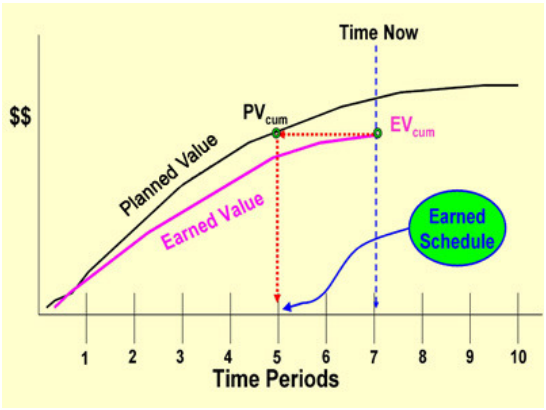
Earned Schedule



Earned Schedule (ES) is a useful tool in the overall management of projects. In our view, the ES methodology provides a valuable adjunct to, and a useful sanity check of, the 'critical path' (CPM) schedule developed for a project. Additional information and insight is developed for very little effort - provided the project has implemented Earned Value Management (EVM)[1].

Using the same data as EVM, ES 'scales' the remaining duration of the project based on the volume of work accomplished to date compared to the planned volume, and has the potential to predict future slippages that the CPM schedule may not be indicating.

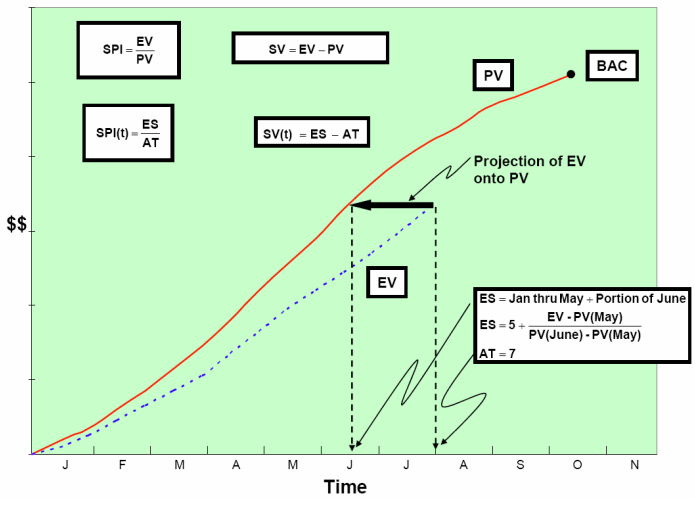
CPM schedules have two major flaws inherent in the methodology:

a. CPM assumes all future work will be accomplished as planned. There is no 'scaling function' for the performance of future work similar to the EVM calculations of EAC = BAC/CPI for cost.

b. CPM schedules do not show critical path slippage if 'float' is being consumed. The 'bow wave' of delayed work eventually becomes critical (usually with disastrous consequences) but there may not be pre-warning.

ES can't replace scheduling (and does not seek to) but it does provide a useful insight above and beyond what's achievable using either traditional EV calculations or traditional CPM scheduling[2].

Earned Schedule (ES) Fundamentals



ES uses standard EV data to calculate a set of schedule indicators, which behave correctly over the entire period of project performance. The methodology and spreadsheets needed for calculation are freely available from the ES website.

The key transposition is understanding two key 'time' metrics:

1. The difference between the number of time periods from the start of the project through to the data date (or 'time now') when the EV data was collected – this is the actual time (AT = 7 months in this example).

[1] For more on ***Earned Value Management*** see: https://mosaicprojects.com.au/WhitePapers/WP1081_Earned_Value.pdf

[2] For more on this see: ***Why Critical Path Scheduling (CPM) is Wildly Optimistic***: https://mosaicprojects.com.au/PDF_Papers/P117_Why_Critical_Path_Scheduling_is_Wildly_Optimistic.pdf

2. The time through to when the earned value achieved, should have been achieved. This time is assessed by transferring the EV back onto the planned value (PV curve) and calculating the time periods from the start of the project to this point in time. This period is the Earned Schedule (ES). ES usually involves a fraction of a month, in this example approximately 5.5 months. For convenience, the ES calculation simply assumes a straight-line expenditure through the final month.

From this information a set of 'time data' can be developed comparable to standard earned value cost data:

	EVM	Earned Schedule
Status	Earned Value (EV)	Earned Schedule (ES)
	Actual Costs (AC)	Actual Time (AT)
	SV	SV(t)
	SPI	SPI(t)
Future Work	Budgeted Cost for Work Remaining (BCWR)	Planned Duration for Work Remaining (PDWR)
	Estimate to Complete (ETC)	Estimate to Complete (time) ETC(t)
Prediction	Variance at Completion (VAC)	Variance at Completion (time) VAC(t)
	Estimate at Completion (EAC) (supplier)	Estimate at Completion (time) EAC(t) (supplier)
	Independent EAC (IEAC) (customer)	Independent EAC (time) IEAC(t) (customer)
	To Complete Performance Index (TCPI)	To Complete Schedule Performance Index (TSPI)

And a similar set of time related calculations can be performed:

Metrics	Earned Schedule	ES_{cum}	ES = C + I number of complete periods (C) plus an incomplete portion (I)
	Actual Time	AT_{cum}	AT = number of periods executed
Indicators	Schedule Variance	SV(t)	SV(t) = ES – AT
		SV(t)%	SV(t)% = (ES – AT) / ES
	Schedule Performance Index	SPI(t)	SPI(t) = ES / AT
	To Complete Schedule Performance Index	TSPI	TSPI = (PD – ES) / (PD – AT)
			TSPI = (PD – ES) / (ED – AT)
Predictors	Independent Estimate at Completion (time)	IEAC(t)	IEAC(t) = PD / SPI(t)
			IEAC(t) = AT + (PD – ES) / PF(t)
	Variance at Completion	VAC(t)	VAC(t) = PD - IEAC(t) or ED

The terminology depicted in this table has a few terms requiring definition:

- PD = Planned Duration
- ED = Estimated Duration
- PF(t) = Performance Factor (time-based)

The Earned Schedule tools are freely available from http://www.earnedschedule.com together with published papers and links to other sites.

Summary

More than a decade of research in the USA, Europe, Israel and Australia has consistently demonstrated that CPI and SPI(t) are closely correlated at a summary level across a range of commercial and defence projects. Therefore, used properly, ES creates a reliable bridge between EVM cost analysis and network schedule analysis, providing the base for further developments in cost-schedule integration:

- CPM is good for motivation and direction but it assumes future work will go as planned. This tool is essential for directing the efficient use of resources (but has limited predictive capability)
- Monte Carlo can calculate contingencies and probability for time and cost outcomes but has no predictive capabilities based on actual performance to date
- Earned Schedule can predict likely time outcomes based on performance
- Earned Value can predict likely cost outcomes based on performance
- But all four are needed for a full understanding of the situation

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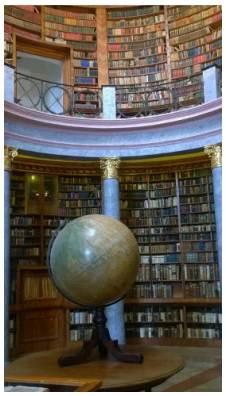
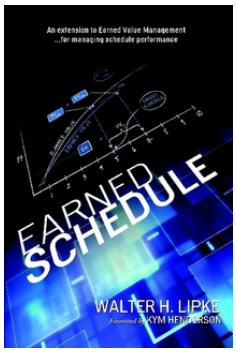


For more on Earned Schedule:

A sensibly priced book that explains the concept of ES and additional advances to the theory and practice of ES including the "P" factor, a measure of schedule adherence and "Effective EV," which discounts the EV accrued by EV earned out of the correct process sequence is available from Lulu Publishing; printed paperback books are available from Amazon, Lulu and a range of other book sellers[3].



[3] ***Earned Schedule*** by Walter H. Lipke: http://www.lulu.com/shop/walter-h-lipke/earned-schedule/paperback/product-18848236.html