

EVMS Training Snippet Library: PARSII Analysis: Schedule Health Assessment



Office of Acquisition and Project Management (OAPM) MA-60
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Achieving Management and Operational Excellence

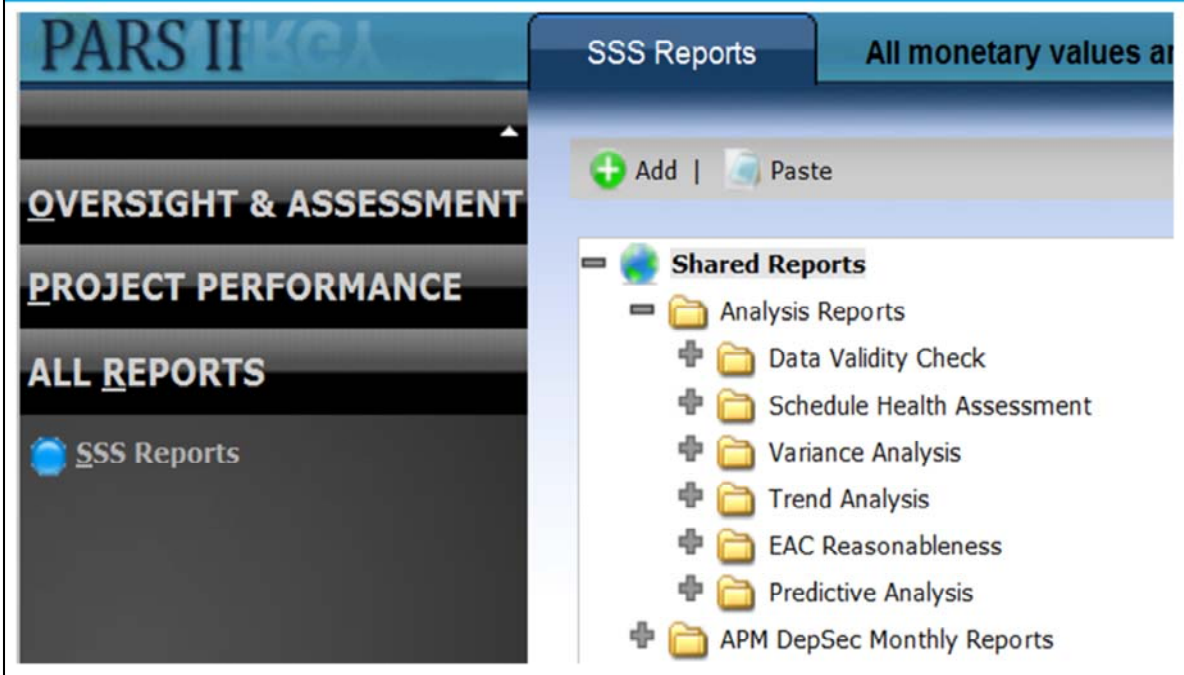
This EVMS Training Snippet, sponsored by the Office of Acquisition and Project Management (OAPM) is one in a series regarding PARS II Analysis reports. PARS II offers direct insight into EVM project data from the contractor's internal systems. The reports were developed with the users in mind, organized and presented in an easy to follow manner, with analysis results and key information to determine the status and health of the project. Snippets will help users understand the specific information provided by each report and what it tells them about project health and/or EVM system health.

This particular snippet focuses on the purpose and use of reports to assist in determining schedule health.

Analysis Reports – Project Analysis SOP



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In PARS II, under the SSS Reports selection on the left, there are folders to the right. The reports being discussed are in the Analysis Reports folder. That folder is broken down into various subfolders pertaining to OAPM's EVMS Project Analysis Standard Operating Procedure (EPASOP). This Snippet covers the subfolder named Schedule Health Assessment.



- **Analysis Reports**

- Report use further explained in OAPM's EVMS Project Analysis Standard Operating Procedure (EPASOP)
- Schedule Health Assessment Subfolder:
 - Schedule Missing Logic (Activity Level)
 - Relationship Leads and Lags (Activity Level)
 - Schedule Relationship Types (Activity Level)
 - Schedule Hard Constraints (Activity Level)
 - Schedule Total Float Analysis (Activity Level)
 - Schedule Duration Analysis (Activity Level)
 - Invalid Forecast and Actual Dates (Activity Level)
 - Schedule "Hit & Miss" Report

These reports are useful for anyone responsible for project management. The reports that will be discussed are:

- Schedule Missing Logic (Activity Level)
- Relationship Leads and Lags Report
- Schedule Relationship Types (Activity Level)
- Schedule Hard Constraints (Activity Level)
- Schedule Total Float Analysis (Activity Level)
- Schedule Duration Analysis (Activity Level)
- Invalid Forecasts and Actual Dates (Activity Level)
- Schedule Hit or Miss Report

What is Schedule Health?



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- **An assessment of schedule reliability through use of diagnostics**
- **Schedule health should be assessed routinely**
- **PARSII Limitations:**
 - Schedule health metrics typically exclude Level of Effort tasks from discrete
 - PARSII does not so results may be somewhat skewed if LOE tasks are included in the schedule
 - Solution: Use PARS II as an indicator. When an issue is found then request the baseline and forecast .xer files. The “check” can be repeated in Acumen Fuse by excluding the LOE.

Just as data must be accurate, the schedule must also be accurate before using schedule trends to make predictions. As stated in the ANSI/EIA-748 (current version), the project schedule and budget are an integrated time-oriented plan for accomplishment of work scope requirements on a project. Schedule planning and control, budget planning and control, work scope definition, and project risk handling are necessary prerequisites for basic and effective project management control. Therefore, step 2 of the analysis plan is to assess the health of the schedule by performing some diagnostics. Schedule health should be assessed on a routine basis. Schedule health assessment should also be done in preparation for EVMS compliance reviews, project analysis when a major schedule restructure has taken place, and whenever schedule health is a concern.

In addition to these schedule health reports in PARS II, OAPM (MA-63) currently uses Acumen Fuse ® software to also assess health and validity of contractor schedules. Any noted concerns in this area not only apply to Project performance but also to systemic concerns with the contractor’s EVMS, particularly with the scheduling system. The following reports include metrics that provide the analyst with a framework for asking educated questions and performing follow-up research. The identification of a triggered metric is not in and of itself an issue that requires correction, but rather an indicator to dig deeper into the analysis for understanding the reason for the situation.

Note that the calculation of these metrics should be based on discrete tasks, excluding LOE tasks and milestones. However, because not all data necessary to differentiate LOE tasks from discrete tasks is currently extracted from contractor schedules and uploaded into PARS II, there may be some subtle differences as compared to the results using other software programs to run schedule health metrics; for example, running the same types of

schedule health checks on the baseline and forecast Integrated Master Schedule (IMS) in Acumen Fuse where LOE tasks can be excluded.

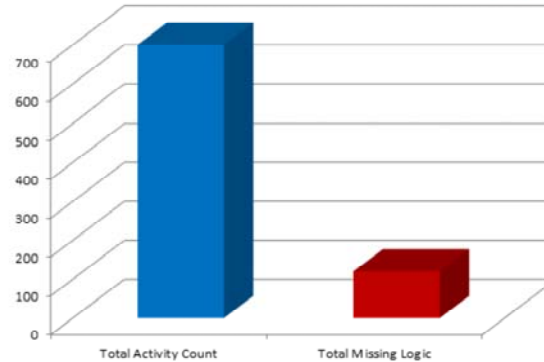
PARSII Schedule Missing Logic (Activity Level) Report



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- **Discrete task linkage**
 - Predecessors and successors
 - Properly calculate the Total Float
 - If logic is missing, the true critical path is unknown
- **Metric identifies:**
 - How well the schedule is linked
 - Even if links exist, the logic still needs to be verified by the technical leads to ensure that the links make sense
- **Threshold**
 - % Missing Logic $\leq 5\%$

Schedule Logic Analysis					
Summary					
Total Activity Count	Activities Missing Predecessor	Activities Missing Successor	Missing Both Predecessor and Successor	Total Missing Logic	% Missing Logic
700	24	103	7	120	17.14%



Logic, used in the scheduling sense, is the relationship tasks have to each other. The objective of this metric is to ensure each task has at least one predecessor and successor link, i.e. logic links. Discrete tasks must be linked (have predecessors and successors) in order to properly calculate the Total Float in the program. If the logic is missing, the true critical path for the program is unknown. Even if links exist, the logic still needs to be verified to ensure that the links make sense. Incomplete tasks missing predecessors and/or successors are included in this metric. The number of tasks without predecessors and/or successors should be less than or equal to 5%. An excess of 5% should be considered a flag for further assessment.

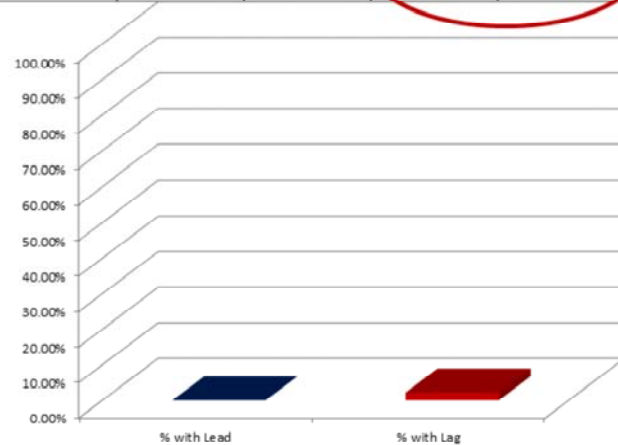
PARSII Relationship Leads and Lags Report



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- **Leads**
 - Negative lag
 - Next tasks must start before end of previous task
- **Lags**
 - Next task cannot start immediately after prior task
- **Metrics identify**
 - Schedule restraints
- **Threshold**
 - Leads = 0
 - % Lags <= 5%

Relationship Leads & Lags				
Total Active Relationships	Active Relationships with Lead	Active Relationships with Lag	% with Lead	% with Lag
1425	0	31	0.00%	2.18%



This report shows leads and lags. A lead, also called a negative lag, refers to a relationship whereby the successor activity is scheduled to begin before the predecessor activity has completed. For example, say Task 1 and Task 2 have a Finish-Start relationship, so when Task 1 finishes, Task 2 can start. If when Task 2 is planned, a Lag of negative 1 is added to the predecessor relationship between Task 1 and Task 2, the schedule would then show that Task 2 must start 1 day prior to the last day Task 1 finished. When tasks are logically linked, it is important to determine if any leads exist because the critical path and any subsequent analysis can be adversely affected by using leads. The use of leads distorts the total float in the schedule and may cause resource conflicts. In some cases, these leads are used to artificially compress the schedule which results in distorted total float values which is discussed later in this section. The reason for using leads should be documented and have proper justification (preferably in a “notes” column of the schedule).

This metric identifies the number of logic links with a lead in predecessor relationships for incomplete tasks. The number of leads should be zero.

Lag refers to a relationship whereby the successor activity cannot start right after the end of its predecessor. The objective of this metric is to ensure that lags are not being used to artificially constrain the schedule. The critical path and any subsequent analysis can be adversely affected by using lags. In many cases, these lag values are appropriately used by the CAMs to represent wait times for government review, waiting for “paint to dry”, etcetera.

Lags should not be used to manipulate float/slack or to restrain the schedule. If lags are used to force a task to start/finish on a certain date, the schedule is being artificially

restrained. The reason for using a lag should be documented and have proper justification (preferably in a “notes” column of the schedule) to discern whether or not the lag is being used in an appropriate manner. The percentage of tasks with lags should be less than or equal to 5%.

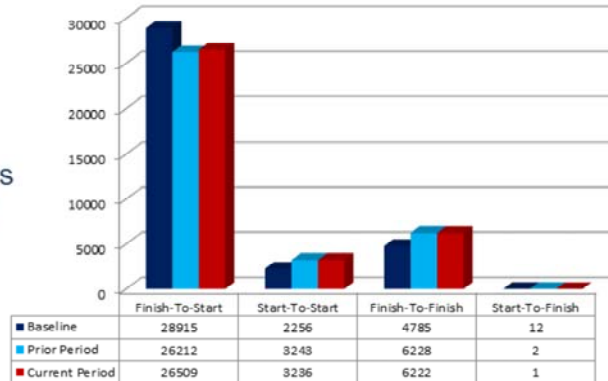
PARSII Schedule Relationship Types (Activity Level)



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- **Relationships**
 - Finish-to-Start (FS)
 - Start-to-Start (SS)
 - Finish-to-Finish (FF)
 - Start-to-Finish (SF)
- **Metrics identify**
 - Shifts in relationship types
- **Threshold**
 - None
 - Monitor for significant fluctuations
 - Indicates unstable baseline and work reshuffling

Schedule Relationship Types (Activity Level)				
Schedule	Finish-To-Start	Start-To-Start	Finish-To-Finish	Start-To-Finish
Baseline	28915	2256	4785	12
Prior Period	26212	3243	6228	2
Current Period	26509	3236	6222	1
Variance from Baseline	-8.3%	43.4%	30.0%	-91.7%
Variance from Prior	1.1%	-0.2%	-0.1%	-50.0%



Next is the Schedule Relationship Types report which provides a count of incomplete tasks containing each type of logic link.

The Finish-to-Start (FS) relationship type (“once the predecessor is finished, the successor can start”) provides a logical path through the project and should account for at least 90% of the relationship types being used. The Start-to-Finish (SF) relationship type is counter-intuitive (“the successor can’t finish until the predecessor starts”) and should only be used very rarely and with detailed justification. By counting the number of Start-to-Start (SS), Finish-to-Finish (FF), and Start-to-Finish (SF) relationship types, the % of Finish-to-Start (FS) relationship types can be calculated.

The histogram bars are positioned to allow for easy viewing of the trend from baseline to current period. Variances can be used to identify if there is a trend of schedule logic shifting from FS type relationship to FF or SS type relationships. Consistently decreasing number of FS type relationships coupled with continuously increasing number of SS and/or FF type relationships may be an indicator of activity relationships that are used to manipulate the critical path and mask schedule delays. Significant fluctuations in relationship types may be an indicator of **an** unstable baseline and work reshuffling.

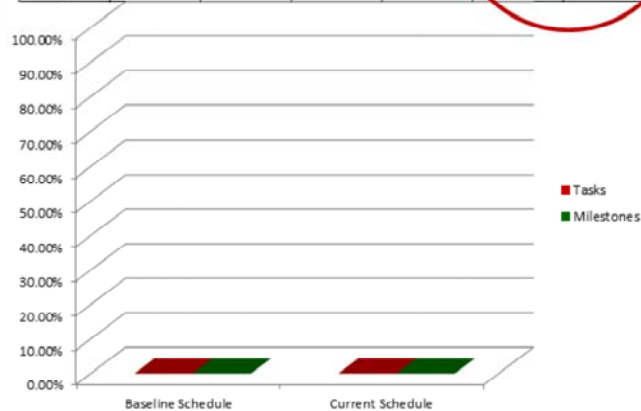
PARSII Schedule Hard Constraints (Activity Level)



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- **Hard Constraints**
 - Anchor a task in time
 - Override logic
- **Metric**
 - Indicates if schedule is overly constrained, preventing it from being logic driven
- **Threshold**
 - % Hard Constraints $\leq 5\%$

Schedule Hard Constraints (Activity Level)						
Activity Type	Incomplete Activity Count		Hard Constraint Count		% Activities w/ Hard Constraint	
	Baseline	Current	Baseline	Current	Baseline Schedule	Current Schedule
Tasks	1513	3540	0	1	0.00%	0.03%
Milestones	94	180	0	0	0.00%	0.00%



Schedule constraints inflict a restriction on either the start or end date of a discrete task and/or milestone. Hard constraints anchor a schedule or task in time to a specific date regardless of predecessor logic, i.e. dependencies. Soft constraints anchor a task's start or finish date but they respect predecessor logic, thus allowing the schedule end date to move to the right should a slip occur. Because hard constraints restrict the schedule, they must be minimized to allow the network schedule to update properly and reflect current status.

The calculation used to determine schedule health regarding the use of hard constraints is based on a count of incomplete tasks with hard constraints in use. Hard constraints include: Must-Finish-On (MFO), Must-Start-On (MSO), Start-No-Later-Than (SNLT), & Finish-No-Later-Than (FNLT). Soft constraints include As-Soon-As-Possible (ASAP), As Late As Possible (ALAP), Start-No-Earlier-Than (SNET), and Finish-No-Earlier-Than (FNET).

The metric indicates if the schedule is over constrained, preventing the schedule from being logic driven. When overly constrained, the schedule won't update properly when statused. The threshold is less than or equal to 5%.

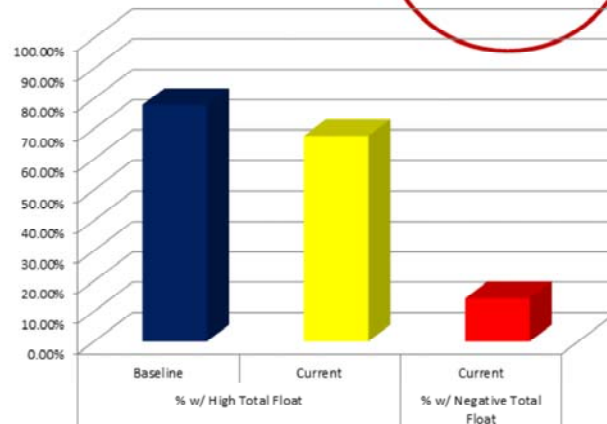
PARSII Schedule Total Float Analysis (Activity Level)



Page 9

- **High Float**
 - > 44 days
- **Negative Float**
 - < 0 days
- **Metric**
 - High Float indicates a possible false sense of cushion
 - Negative Float indicates problem with schedule achievability
- **Threshold**
 - % High Total Float < =5%
 - % Negative Float = 0

Schedule Total Float Analysis (Activity Level)						
Incomplete Activity Count		High Total Float (> 44 days)		Negative Total Float (< 0 days)	% w/ High Total Float	% w/ Negative Total Float
Baseline	Current	Baseline	Current	Current	Baseline	Current
1513	3540	1179	2394	505	77.92%	67.63%
						14.27%



Free float is the amount of time a predecessor activity can be delayed without impacting its successor. Total Float is the amount of time an activity can be delayed or extended before it impacts the project end date. The highest risk to schedule completion includes those activities with the lowest float values. Conversely, activities with unreasonably high amounts of total float indicate missing activities, missing or incomplete logic, and date constraints. When these things occur, the high total float gives a false sense of a cushion toward meeting the project completion date. The schedule should identify reasonable float, sometimes called slack, so that the schedule's flexibility can be determined and monitored. When evaluating float values is it important to understand:

- Float/total float should always be greater than or equal to zero.
- Negative float indicates a problem with the schedule's achievability.
- Excessive float usually indicates there is a problem with the logic connections.
- The two key metrics to focus on when conducting schedule analysis are High Total Float and Negative Float.

An incomplete task with total float greater than 44 working days (2 months) is counted in this metric. A task with total float over 44 working days may be a result of missing predecessors and/or successors. If the percentage of tasks with excessive total float exceeds 5%, the network may be unstable and may not be logic-driven.

Negative float is total float less than 0 working days and is included in this metric. It helps identify tasks that are delaying completion of one or more milestones. Negative float also may be an indicator of a constrained activity completion date or activities completed out of sequence. Tasks with negative float should have an explanation and a corrective action

plan to mitigate the negative float. Ideally, there should not be any negative float in the schedule.

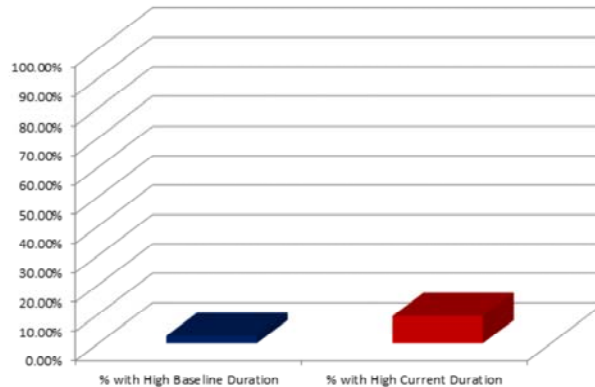
PARSII Schedule Duration Analysis (Activity Level)



Page 10

- **Duration**
 - > 44 days
- **Metric**
 - Indicates tasks that may be too large to manage effectively
- **Threshold**
 - % Tasks of High Duration <= 5%

Schedule Duration Analysis (Activity Level)				
Total Incomplete Activity Count	Incomplete w/ High Baseline Duration (> 44 days)	% with High Baseline Duration	Incomplete w/ High Current Duration (> 44 days)	% with High Current Duration
3540	91	2.57%	330	9.32%



Duration is the estimated amount of time to complete a task. The purpose of monitoring durations is to ensure that baseline durations are realistic and manageable. The rationale behind this metric is that a task with baseline duration greater than 44 working days should be analyzed to determine whether or not it can be broken into two or more discrete tasks. By breaking down the tasks into smaller pieces, it is likely that the tasks will be more manageable and provide better insight into cost and schedule performance. However, care should be taken not to illogically break longer tasks into shorter tasks simply to meet a threshold.

The percentage of tasks with high duration should be less than or equal to 5%.

PARSII Invalid Forecasts and Actual Dates (Activity Level)



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- **Forecast Dates**

- Must be in the future

- **Actual Dates**

- Must not be in future

- **Metric**

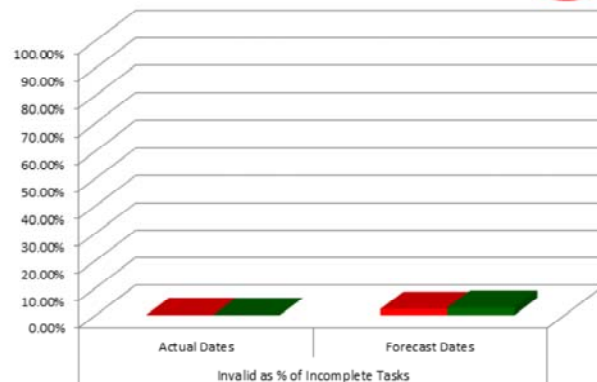
- Indicates if IMS has not been properly statused thus invalidating the IMS and critical path

- **Threshold**

- Invalid Future Dates = 0
 - Invalid Actual Dates = 0

Invalid Forecast and Actual Dates (Activity Level)										
Type	# Incomplete	# Completed	# Invalid Actual Dates			# Invalid Forecast Dates			Invalid as % of Incomplete Tasks	
			Start	Finish	Both	Start	Finish	Both	Actual Dates	Forecast Dates
Tasks	3540	13483	1	0	0	47	48	66	0.01%	2.27%
Milestones	180	590	0	0	0	0	0	10	0.00%	2.78%

■ Tasks ■ Milestones



This metric is designed to identify issues relative to invalid forecast dates and invalid actual dates. The objective of the Invalid Forecast Dates metric is to ensure that forecast start and forecast finish dates are being updated for incomplete tasks. A task should have forecast start and forecast finish dates that are in the future relative to the status date, which is sometimes called the data date, in the IMS. Tasks that have forecast start and/or finish dates that do not meet this criterion are invalid and indicate that the IMS has not been properly statused. Accurate and updated forecast dates are necessary for good program management, for calculating a valid critical path, and for EVMS compliance in general. There should be zero tasks with invalid forecast start and/or finish dates.

The objective of the Invalid Actual Dates metric is to ensure that actual start and actual finish dates are valid. A task should not have actual start and actual finish dates that are in the future relative to the status date of the IMS. Tasks that have actual start and/or actual finish dates that do not meet this criterion are invalid and indicate that the IMS has not been properly statused. Accurate and updated actual start and actual finish dates are necessary for good program management and for calculating a valid critical path. Additionally, invalid actual dates adversely affect “out of sequence tasks” and ultimately affect meeting the correct forecasting required to be EVMS compliant. There should be zero tasks with invalid actual start and/or actual finish dates.

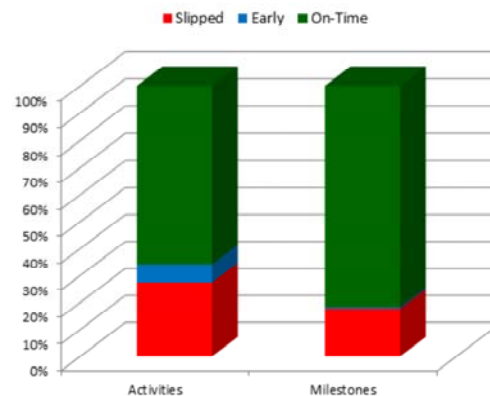
PARSII Schedule Hit or Miss Report



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- **Hit**
 - Completed early or on time
- **Miss**
 - Completed late or expected to finish late
- **Metric**
 - Indicates schedule progress in meeting the baseline plan
- **Threshold**
 - % Missed Tasks < =5%

Schedule "Hit & Miss" Report							
	Total	"Miss"	"Hit"		"Miss"	"Hit"	
		Slipped	Early	On-Time	Slipped	Early	On-Time
Activities	14,094	3,863	942	9,289	27.41%	6.68%	65.91%
Milestones	645	114	4	527	17.67%	0.62%	81.71%



The last report is the Hit or Miss report. A "hit" means that the task finished early or on time based on the baseline schedule. A 'miss' is a discrete task that is expected to finish late in the future, or has already finished late in the past. The number of missed tasks should be less than or equal to 5%.

This report also measures hit or missed milestone dates, for informational purposes.

This metric helps identify how well or poorly the schedule is meeting the baseline plan. An excessive amount of missed tasks indicates that the program is performing poorly to the baseline plan due to a lack of adequate resources, unrealistic planning, etc, or just poor program management in general. As a result, it is very likely that the program will not complete on time.

The Slip Severity tab of the PARS II report provides insight into the severity of the missed activities. Large numbers of slipped activities associated with significantly lower numbers of slipped milestones may be an indication that the project is encountering schedule issues in certain areas of the project that have not yet impacted other areas. Large numbers of slips in both activities and milestones may be an indication of:

- a) severe schedule problems across the entire project, and
- b) the baseline no longer represents the true project environment and may need to be reviewed

Summary




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- **Project management relies on accurate schedules**
- **The schedule health assessment reports provide insight into whether the schedule was properly constructed and maintained**
- **Concerns highlighted on these reports should be discussed with the contractor and corrective action (if required) monitored**

Project management relies on accurate schedules in order to make predictions regarding project completion. The schedule health assessment reports provide insight into whether the schedule was properly constructed and if it is being properly maintained. The FPD should communicate all concerns highlighted on these reports, to the contractor, so corrections are made if necessary. The FPD should also monitor those corrective actions, if required, to ensure they are made in a timely manner and monitor the schedule metrics to identify reoccurrence.

DOE OAPM EVM Home Page



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Earned Value Management (EVM) is a systematic approach to the integration and measurement of cost, schedule, and technical (scope) accomplishments on a project or task. It provides both the government and contractors the ability to examine detailed schedule information, critical program and technical milestones, and cost data.

- EVMS Surveillance Standard Operating Procedure (ESSOP) - 26 Sep 2011 (pdf)
- EV Guideline Assessment Templates - (MS Word)
- DOE EVMS Cross Reference Checklist - (pdf)
- DOE EVMS Risk Assessment Matrix - (MS Word)
- Formulas and Terminology "Gold Card" - Sep 2011 (pdf)
- Slides from the OECM Road Show: Earned Value (EV) Analysis and Project Assessment & Reporting System (PARS II) - May 2012 (pdf)
- DOE EVM Guidance

EVM TUTORIALS

Module 1 - Introduction to Earned Value (pdf 446.86 kb) July 17, 2003

This module is the introduction to a series of online tutorials designed to enhance your understanding of Earned Value Management. This module's objective is to introduce you to Earned Value and outline the blueprint for the succeeding modules. This module defines Earned Value management. It looks at the differences between Traditional management and Earned Value management, examines how Earned Value management fits into a program and project environment, and defines the framework necessary for proper Earned Value management implementation.

http://energy.gov/management/office-management/operational-management/project-management/earned-value-management

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History

For information relative to EVMS procedures, templates, helpful references, and training materials, please refer to OAPM's EVM Home page. Check back periodically for updated or new information.

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