



Defence & Industry Conference

Adelaide Convention Centre

20-23 August 2007



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)

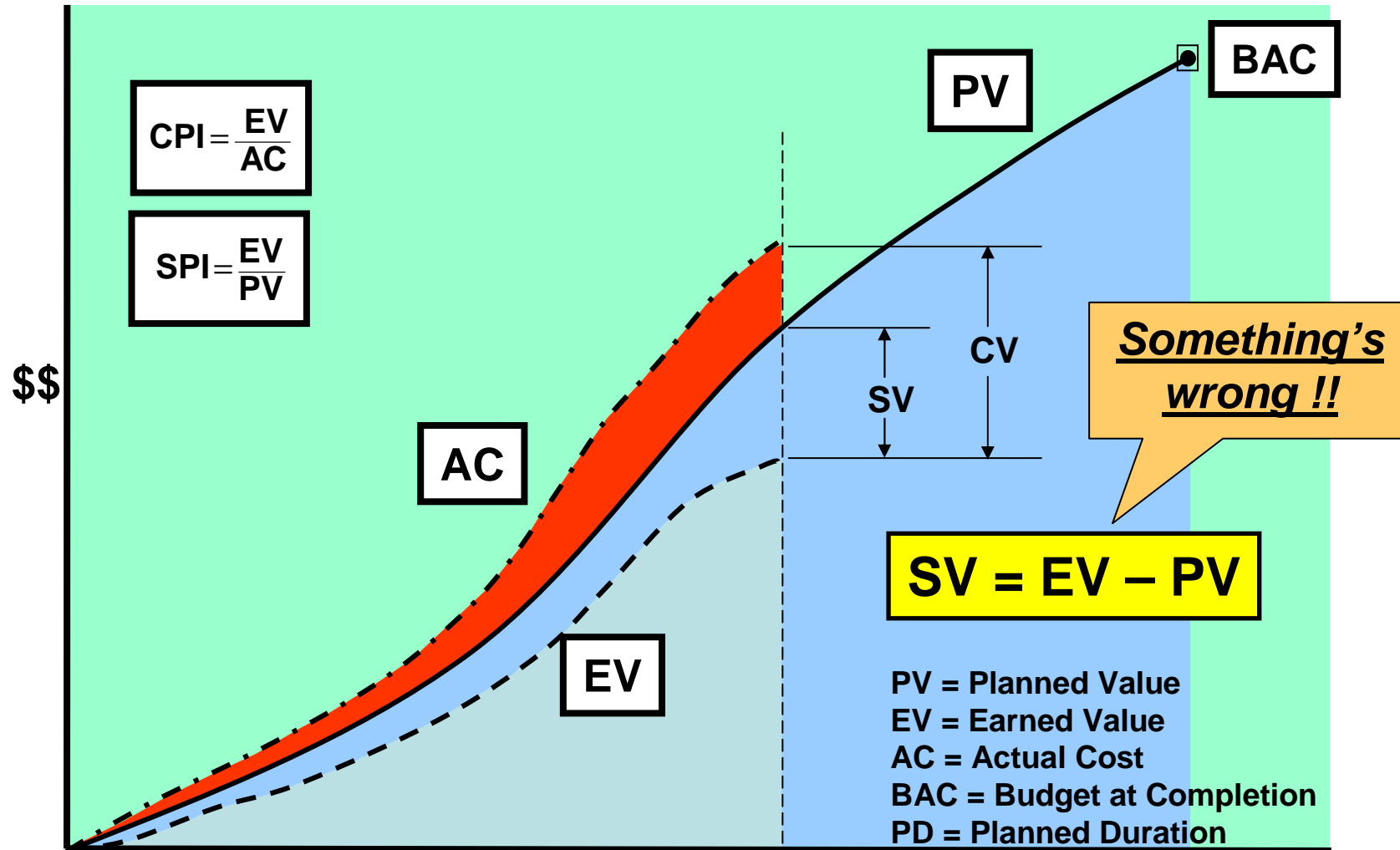
Quote taken from DMO Bulletin, July 2006, Issue 61, page 3



Overview

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

Earned Value Basics



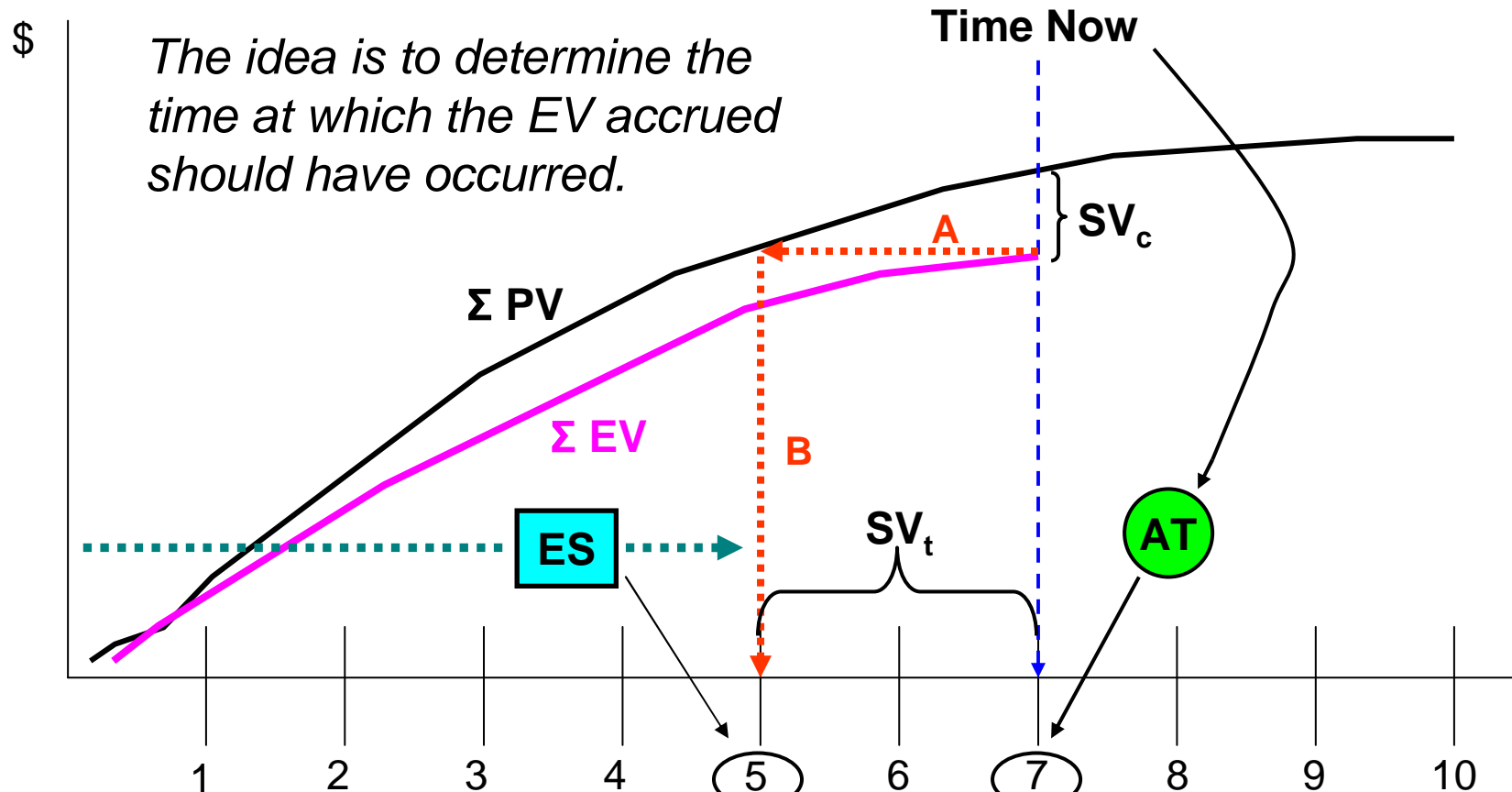


EVM Schedule Indicators

- 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 $EV \geq PV$
 $I = (EV - PV_C) / (PV_{C+1} - PV_C)$



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

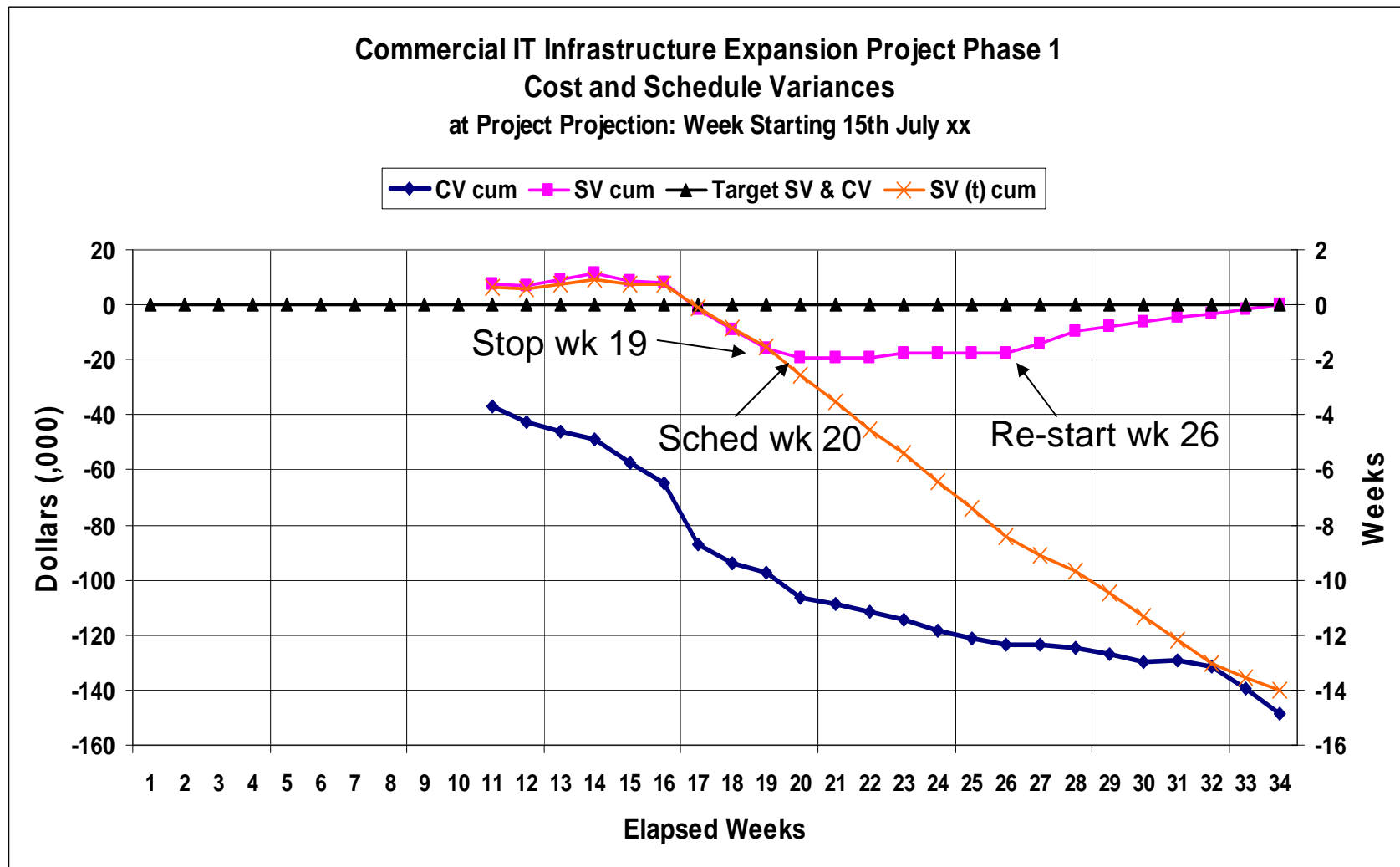
- What happens to the ES indicators, $SV(t)$ & $SPI(t)$, when the planned project duration (PD) is exceeded ($PV = BAC$)?

They Still Work ...Correctly!!

- ES will be $\leq PD$, 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?
 - $TSPi = \text{Plan Remaining} / \text{Time Remaining}$
 $= (PD - ES) / (PD - AT)$
 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 predict final cost
- Independent Estimated Completion Date (IECD)
 - $IECD = \text{Start Date} + IEAC(t)$

Schedule Analysis with EVM?

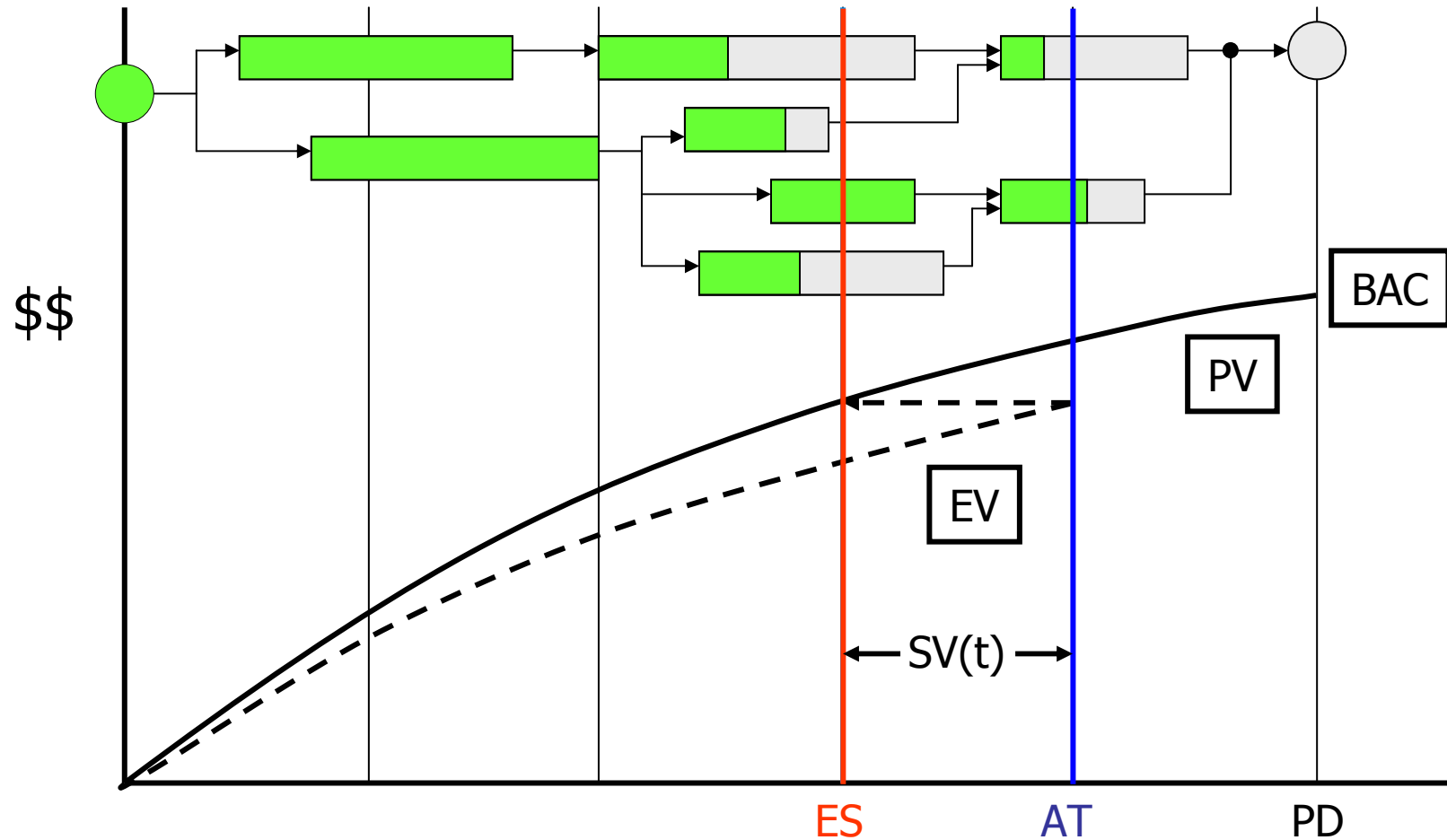
- Most practitioners analyze schedule from the bottom up using the network schedule, independent from EVM
 -“It is the only way possible.”
 - Analysis of the Schedule is overwhelming
 - Critical Path is used to shorten analysis
 - (CP is longest path of the schedule)
- Duration prediction using Earned 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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