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Earned Schedule

an emerging enhancement to Earned Value Management

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Importance of Schedule

"We need to maintain our attention on schedule delivery. Data tells us that since July 2003, real cost increase in projects accounted for less than 3 percent of the total cost growth. …*Therefore, our problem is not cost, it is SCHEDULE*."

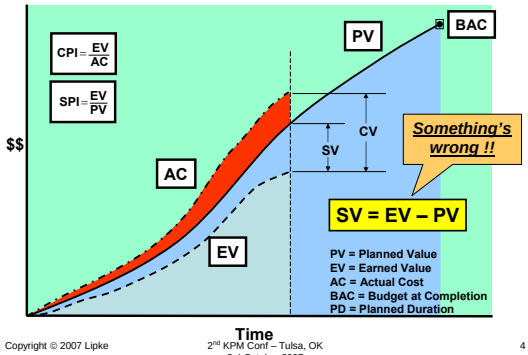
- Dr. Steve Gumley, CEO
Defence Materiel Organization (Australia)

Quote taken from DMO Bulletin, July 2006, Issue 61, page 3

Overview

- Introduce the Earned Schedule Concept
- Develop the Schedule Indicators
- Apply to Project Duration Prediction
- Apply to Schedule Analysis

Earned Value Basics

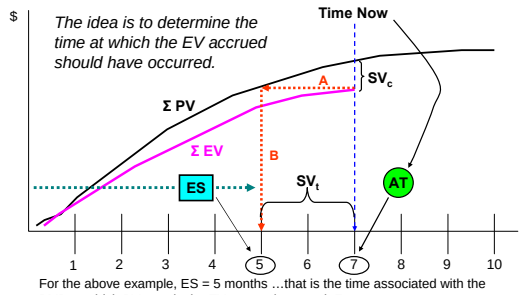


EVM Schedule Indicators

- SV & SPI behave erratically for projects behind schedule
  - ***SPI improves and equals 1.00 at end of project***
  - ***SV improves and concludes at $0 variance***
- Schedule indicators lose predictive ability over the last third of the project
- Why does this happen?
  - SV = EV – PV
  - SPI = EV / PV

At planned completion PV = BAC
At actual completion EV = BAC

Earned Schedule Concept



For the above example, ES = 5 months …that is the time associated with the PMB at which PV equals the EV accrued at month 7.

Earned Schedule Metric

- Required measures
  - Performance Measurement Baseline (PMB) – the time phased planned values (PV) from project start to completion
  - Earned Value (EV) – the planned value which has been "earned"
  - Actual Time (AT) - the actual time duration from the project beginning to the time at which project status is assessed
- All measures available from EVM

Earned Schedule Calculation

- ES (cumulative) is the:
  Number of complete PV time increments EV equals or exceeds + the fraction of the incomplete PV increment
- ES = C + I where:
  C = number of time increments for EV ≥ PV
  $I = (EV - PV_C) / (PV_{C+1} - PV_C)$

Earned Schedule Indicators

- Schedule Variance:
  $SV(t) = ES - AT$
- Schedule Performance Index:
  $SPI(t) = ES / AT$

  where AT is "Actual Time" – the duration from start to time now
- SV(t) and SPI(t) are time-based (months, weeks …)

Earned Schedule Indicators

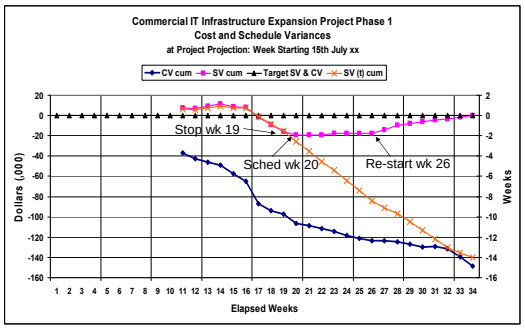
- What happens to the ES indicators, SV(t) & SPI(t), when the planned project duration (PD) is exceeded (PV = BAC)?

  They Still Work …Correctly!!

- ES will be ≤ PD, while AT > PD
  - SV(t) will be negative (time behind schedule)
  - SPI(t) will be < 1.00

  Reliable Values from Start to Finish !!

Late Finish Project



Schedule Prediction

- Can the project be completed as planned?
  - TSPI = Plan Remaining / Time Remaining
    = (PD – ES) / (PD – AT)

    where PD is the planned duration (time at BAC)
    (PD – ES) = PDWR
    PDWR = Planned Duration for Work Remaining
- …completed as estimated?
  - TSPI = (PD – ES) / (ED – AT)

    where ED = Estimated Duration

TSPI Value	Predicted Outcome
≤ 1.00	Achievable
> 1.10	Not Achievable

Schedule Forecasting

- Long time goal of EVM …*Prediction of total project duration from present schedule status*
- Independent Estimate at Completion (time)
  - IEAC(t) = PD / SPI(t)
  - IEAC(t) = AT + (PD – ES) / PF(t)
    where PF(t) is the Performance Factor (time)
  - Analogous to IEAC used to forecast final cost
- Independent Estimated Completion Date (IECD)
  - IECD = Start Date + IEAC(t)

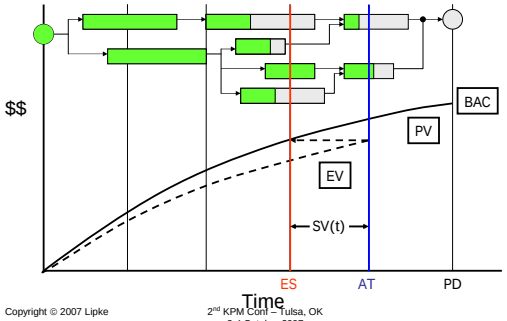
Schedule Analysis with EVM?

- Most practitioners analyze schedule from the bottom up using the network schedule, independent from EVM
  ….“It is the only way possible.”
  - Analysis of the Schedule is overwhelming
  - Critical Path is used to shorten analysis
    (CP is longest path of the schedule)
- Duration forecasting using Earned Schedule provides a macro-method similar to the method for estimating Cost
  - A significant advance in practice
- *But, there’s more that ES facilitates ….*

Facilitates Drill-Down Analysis

- ES can be applied to any level of the WBS, to include task groupings such as the Critical Path
  - Requires creating PMB for the area of interest
  - EV for the area of interest is used to determine its ES
- Enables comparison of forecasts, total project (TP) to Critical Path (CP)
  - Desired result: forecasts are equal
  - When TP forecast > CP forecast, CP has changed
  - When CP > TP, possibility of future problems

ES Bridges EVM to the Schedule



How Can This Be Used?

- Tasks behind – possibility of impediments or constraints can be identified
- Tasks ahead – a likelihood of future rework can be identified
- The identification is independent from schedule efficiency
- The identification can be automated

PMs can now have a schedule analysis tool connected to the EVM Data!!

Leads to …

- Concept of *Schedule Adherence*
  - Most efficient project execution follows the plan
  - ES provides a way to measure how closely execution is to the plan
- *Schedule Adherence* provides a means to refine predictions and forecasts
  - Research underway
  - Application has begun

Summary

- Derived from EVM data … only
- Provides time-based schedule indicators
- Indicators do not fail for late finish projects
- Application is scalable up/down, just as is EVM
- Schedule prediction is better than any other EVM method presently used
- Facilitates bridging EVM analysis to include the Schedule
- Provides capability to understand source of rework and refine forecasts & predictions

Available Resources

- PMI-Sydney http://sydney.pmichapters-australia.org.au/
  - Repository for ES Papers and Presentations
- Earned Schedule Website
  http://www.earnedschedule.com/
  - Established February 2006
  - Contains News, Papers, Presentations, ES Terminology, ES Calculators
  - Identifies Contacts to assist with application
- Wikipedia references Earned Schedule
  http://en.wikipedia.org/wiki/Earned_Schedule

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