EVMS Training Snippet Library:

Schedule Health Metrics

Office of Acquisition and Project Management (APM) MA-60
U. S. Department of Energy
July 2014

Purpose and Types of Schedule Checks

- **"Periodic schedule health assessments are essential to ensure the IMS is valid and effective for reporting on accomplishments and predicting future performance." NDIA PMSC PASEG p. 134**
- **Types of Schedule Checks**
  - Health: Assess if schedule adequately constructed/maintained and thus predictive
  - Performance: Assess project performance

Why Should Projects Run Schedule Metrics?

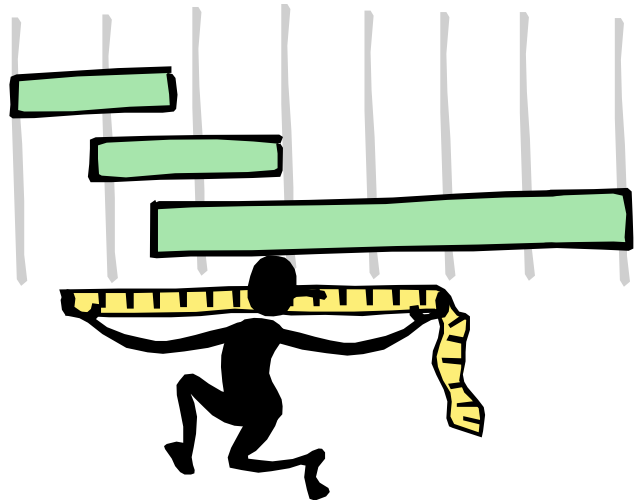
- **Assesses the validity of the critical path for prediction of finish dates**
  - Many Planners/Schedules feeding the project schedule
  - Easy to miss things that could impact schedule validity
  - Monthly maintenance checks help assure schedule accuracy
- **Important for DOE customers and contractors**
  - Need for realistic finish dates
  - Helps assess the schedule risks

Schedule Health Metrics

- **Indicators reveal the technical construction of the schedule itself**
- **Provide the "believability factor"**
  - "How can I have faith in this critical path if over 50% of the detail tasks have no predecessors or successors?"
  - "How accurate can the forecast finish date be if many of the activities have forced finish dates, not allowing tasks to be progressed in terms of duration, according to physical accomplishment?"
  - "When are the resources required if all of the tasks have excess float?"

Useful for Both Contractor and DOE

- **Used to track progress and improvement of schedule health**
  - Contractors should be monitoring these health metrics to continuously improve fidelity of management tool
  - Internal scheduling processes should use these metrics as a guide to build and maintain the schedule
  - Useful to track maintenance in a growing/evolving schedule



Schedule Health Metrics

- **Schedule Health Metrics covered in this Snippet:**
  - Missing Logic
  - Leads
  - Lag
  - Relationship Types
  - Hard Constraints
  - Float: High Float and Negative Float
  - High Duration
  - Invalid Dates: Forecast and Actual
  - Missing Resources

Schedule Health Metrics

- **Note on metric filters**
  - Common Exclusions from the Metric Calculations:
    - Level of Effort and Completed Tasks
    - Planning Packages; Milestones
  - Many select only the to-go tasks, i.e. incomplete
  - Some exclude Schedule Visibility Tasks (SVTs) if any
  - Criteria based on lessons learned (primarily from within DoD)
- **PARS II includes schedule health metrics**
  - Refer to Snippet Group 5 for detailed information
- **Commercially Available Tools Have Schedule Health Metrics**
  - Deltek Acumen Fuse – DOE OAPM has metric library available
  - Steelray Project Analyzer
  - Others

Missing Logic

- **Criteria**
  - All incomplete tasks, with a few exceptions, have predecessors and successors
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Typical tasks without a predecessor need to be logical, without successors should be a delivery to the customer
- **Metric**
  - [*# Missing Logic / Incomplete Task Count*] <= 5%

Missing Logic / Predecessor and Successor

- **Why is this important?**
  - Discrete tasks must be linked (have predecessors and successors) in order to properly calculate the Total Float in the project and the true critical path
  - Without logic, there is no task flow; therefore, the schedule has no foundation for schedule date calculations and critical path.
  - One missing logic tie could adversely affect the project's ability to successfully execute the project
  - When the schedule is logically linked, the schedule can be used to predict completion dates, run 'what if' scenarios, and identify those tasks that are on the critical path

Leads

- **Criteria**
  - No incomplete tasks should have a lead, also called negative lags
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Leads are a technique to crash the schedule inappropriately. All use of leads should be justified.
- **Metric**
  - [*# of Leads / Relationship Count*] = 0%

Leads

- **Why is this important?**
  - Use of leads distorts the total float in the schedule and may cause resource conflicts, critical path errors, and adversely affect analysis
  - Leads could be used to artificially compress the schedule which results in distorted total float values
  - Rationale for using leads should be documented and have proper justification
  - The IMS should be used as a workload planning and scheduling tool as opposed to being used simply as a reporting tool

Lags

- **Criteria**
  - Lags >20 days or one accounting month should be avoided
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Excessive lags if any, indicate a task missing from the baseline
- **Metric**
  - [*# of Lags / Relationship Count*] <= 5%

Lags

- **Why is this important?**
  - Critical path and any subsequent analysis can be adversely affected by using lags
  - Lags represent wait times for government review, waiting for “paint to dry”, for supplier work to complete, etc.
  - Lags should not be used to manipulate float/slack or to restrain the schedule
  - Justification for using a lag should be documented

Relationships

- **Criteria**
  - At least 90% of incomplete tasks are logically tied with Finish-to-Start (FS) relationships
- **Exclusions**
  - Level of Effort, Summary level, Completed tasks, Milestones
- **Results**
  - FS relationships are logical and should be the standard
- **Metric**
  - [*# of FS Relationships / Relationship Count*] >= 90%

Relationships

- **Why is this important?**
  - The Finish-to-Start (FS) relationship type provides the most logical path through the project
  - A relationship type such as Start-to-Start (SS) or Finish-to-Finish (FF) can potentially cause resource conflicts
    - Work is performed concurrently
  - The Start-to-Finish (SF) relationship type is counter-intuitive (“the successor can’t finish until the predecessor starts”)
    - Should only be used very rarely and with detailed justification

Relationships

- **Why is this important? (continued)**
  - Predominantly use Finish-to-Start (FS) relationships
  - Changes from FS-type to other types may be an indicator of critical path manipulation and masking of delays
  - Significant fluctuations in relationship types may be an indicator of unstable baseline and work reshuffling

Hard Constraints

- **Criteria**
  - No tasks other than completion or deliveries have constraints that restrict forecasting completion
  - Hard Constraints are Must-Finish-On, Must-Start-On, Start-No-Later-Than, and Finish-No-Later-Than
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Constraints restricting movement for anything other than phase or project completion should be removed
- **Metric**
  - [*# of Hard Constraints / Incomplete Tasks Count*] <= 5%

Soft Constraints

- **Criteria**
  - Less than 5% of incomplete tasks utilize constraints that delay forecast start or finish dates
  - Soft Constraints are As-Soon-As-Possible, As Late As Possible, Start-No-Earlier-Than, and Finish-No-Earlier-Than
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Constraints override the schedule calculation; over 5% means a schedule that is overly constrained
- **Metric**
  - [*# of Soft Constraints / Incomplete Tasks Count*] <= 5%

Constraints

- **Why is this important?**
  - Constraints are used to restrict a task start or end date to a specific date in time
    - Examples may be due to parts or subassembly deliveries, resources, or contractual restrictions
  - 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
  - Hard constraints prevent tasks from being moved by their dependencies; prevent the schedule from being logic-driven
    - Critical path and other analysis (risk based what-if scenarios) may be adversely affected

Total Float

- **Criteria**
  - At least 95% of incomplete tasks have less than 44 working days of float
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Greater than 5% indicate that the schedule is not logically linked. Typically large float value indicate task without a logical successor
- **Metric**
  - [*# of tasks with High Float / Incomplete Tasks]* <= 5%

Negative Total Float

- **Criteria**
  - The number of tasks with negative float should be zero
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Negative float indicates a constrained task or tasks completed out of sequence
  - Negative float indicates a problem with the schedule's achievability
  - Tasks with negative float should have an explanation and a corrective action plan
- **Metric**
  - The number of tasks with negative float should be zero

High Total Float / Negative Float

- **Why is this important?**
  - Tasks with total float greater than 44 working days may indicate issues related to technical accomplishment and scope
  - Investigate
    - Missing predecessors and/or successors
    - Incorrect sequencing of predecessors / successors
    - Too many predecessors / successors connected to a milestone / task
    - Missing scope
  - Above list is not all-inclusive

High Total Float / Negative Float

- **Why is this important? (continued)**
  - Percentage of tasks with total float greater than 5% may indicate unstable and non-logic driven schedule
  - Tasks with negative float
    - Should have an explanation and a corrective action plan to mitigate the negative float
    - Indicates delayed completion

Baseline Duration < 44 days

- **Criteria**
  - At least 95% of activities should have baseline durations less than or equal to 44 working days
- **Exclusions**
  - Completed tasks, LOE tasks, Milestones, and Planning Packages
- **Results**
  - If less than 95%, indicates that the baseline is not planned discretely
- **Metric**
  - [*# of tasks with Baseline Duration > 44 days / Incomplete Tasks*] <= 5%

Forecast Duration < 44 days

- **Criteria**
  - At least 75% of activities have forecast durations less than or equal to 44 working days
- **Exclusions**
  - Completed tasks, LOE tasks, Milestones, and Planning Packages.
- **Results**
  - If less than 75%, indicates that the forecast is not planned discretely
- **Metric**
  - [*# of tasks with Forecast Duration > 44 days / Incomplete Tasks Count*] <= 25%

High Duration

- **Why is this important?**
  - Duration is amount of time to complete a task based on technical achievement
  - The purpose of monitoring durations is to ensure that durations are realistic and manageable
  - When durations are padded with buffers or margins, management visibility is limited should problems arise elsewhere
  - Primary emphasis is the immediate time period of six months to a year (near-term)
    - It is expected that later tasks may indeed be longer
  - Note: Rather than 44 days, the Government may specify a different value for the goal

Invalid Actual Dates

- **Criteria**
  - To ensure that actual start and actual finish dates are valid, there should be zero tasks where either of these dates are in the future of the status date.
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - The check is two-fold as it searches for both actual start and actual finish dates in the future of the status date
- **Metric**
  - [*# of tasks with Invalid Actual Dates / (Incomplete Tasks Count x 2)*] = 0%

Invalid Actual Dates

- **Why is this important?**
  - A task should NOT have actual start and actual finish dates that are in the future
  - These “invalid” actual dates indicate that the IMS has not been properly statused
  - Accurate and updated actual start/finish dates are necessary for good project management and critical path calculation
  - Invalid actual dates adversely affect “out of sequence tasks”; ultimately affect correct forecasting

Invalid Forecast Dates

- **Criteria**
  - There should be zero tasks with invalid forecast start and/or finish date.
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - Even though Primavera does not allow forecast dates to remain in the past, it is still possible to create a filter in Primavera that finds discrete tasks that have forecast start and/or finish dates that are before the status date
- **Metric**
  - [*# of tasks with Invalid Forecast Dates / (Incomplete Tasks Count x 2)*] = 0%

Invalid Forecast Dates

- **Why is this important?**
  - A task should have forecast start and forecast finish dates that are in the future relative to the status date of the IMS
  - These “invalid” forecast dates indicate improper statusing of the IMS
  - Accurate and updated forecast dates are necessary for calculating a valid critical path

Missing Resources

- **Criteria**
  - All discrete tasks in the Performance Measurement Baseline should have resources assigned.
- **Exclusions**
  - Completed tasks, LOE tasks, and Milestones
- **Results**
  - To ensure that resources (hours and dollars) are properly loaded into the schedule, all incomplete discrete tasks should have resources assigned.
- **Metric**
  - [*# of tasks Missing Resources / Incomplete Tasks*] = 0%

Missing Resources

- **Why is this important?**
  - Proper allocation of resources are required to complete the assigned work
  - DOE Order 413.3B, Attachment 1, paragraph 5 states:

    “A critical path schedule and a resource-loaded schedule must be developed and maintained for the project. As a minimum, resource-loaded schedules must contain labor, material and equipment costs to include unit prices and quantities. For firm fixed-price contracts, the total project cost must be included in the resource loaded schedule.”

Conclusion

- Review schedule metrics monthly to see if there are schedule health risks on your project.
- It may save you from experiencing unexpected surprises . . .

DOE OAPM EVM Home Page

ENERGY.GOV
Office of Management

SEARCH

SERVICES | OPERATIONAL MANAGEMENT | MISSION | About Us | OFFICES

Home » Operational Management » Project Management » Earned Value Management

EARNED VALUE MANAGEMENT

- Aviation Management
- Executive Correspondence
- Energy Reduction at HQ
- Facilities and Infrastructure
- Freedom of Information Act
- Financial Assistance
- Information Systems
- Procurement and Acquisition
- Project Management
- Earned Value
- Lessons Learned
- Reviews and Validations
- Documents and Publications
- RCA and CAP
- Career Development Program
- Real Estate
- History

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