkage—Baseline SM Duration Consistent with Risk—Forecast SM Duration Consistent with Risk—Forecast
55 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	18 19 24 43 44 45 48 49 20 22 23 46 47 50 25 51	Critical Path Puth Assessment—Baseline Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast 6. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Routed Path—Forecast No LOE on Critical Path—Baseline Reasonable Total Float—Forecast 8. Conducting a Schedule Risk Analysis SM Linkage—Baseline SM Linkage—Baseline SM Linkage—Forecast SM Linkage—Forecast 9. Upotating the Schedule Using Actual Progress and Logic
57 Status Reliability—Forecast 58 Baseline Versus Forecast Activity Count 59 Forecast Versus Baseline Activity Count. 10 Maintaining a Baseline Schedule	18 19 24 43 44 45 48 49 20 22 23 46 47 50 25 51 51 52 53	Critical Path Puth Assessment—Baseline Critical Path Pull Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast On Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Forecast Critical Path Reasonably Defined—Forecast No LOE on Critical Path—Forecast No LOE on Critical Path—Forecast Reasonable Total Float—Forecast Reasonable Total Float—Forecast S. Conducting a Schedule Risk Analysis SM Linkage—Baseline SM Duration Consistent with Risk—Forecast SM Linkage—Forecast 9. Updating the Schedule Using Actual Progress and Logic Physical Complete with No Actual Finish Date—Forecast
58 Baseline Versus Forecast Activity Count 59 Forecast Versus Baseline Activity Count 10 Maintaining a Baseline Schedule	18 19 24 43 44 45 48 49 20 22 22 23 46 47 50 25 51	Critical Path Puth Assessment—Baseline Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast 6. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Forecast No LOE on Critical Path—Forecast No LOE on Critical Path—Forecast 7. Ensuring Reasonable Total Float Reasonable Total Float—Forecast 8. Conducting a Schedule Risk Analysis SM Linkage—Forecast SM Linkage—Forecast SM Linkage—Forecast SM Linkage—Forecast O Updating the Schedule Using Actual Progress and Logic Physical Complete with No Actual Finish Date—Forecast Statused Out of Sequence—Forecast
59 Forecast Versus Baseline Activity Count. 10. Maintaining a Baseline Schedule	18 19 24 43 44 45 48 49 20 22 23 46 47 50 25 51	Critical Path Puth Assessment—Baseline Vertical Traceability—Baseline Vertical Traceability—Baseline Vertical Traceability—Baseline Vertical Traceability—Forecast Supplemental Vertical Traceability—Forecast Subcontractor Vertical Traceability—Baseline Critical Path Puth Assessment—Forecast Critical Path Puth Assessment—Forecast 6. Confirming That The Critical Path is Valid No LOE on Critical Path—Baseline Critical Path Reasonably Defined—Baseline Continuous Critical Path—Baseline Continuous Critical Path—Forecast No LOE on Critical Path—Forecast 7. Ensuring Reasonable Total Float Reasonable Total Float—Forecast 8. Conducting a Schedule Risk Analysis SM Linkage—Baseline 8. Conducting a Schedule Risk Analysis SM Linkage—Baseline SM Durathon Consistent with Risk—Forecast SM Linkage—Forecast 9. Updating the Schedule Using Actual Progress and Logic Physical Complete with No Actual Finish Date—Forecast Statused Out of Sequence—Forecast Actual Start without Physical Forect Complete—Forecast
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Assessment: Complete the assessments in Table 6 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.

Well, that's it for this month, but there is more to come in the next edition of the Practitioner when we continue to with the Planning and Scheduling Special Topics Section where we will look at:

- Integration of Risk Management into the Schedule
- Level of Effort
- Schedule Margin and DOE Schedule Contingency in an IMS

And more...see you next month!

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Just for Fun: October's Notable Events and Famous Birthdays

Notable Events

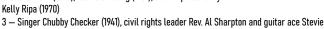
- 1 Yosemite National Park was established (1890), the first World Series game was played (1903), the first Ford Model T was introduced (1908), the People's Republic of China was established (1949), American Express issued the first credit card in the U.S. (1958), Roger Maris broke Babe Ruth's single-season home run record with his 61st (1961), and 58 people were killed in a mass shooting in Las Vegas (2017).
- 2 The Texas Revolution began (1835), Thurgood Marshall was sworn in as the first African-American Supreme Court justice (1967), Bob Gibson set the World Series single-game strikeout record with 17 (1968), and actor Rock Hudson died of AIDS (1985).
- 3 Thanksgiving became an official holiday (1863), Iraq became an independent nation (1932), Britain successfully tested an atomic bomb (1952), the "Guinness Book of World Records" made its debut (1955), East and West Germany were reunited (1990), and O.J. Simpson was acquitted of
- 4 Construction of Mount Rushmore began (1927), the Brooklyn Dodgers won their first and only World Series title (1955), the Soviet Union launched Sputnik, the first artificial satellite, into orbit (1957), and Pope Paul VI became the first pope to visit the U.S. (1965).
- 5 President Harry Truman delivered the first televised presidential speech (1947), the New York Yankees won a record fifth consecutive World Series title (1953), the first NC-17 film rating was given for Henry & June (1990), and Apple founder Steve Jobs died (2011).



- 6 The first train robbery in the U.S. was staged (1866), and the Yom Kippur War between Israel and Egypt/Syria began (1973).
- 7- The assembly line made its debut in a Ford factory (1913), East Germany was established (1949), and Operation Enduring Freedom began in Afghanistan (2001).
- 8 The Great Chicago Fire began (1871), Don Larsen pitched the only perfect game in World Series history (1956), and impeachment proceedings against President Bill Clinton began (1998). 9 - Hoover Dam began transmitting electricity (1936).
- 10 The U.S. Naval Academy was established (1845), and the first major operation of the Vietnam War began (1965).
- 11 The first manned Apollo mission launched (1968), and Saturday Night Live debuted (1975).
- 12 Christopher Columbus reached the New World (1492).
- 13 The Continental Navy was established (1775), the cornerstone of the White House was laid (1792), and Bill Mazeroski hit the first ever World Series-winning walkoff home run (1960).
- 14 USAF Capt. Chuck Yeager broke the sound barrier (1947), and the Cuban Missile Crisis began (1962).
- 15 Wayne Gretzky broke the NHL career scoring record with 1,851
- 16 China successfully tested its first nuclear bomb (1964), "Baby Jessica" was rescued from a well on live TV (1987), and 84 people died in a stampede at a World Cup match in Guatemala (1996).
- 17 OPEC enacted an oil embargo on the U.S. and other nations (1973), and a 7.1 magnitude earthquake hit the Bay Area, postponing Game 3 of the World Series for 10 days (1989). 18 — The Mason-Dixon Line was established (1767), and the U.S. took possession of Alaska (1867)
- and Puerto Rico (1898). 19 — The American Revolutionary War ended with the British surrender at Yorktown, Va. (1781), and Maurice Richard became the first NHL player to score 500 goals (1957).
- 20 The Louisiana Purchase was ratified (1803), and three members of the rock band Lynyrd Skynyrd died in a plane crash (1977).
- 21 About 100,000 antiwar protesters marched on the Pentagon (1967).
- 22 The U.S. suffered its first casualties in Vietnam (1957), President John F. Kennedy ordered a blockade of Cuba (1962), and Lance Armstrong was stripped of his 7 Tour de France titles (2012).
- 23 A car bomb exploded at the U.S. Marines barracks in Beirut, Lebanon, killing 241 (1983).
- 24 The first transcontinental telegraph line was completed (1861), the United Nations was formally established (1945), Toronto won Canada its first World Series title (1992), and the supersonic Concorde jet made its last flight (2003).
- 25 Artist Pablo Picasso was born (1881), and the U.S. invaded Grenada (1983).
- 26 The Erie Canal opened (1825), the Shootout at the OK Corral occurred (1881), and President George W. Bush signed the Patriot Act (2001).
- 27 New York's subway system began operation (1904), the Cuban Missile Crisis ended (1962), and the Boston Red Sox won their first World Series title in 86 years (2004).
- 28 The Statue of Liberty was dedicated (1886), Congress overruled President Wilson's veto and enacted Prohibition (1919),
- and the Digital Millennium Copyright Act was signed (1998). 29 — The stock market crashed, touching off the Great Depression (1929), the Suez Crisis began when Israel invaded Egypt (1956), and guitarist Duane Allman died in a motorcycle crash (1971),
- 30 "The War of the Worlds" was broadcast, causing a nationwide panic (1938), and Muhammad Ali beat George Foreman for the heavyweight title in the "Rumble in the Jungle" (1974).
- 31 Nevada became a state (1864), magician/escape artist Harry Houdini died (1926), Earl Lloyd broke the color line in the NBA (1950), and Indian prime minister Indira Gandhi was assassinated (1984).

Birthdays

- 1 Actor Walter Matthau (1920), 39th U.S. President Jimmy Carter (1924), actress/singer Julie Andrews (1935), and actors Randy Quaid (1950) and Zach Galifianakis (1969)
- 2 Civil rights leader Mahatma Gandhi (1869), entertainer Groucho Marx (1890), rock star Sting (1951), and TV personality Kelly Ripa (1970)



Ray Vaughan (1954), and singer Gwen Stefani (1969) 4 – 19th U.S. President Rutherford B. Hayes (1822), actor Charlton Heston (1924), author Anne

Rice (1941), and actresses Susan Sarandon (1946) and Alicia Silverstone (1976)

5 - 21st U.S. President Chester Arthur (1829), fast food entrepreneur Ray Kroc (1902), astronomer Neil deGrasse Tyson and actor/comedian Bernie Mac (1958), and actress Kate Winslet

- 6 Actresses Carole Lombard (1942) and Elisabeth Shue (1963)
- 7 Rock singer John Mellencamp (1951), Russian president Vladimir Putin (1952), cellist Yo-Yo Ma (1955), music judge Simon Cowell (1959), and actress Rachel McAdams (1976)
- 8 Automobile inventor Frank Duryea (1869), civil rights leader Rev. Jesse Jackson (1941), actor Chevy Chase (1943), actress Sigourney Weaver (1949), and actor Matt Damon (1970)
- 9 Musician John Lennon (1940), and actors Scott Bakula and John O'Hurley (1954)
- 10 Rock singer David Lee Roth (1955), football hall of famer Brett Favre (1969), and stock car racer Dale Earnhardt Jr. (1974)
- 11 First lady Eleanor Roosevelt (1884), singer Daryl Hall (1946), football hall of famer Steve Young (1961), and actress Joan Cusack (1962)
- 12 Opera singer Luciano Pavarotti (1935), and actors Hugh Jackman (1968) and Kirk Cameron (1970)
- 13 Jazz pianist Art Tatum (1909), comedian Lenny Bruce and British prime minister Margaret Thatcher (1925), singer/songwriter Paul Simon (1941), rocker Sammy Hagar (1949), singer Marie Osmond (1959), football hall of famer Jerry Rice (1962), and actor/ comedian Sacha Baron Cohen (1971)
- 14 General and 34th U.S. President Dwight Eisenhower (1890), actor Roger Moore (1927), fashion designer Ralph Lauren (1934), and rapper/singer Usher (1979)
- 15 Philosopher Nietzche (1844), and British royal Sarah Ferguson and TV chef Emeril Lagasse (1959)
- 16 Dictionary author Noah Webster (1758), playwright Oscar Wilde (1854), and actresses Angela Lansbury (1925) and Suzanne Somers (1946)
- 17 Actress Rita Hayworth (1918), motorcycle daredevil Evel Knievel (1938), actor George Wendt (1948), country singer Alan Jackson (1958), comedian Norm MacDonald (1963), and rapper Eminem (1972)
- 18 Rocker Chuck Berry (1926), football hall of famer Mike Ditka and JFK assassin Lee Harvey Oswald (1939), tennis legend Martina Navratilova (1956), Olympic skier Lindsey Vonn (1984), and actor Zac Efron (1987)
- 19 Actors John Lithgow (1945) and Jon Favreau (1966)
- 20 Actor Bela Lugosi (1882), baseball Hall of Famer Mickey Mantle (1931), rocker Tom Petty (1953), and rapper Snoop Dogg (1972)
- 21 Jazz trumpeter Dizzy Gillespie (1917), Israeli prime minister Benjamin Netanyahu (1949), actress Carrie Fisher (1956), and celebrity Kim Kardashian (1980)
- 22 Actors Christopher Lloyd (1938) and Jeff Goldblum (1952)
- 23 TV personality Johnny Carson (1925), soccer legend Pele (1940), singer Dwight Yoakam (1956), musical parodist Weird Al Yankovic
- (1959), and actor Ryan Reynolds (1976)
- 24 Author Stephen Covey (1932)
- 25 Artist Pablo Picasso (1881), hall of fame basketball coach Bobby Knight (1940), and singers Jon Anderson (1944) and Katy Perry (1984)
- 26 TV game show host Pat Sajak and politician Hillary Clinton (1947), and actor Dylan McDermott (1962)
- 27 26th U.S. President Theodore Roosevelt (1858)
- 28 Musician Charlie Daniels (1936), Microsoft co-founder Bill Gates (1955), and actress Julia **Roberts (1967)**
- 29 Actor Richard Drevfuss (1947), actress Winona Ryder (1971)
- 30 2nd U.S. President John Adams (1735), singer Grace Slick (1939), and actor Henry Winkler (1945)
- 31 Actor Michael Landon (1936), actor John Candy (1950), football coach Nick Saban (1951), actor Rob Schneider (1963), and rapper Vanilla Ice (1967)





