Using Earned Schedule
to improve Project Controls and reduce Risk

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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)
Overview

• Introduce the Earned Schedule Concept
• Develop the Schedule Indicators
• Apply to Project Duration Prediction
• Apply to Schedule Analysis
Earned Value Basics

\[ \text{SPI} = \frac{\text{EV}}{\text{PV}} \]
\[ \text{CPI} = \frac{\text{EV}}{\text{AC}} \]

\[ \text{PV} = \text{Planned Value} \]
\[ \text{EV} = \text{Earned Value} \]
\[ \text{AC} = \text{Actual Cost} \]
\[ \text{BAC} = \text{Budget at Completion} \]
\[ \text{PD} = \text{Planned Duration} \]

***Something's wrong!!***

\[ \text{SV} = \text{EV} - \text{PV} \]
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
The idea is to determine the time at which the EV accrued should have occurred.

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 = \( \frac{EV - PV_c}{PV_{c+1} - PV_c} \)
Earned Schedule Indicators

- Schedule Variance:
  \[ SV(t) = ES - AT \]

- Schedule Performance Index:
  \[ SPI(t) = \frac{ES}{AT} \]

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

Commercial IT Infrastructure Expansion Project Phase 1
Cost and Schedule Variances
at Project Projection: Week Starting 15th July xx

CV cum  SV cum  Target SV & CV  SV (t) cum

- Stop wk 19
- Sched wk 20
- Re-start wk 26

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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

<table>
<thead>
<tr>
<th>TSPI Value</th>
<th>Predicted Outcome</th>
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<tbody>
<tr>
<td>≤ 1.00</td>
<td>Achievable</td>
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<tr>
<td>&gt; 1.10</td>
<td>Not Achievable</td>
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Schedule Forecasting

• Long time goal of EVM … *Prediction of total project duration from present schedule status*

• Independent Estimate at Completion (time)
  – $\text{IEAC}(t) = \frac{\text{PD}}{\text{SPI}(t)}$
  – $\text{IEAC}(t) = \text{AT} + \frac{(\text{PD} - \text{ES})}{\text{PF}(t)}$
    where $\text{PF}(t)$ is the Performance Factor (time)
  – Analogous to IEAC used to forecast final cost

• Independent Estimated Completion Date (IECD)
  – $\text{IECD} = \text{Start Date} + \text{IEAC}(t)$
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
## Contact Information

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