



GSDO Schedule Health Metrics

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Study Recommendation



- ❑ With the implementation of cost & schedule joint analysis, two new schedule products have been introduced—the analysis schedule and the JCL model
- ❑ Analysis schedules are built differently and have separate objectives from the “business-as-usual” schedule—some of the metrics used on one may not be applicable to the other
- ❑ This study recommends a specific set of criteria to be used for each product—not a comprehensive list—yet it gets the dialogue started that the Health Check metrics are not a "one size fits all" solution



Value of Schedule Health Checks



- ❑ Schedule Health Checks help validate scheduling best practices
 - ❑ Minimal standards or recommended metrics exist for JCL models
 - ❑ Current guidelines designed primarily focus on detailed schedules

- ❑ Schedule Health Check Study initiated to determine appropriate best practice metrics for JCL analysis schedule
 - ❑ Evaluate the current schedule assessment guidelines and JCL modeling application in the industry to determine what metrics are used to assess schedule health
 - ❑ Group the metrics into the GAO Best Practice Areas and assess consistency across the guidelines/tools
 - ❑ Recommend the health check metrics for GSDO use in evaluating schedules at different levels of fidelity and purposes (e.g., detail schedules, IMS, analysis schedules, JCL models)



GAO Schedule Best Practice Metrics



- ❑ GAO conducts Best Practices Reviews to identify public and private sector organizations that are widely recognized for major improvements in their performance in a specific area, such as scheduling
 - ❑ The processes, practices, and systems identified in these organizations are identified as best practices and provide a model for other organizations with similar functions and/or missions
 - ❑ GAO develops Best Practices Methodologies by studying these processes, practices, and systems and coordinating with industry practitioners and stakeholders to create a framework for assessing similar programs, operations, or functions
- ❑ In May 2012, the GAO published GAO published an exposure draft for the GAO Schedule Assessment Guide (GAO-12-120G)
 - ❑ GAO identified ten (10) best practice areas in the GAO Schedule Assessment Guide, outlined in the next slide
- ❑ GAO guidelines are broader than DCMA
 - ❑ DCMA focuses primarily on EVM
 - ❑ As such, GAO was determined to be a good foundation for establishing the areas for metrics to be identified

GAO Handbook still DRAFT

Best Practice #	Best Practice Area	Best Practice Description
GAO – 1	Activity Capture	The schedule should reflect all activities as defined in the project's work breakdown structure (WBS)
GAO – 2	Activity Sequencing	The schedule should be planned so that critical project dates can be met (activities need to be logically sequenced)
GAO – 3	Resource Assignment	The schedule should reflect the resources needed to do the work
GAO – 4	Duration Establishment	The schedule should realistically reflect how long each activity will take
GAO – 5	Vertical and Horizontal Traceability	Detailed schedule should be horizontally traceable - should link products and outcomes associated with other sequenced activities IMS should be vertically traceable - varying levels of activities and supporting sub-activities can be traced
GAO – 6	Critical Path Validity	The schedule should identify the program critical path
GAO – 7	Float Reasonableness	The schedule should identify reasonable float (or slack) so that the schedule's flexibility can be determined
GAO – 8	Schedule Risk Analysis	Ability to predict the level of confidence in meeting a program's completion date, determine the time contingency needed for a level of confidence, and identify high-priority risks and opportunities via statistical simulation
GAO – 9	Progress Updates	Provide a realistic forecast of start and completion dates for program activities
GAO - 10	Baseline Analysis	The schedule should be continually monitored so as to reveal when forecasted completion dates differ from planned dates and whether schedule variances will affect downstream work



Comparative Analysis of Metrics



- ❑ Health check metrics for five separate tools and guidelines were assessed
 - ❑ GAO Scheduling Best Practices
 - ❑ Identifies best practice areas and metrics/criteria that schedules should meet to be deemed healthy
 - ❑ DCMA 14 Point Assessment
 - ❑ Set of criteria developed by the Defense Contract Management Agency [DCMA] to assess schedule quality
 - ❑ NASA Schedule Test and Assessment Tool (STAT)
 - ❑ Tool developed by MSFC to assist the scheduling community in the identification, measurement, and rating of key credibility indicators contained within a project IMS (only supports MS Project)
 - ❑ Oracle Primavera Risk Analysis (OPRA) Health Check
 - ❑ Utility within the OPRA tool to conduct a health check on a schedule to assess its potential for conducting a schedule risk analysis
 - ❑ Joint Analysis of Cost and Schedule (JACS) Health Checks
 - ❑ Utility within the JACS tool that provides two reports; one report is a DCMA 14 point assessment the other report is a review of over 75 metrics to assess a schedule's suitability for conducting an integrated cost and schedule risk analysis and to verify that data was properly specified within JACS to run the model appropriately



Recommended Health Check Metrics by Product



- ❑ Review the current health check metrics in use for schedules and determine a sub-set that are applicable to Detail Schedules, Analysis Schedules, and JCL Models
 - ❑ Metrics divided into two sub-sections:
 1. Identifies those metrics for which quantifiable values can be generated and check criteria can be identified
 2. Identifies important metrics to review but there should not be any attempt at developing a scoring to rate goodness/healthiness for the metric

Schedule Type	Schedule Objective	Important Factors for Health
Detail Schedule	Provide detailed identification of work effort and progress status for the ongoing effort at the level that the actual work is performed.	Structural integrity, accurately stated, enable tracking to a baseline, alignment with the WBS, granularity in detail and timespans calculation of earned value, and insight into downstream challenges if work slips occur.
Analysis Schedule	Provide a higher level replication of the schedule effort focused on capturing the major work-flows of the project scope with specific emphasis on integration points and work flows leading to deliverables.	Analysis schedules must be structurally sound with solid logic and be accurately stated. For use in SRAs and JCLs the network must be able to move freely without limitations of constraints.
JCL Model	Enables the alignment of project costs and risks so that an integrated cost and schedule risk analysis can be performed.	In addition to factors for an Analysis Schedule a JCL model must have alignment with costs, linked to risks, and proper uncertainty specification.



Health Metrics for Scoring a Schedule



GAO Best Practice Area	Metric	Sub-Metric	GAO Scheduling Best Practices	DCMA 14 Point Assessment	STAT Health Check	Oracle PRA Health Check	JACS Health Check	Detailed Schedule	Analysis Schedule	JCL Model	Included in GSDO
Activity Capture (GAO - 1)											
	<i>Detail</i>										
		Manual Tasks	N	N	Y	N	N	H	H	H	
		Tasks and Milestones Needing Updates	N	N	Y	N	N	H	H	H	
		Constraints Defined Count	Y	Y	Y	Y	Y	H	H	H	
	<i>Milestones</i>										
		Milestone Ratio	Y	Y	Y	N	N	H	H	H	Y
	<i>LOE (Long Duration Tasks Whose Durations are not Affected by a Start and Finish Activity)</i>										
		LOE Count	N	N	N	N	N		H	H	
Activity Sequencing (GAO - 2)											
	<i>Logic</i>										
		No Predecessors	Y	Y	Y	Y	Y	H	H	H	Y
		No Successors	Y	Y	Y	Y	Y	H	H	H	Y
		Summary Task with Predecessor	Y	N	Y	Y	Y	H	H	H	Y
		Summary Task with Successor	Y	N	Y	Y	Y	H	H	H	Y
		Lead (Negative Lag)	Y	Y	N	Y	Y	H	H	H	Y
		Lag	Y	Y	N	Y	Y	H	H	H	Y
	<i>Relationship Count</i>										
		SF Relation	N	Y	N	Y	Y	H	H	H	
	<i>Constraints</i>										
		Start No Later Than	Y	Y	Y	N	Y	H	H	H	
		Finish No Later Than	Y	Y	Y	N	Y	H	H	H	Y
		Must Start On	Y	Y	Y	N	Y	H	H	H	Y
		Must Finish On	Y	Y	Y	N	Y	H	H	H	Y
		Finish No Earlier Than	Y	Y	Y	N	Y	H	H	H	

❑ For the most part, the recommended GAO-1 and GAO-2 Health Checks in the study were found across most of the investigated tools



Health Metrics for Scoring a Schedule



GAO Best Practice Area	Metric	Sub-Metric	GAO Scheduling Best Practices	DCMA 14 Point Assessment	STAT Health Check	Oracle PRA Health Check	JACS Health Check	Detailed Schedule	Analysis Schedule	JCL Model	Included in GSDO
Resource Assignment (GAO - 3)											
	<i>Cost Specification</i>										
		LOE Task with Cost Loading	N	N	N	N	Y			H	
Establishing Durations (GAO - 4)											
	<i>Duration Length</i>										
		Long Duration	Y	Y	N	N	N	H	H	H	Y
	<i>Duration Specification</i>										
		Tasks with Estimated Duration	N	N	Y	N	Y	H	H	H	
Critical Path Validity (GAO - 6)											
	<i>Critical Tasks</i>										
		Critical Path Test	N	Y	Y	N	N	H	H	H	
		LOE tasks on Critical path	Y	N	N	N	N	H	H	H	Y
Float Reasonableness (GAO - 7)											
	<i>Long Float</i>										
		High Float Tasks (Long Total Float Tasks)	N	Y	N	N	Y	H	H	H	Y
	<i>Short and negative Float</i>										
		Negative Float Tasks	Y	Y	N	N	N	H	H	H	Y

GAO-5 metrics not recommended for scoring a schedule's health



Health Metrics for Scoring a Schedule



GAO Best Practice Area	Metric	Sub-Metric	GAO Scheduling Best Practices	DCMA 14 Point Assessment	STAT Health Check	Oracle PRA Health Check	JACS Health Check	Detailed Schedule	Analysis Schedule	JCL Model	Included in GSDO
Schedule Risk Analysis (GAO - 8)											
<i>Duration Uncertainty - Inputs</i>											
		Actual Finish Declared With Uncertainty	N	N	N	N	Y			H	
		Duration Without Uncertainty (in-Progress or Future)	Y	N	N	N	Y			H	
		Hammock With Duration Uncertainty	N	N	N	N	Y			H	
		Uncertainty on non-Hammock LOE Task	N	N	N	N	Y			H	
<i>Risk Specification - Inputs</i>											
		Risk Impact On Actual Finish	N	N	N	N	Y			H	
		Risk Missing Uncertainty Declaration	N	N	N	N	Y			H	
		Risk with Invalid Likelihood	N	N	N	N	Y			H	
		Risk with Negative Likelihood	N	N	N	N	Y			H	
		Risk with Zero Likelihood	N	N	N	N	Y			H	
<i>Cost Uncertainty - Inputs</i>											
		TD Cost Without Uncertainty	N	N	N	N	Y			H	
		TI Cost Without Uncertainty	N	N	N	N	Y			H	
		Task with TD Cost and Zero Duration	N	N	N	N	Y			H	
<i>Correlation - Inputs</i>											
		Task without Correlation	N	N	N	N	Y			H	
Schedule Progress Updates (GAO - 9)											
<i>Status</i>											
		Task Behind of Schedule	N	N	N	N	Y	H	H	H	
		No Status Date Defined	N	N	N	N	Y	H	H	H	
		Invalid Actual Dates	N	Y	N	N	N	H	H	H	
<i>In Progress Tasks</i>											
		Started Activities with no Actual Start	Y	N	N	N	N	H	H	H	
		Actual Start in the Future	N	N	Y	N	Y	H	H	H	Y
		Actual Finish in the Future	N	N	Y	N	Y	H	H	H	Y
<i>Completed Tasks</i>											
		Finished Activities with no Actual Finish	Y	N	N	N	N	H	H	H	
		Actual Start With Non-Completed Predecessor Tasks	N	N	N	N	N	H	H	H	

❑ GAO-8 metrics analyze uncertainty/risk inputs and are not found in the majority of the tools investigated



Health Metrics for Information on a Schedule



GAO Best Practice Area	Metric	Sub-Metric	GAO Scheduling Best Practices	DCMA 14 Point Assessment	STAT Health Check	Oracle PRA Health Check	JACS Health Check	Detailed Schedule	Analysis Schedule	JCL Model	Included in GSDO
Activity Capture (GAO - 1)											
	<i>Detail</i>										
		Task Marked As Margin	N	N	N	N	Y	I	I	I	
	<i>LOE (Long Duration Tasks Whose Durations are not Affected by a Start and Finish Activity)</i>										
		LOE Task with Successor	N	N	N	N	Y		I	I	
	<i>Hammocks (Tasks Whose Durations are Directly Affected by a Start and Finish Activity)</i>										
		Hammock Count	Y	N	N	Y	N		I	I	
Activity Sequencing (GAO - 2)											
	<i>Logic</i>										
		Mega Hotspot	Y	N	N	N	N	I	I	I	Y
		Positive lags on FS links	N	N	N	Y	N		I	I	
		Task with External Links	N	N	N	N	Y		I	I	
	<i>Relationship Count</i>										
		SS Relation	Y	Y	N	N	N		I	I	Y
		FF Relation	Y	Y	N	N	N		I	I	Y
	<i>Constraints</i>										
		Start No Earlier Than	Y	Y	Y	N	Y	I	I	I	Y
Resource Assignment (GAO - 3)											
	<i>Cost Specification</i>										
		TD Cost And No Spending Profile	N	N	N	N	Y			I	
		TI Cost And No Spending Profile	N	N	N	N	Y			I	
		Invalid TD Spending Profile	N	N	N	N	Y			I	
		Invalid TI Spending Profile	N	N	N	N	Y			I	

- ❑ Many GAO-2 metrics that the investigated tools use for scoring are recommended for informational purposes to the schedule analyst



Health Metrics for Information on a Schedule



GAO Best Practice Area	Metric	Sub-Metric	GAO Scheduling Best Practices	DCMA 14 Point Assessment	STAT Health Check	Oracle PRA Health Check	JACS Health Check	Detailed Schedule	Analysis Schedule	JCL Model	Included in GSDO
Establishing Durations (GAO - 4)											
		<i>Duration Length</i>									
		Average Duration	Y	N	N	N	N		I	I	
		Median Duration	Y	N	N	N	N		I	I	
Vertical and Horizontal Traceability (GAO - 5)											
		<i>Vertical Integration</i>									
		Vertical Integration	Y	N	N	N	N	I	I	I	
		<i>Horizontal Integration</i>									
		Horizontal Integration	Y	N	N	N	N	I	I	I	
Critical Path Validity (GAO - 6)											
		<i>Critical Tasks</i>									
		Critical Task Count	Y	Y	Y	N	N	I	I	I	Y
		Critical Path Length Index (CPLI)	N	Y	N	N	N		I	I	
		Critical High Duration	N	N	N	N	N		I	I	Y

- ❑ GAO-5 and GAO-6 metrics used for informational purposes rather than scoring



Health Metrics for Information on a Schedule



GAO Best Practice Area	Metric	Sub-Metric	GAO Scheduling Best Practices	DCMA 14 Point Assessment	STAT Health Check	Oracle PRA Health Check	JACS Health Check	Detailed Schedule	Analysis Schedule	JCL Model	Included in GSDO
Schedule Risk Analysis (GAO - 8)											
<i>Duration Uncertainty - Inputs</i>											
		Duration Outside Uncertainty Range	N	N	N	N	Y			I	
		Uncertainty on Margin Task	N	N	N	N	Y			I	
		Summary Task with Duration Uncertainty	N	N	N	N	Y			I	
		Broad Uncertainty Range	Y	N	N	N	N			I	
<i>Risk Specification - Inputs</i>											
		Task with Multiple Risk Impacts	N	N	N	N	Y			I	
		Task Dependent Upon Multiple Risk Impacts	N	N	N	N	Y			I	
		Risk with Small Likelihood	N	N	N	N	Y			I	
		Risk without Threat ID	N	N	N	N	Y			I	
		Risk Deactivated	N	N	N	N	Y			I	
<i>Cost Uncertainty - Inputs</i>											
		TD Cost Outside Uncertainty Range	N	N	N	N	Y			I	
		TI Cost Outside Uncertainty Range	N	N	N	N	Y			I	
<i>Critical Path Exposure - Output Analysis</i>											
		High Criticality	Y	N	N	N	N			I	
		Hidden Critical Paths	Y	N	N	N	N			I	
<i>Uncertainty Range - Output Analysis</i>											
		No Downside	Y	N	N	N	N			I	
		No Upside	Y	N	N	N	N			I	
<i>Other - Output Analysis</i>											
		Schedule Risk Hot Spots	Y	N	N	N	N			I	

- ❑ GAO-8 metrics analyze uncertainty/risk inputs and are not found in the majority of the tools investigated



Health Metrics for Information on a Schedule



GAO Best Practice Area	Metric	Sub-Metric	GAO Scheduling Best Practices	DCMA 14 Point Assessment	STAT Health Check	Oracle PRA Health Check	JACS Health Check	Detailed Schedule	Analysis Schedule	JCL Model	Included in GSDO
Schedule Progress Updates (GAO - 9)											
	<i>Status</i>										
	Completed Tasks		N	N	N	Y	N	I	I	I	
	Underway (In-Progress)		Y	N	N	Y	N	I	I	I	
	Critical Underway		Y	N	N	N	N	I	I	I	
	In-Progress On Schedule		Y	N	N	N	N	I	I	I	
	Task Ahead of Schedule		N	N	N	N	Y	I	I	I	
	Actual Start Defined		N	N	N	N	Y	I	I	I	
	Actual Finish Defined		N	N	N	N	Y	I	I	I	
Baseline Analysis (GAO - 10)											
	<i>Baseline Data</i>										
	Baseline Execution Index (BEI)		Y	Y	N	N	N	I	I		Y
	Scheduled/Baselined to Start		Y	N	N	N	N	I	I		
	Scheduled/Baselined to Finish		Y	N	N	N	N	I	I		

- ❑ GAO-9 metrics for status and GAO-10 metrics used for informational purposes rather than scoring



Conclusion



- ❑ Study evaluated the current schedule assessment guidelines and several JCL modeling applications to determine what metrics are used to assess schedule health
 - ❑ Grouped into the ten (10) GAO best practice areas and a comparative analysis was conducted to determine overlap and gaps between the various guidelines and tools
 - ❑ Study identified that although many of the tools and guidelines identify similar metrics, there is a wide variation in the capture of the metrics
 - ❑ Detailed review of the metrics in each tool/guideline conducted to make sure that non-duplicate metrics are not identified

- ❑ Metrics were identified as the recommended list of health check metrics for GSDO to use in evaluating schedules at different levels of fidelity and purposes (e.g., detail schedules, IMS, analysis schedules, JCL models)
 - ❑ Metrics for which criteria could be developed and an overall schedule health rating could be generated
 - ❑ Additional metrics that were valuable to provide insight into the schedule structure, topology, and integrity



Backup





Background



- ❑ NPR 7120.5 established requirements for program/projects to conduct and assess the cost and schedule joint confidence levels (JCL) expected for their program/project baselines
 - ❑ JCL evaluates the likelihood that a project can achieve planned cost and schedule targets
- ❑ Central to the concept of a JCL analysis is that costs are directly related to schedule
 - ❑ This concept causes the underlying schedule network and ensuing schedule risk analysis (SRA) to be the core central enablers for conducting a JCL analysis
 - ❑ Ensuring that the underlying schedule logic meets a basic level of integrity is a fundamental precursor toward conducting an SRA or JCL

A “healthy” schedule plays an indispensable role in modeling the Joint Confidence Level (JCL)