INTRODUCTION TO EARNED SCHEDULE

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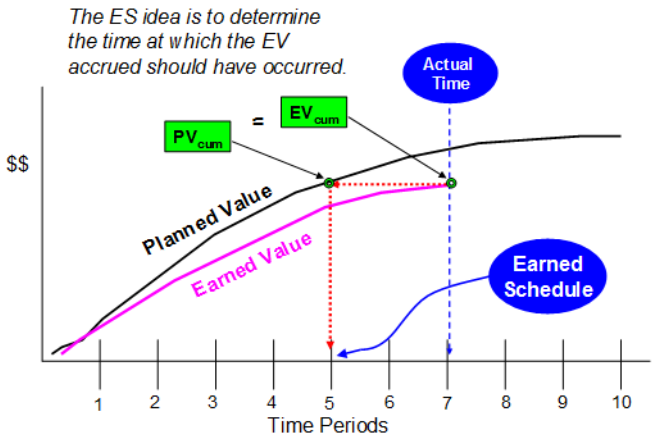
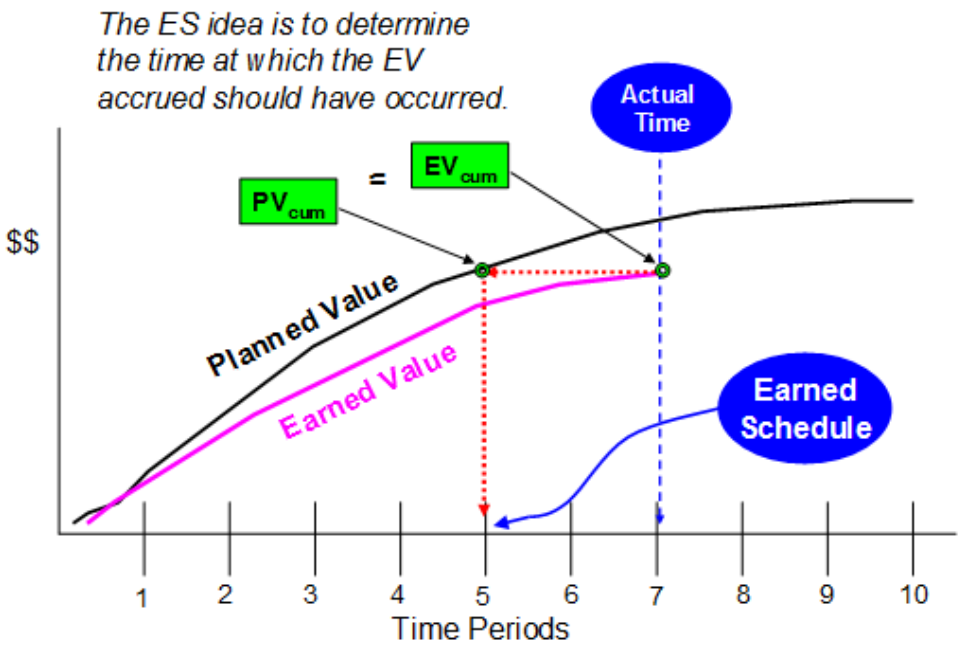


Abstract

Earned Schedule is an extension to Earned Value Management. The method provides considerable capability to project managers for analysis of schedule performance. From the time of the public's first view of Earned Schedule, its propagation and uptake around the world has been extraordinary. This presentation will cover the capabilities, affirmation, and resources available supporting the practice.

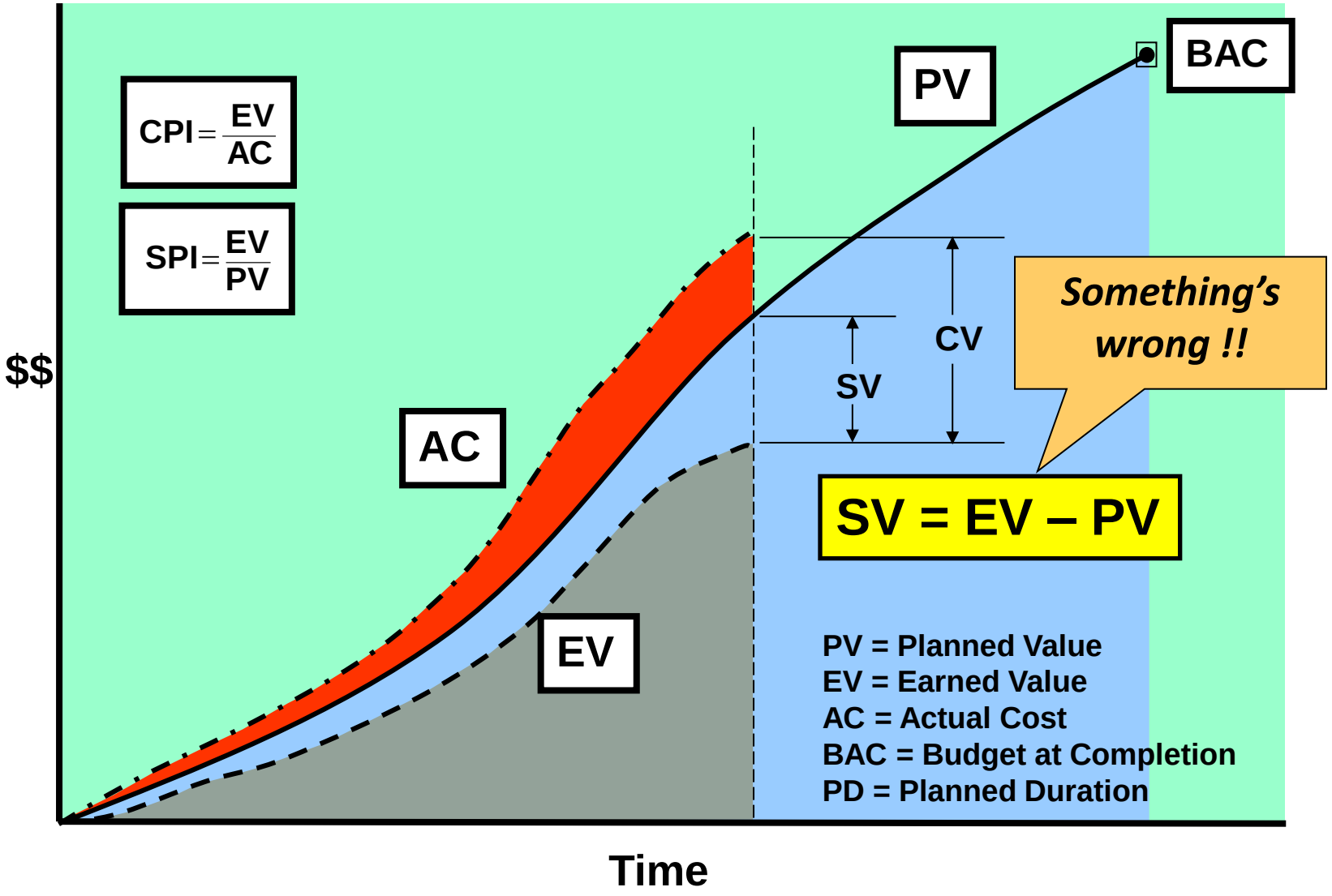
Overview

- Description
- Capabilities
- Affirmation
- Resources
- Computation
- Summary

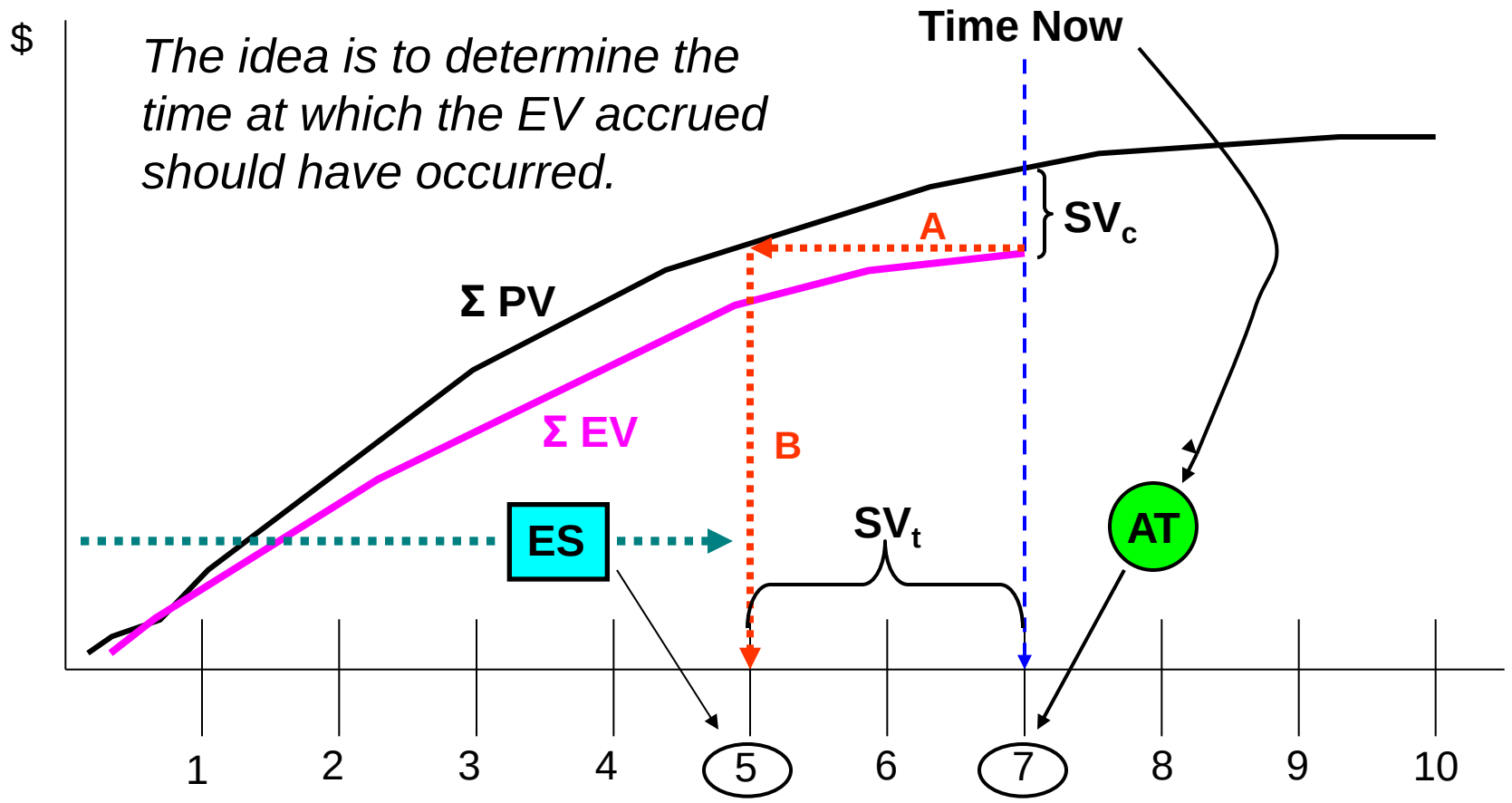


DESCRIPTION

EVM Schedule Indicators



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 Concept

- Formula
  - $ES = C + I$

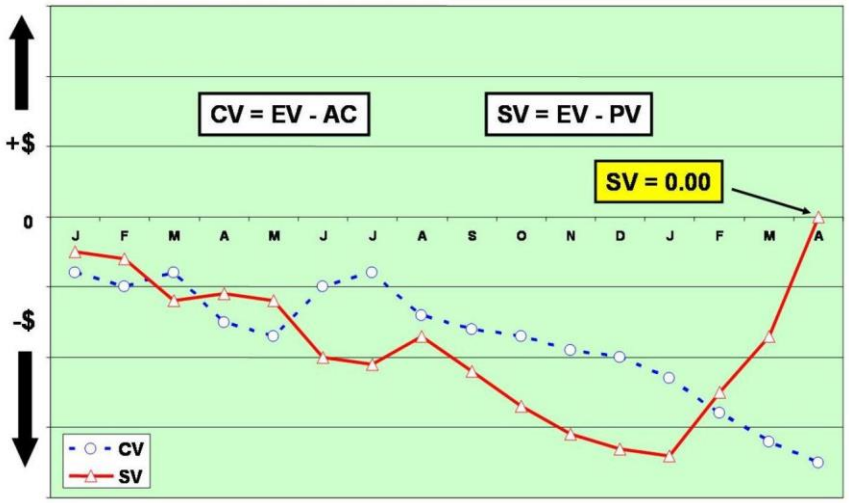
    where: C = number of time increments for $EV \geq PV$

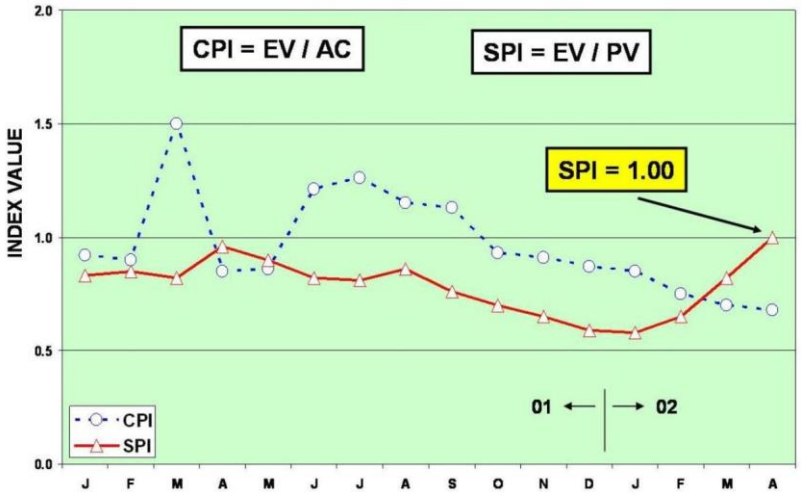
    $I = (EV - PV_C) / (PV_{C+1} - PV_C)$
- Indicators
  - Schedule Variance: $SV(t) = ES - AT$
  - Schedule Performance Index: $SPI(t) = ES / AT$

CAPABILITIES

Capabilities

- Reliable indicators – SV(t) & SPI(t)
  - True performance at completion

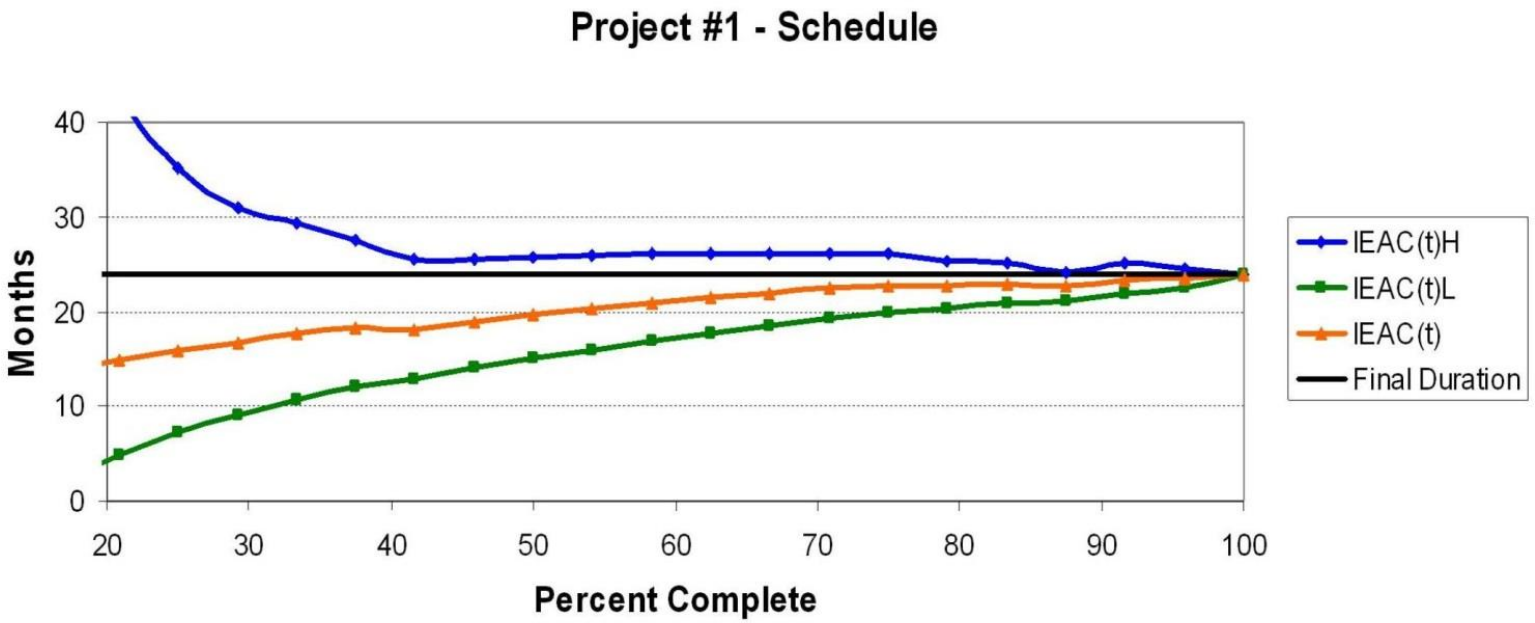




EVM schedule indicators fail for late performing projects

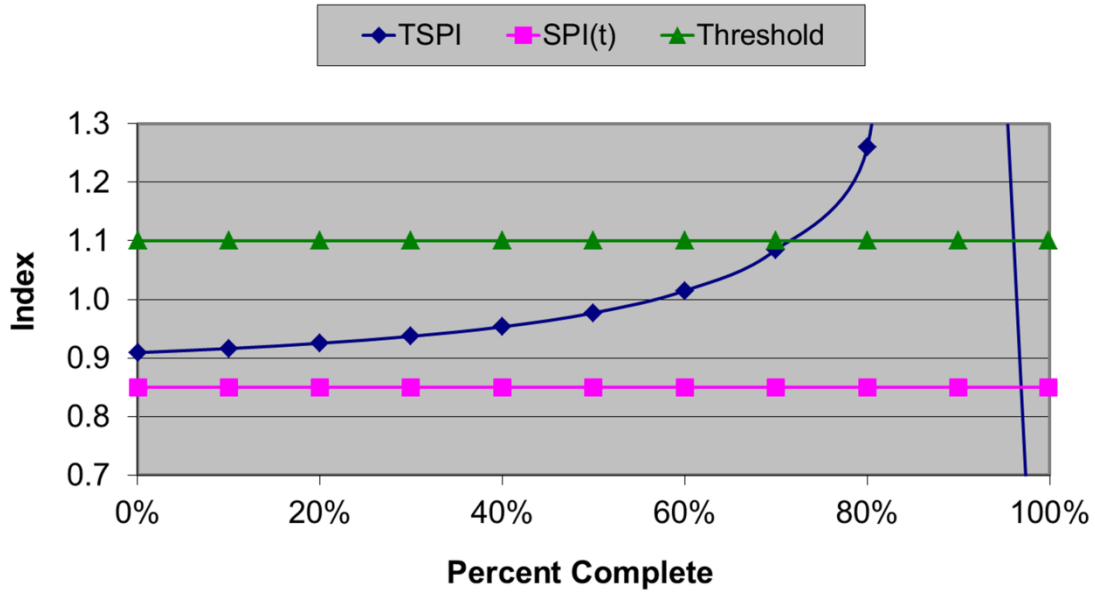
Capabilities

- Forecasting
  - Duration & completion date
  - Always converges to actual result



Capabilities

- Prediction
  - To Complete Schedule Performance Index (TSPI)
  - Answers question – “Is completion at (time) achievable?”



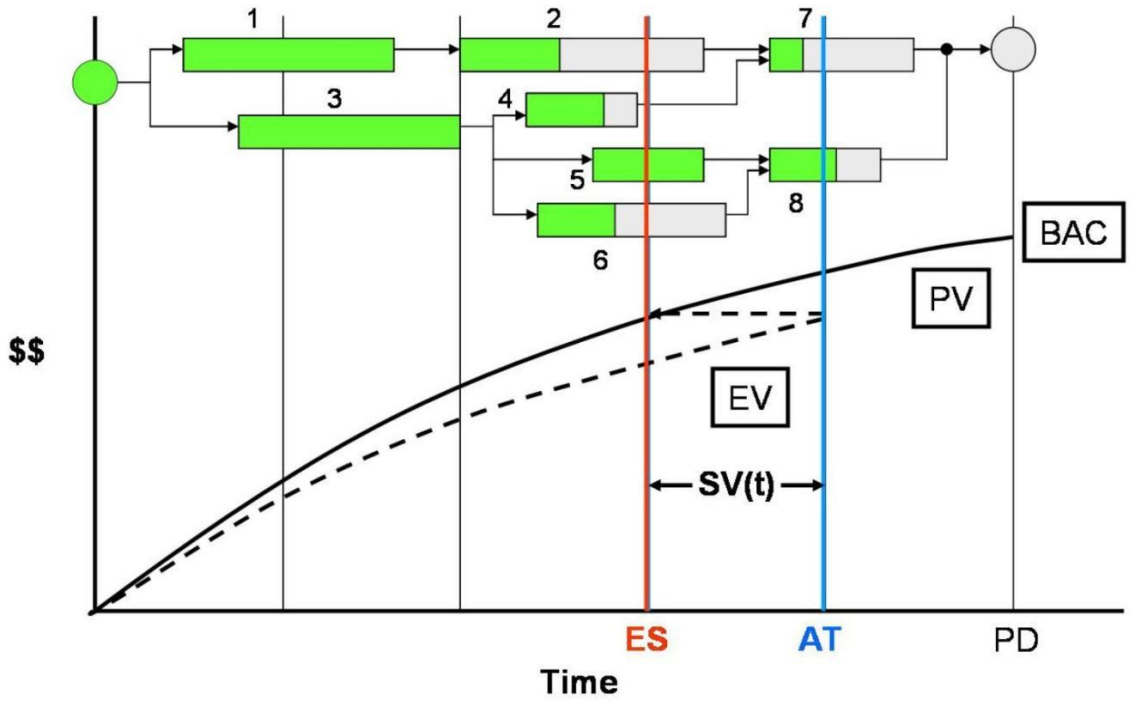
Capabilities

- Critical Path
  - Comparison of project and CP performance

		••• Performance Period •••												
	Indicator	0	1	2	3	4	5	6	7	8	9	10	11	12
Total Project	CPIp	xxx	xxx	0.800	0.800	0.827	0.771	0.900	0.838	0.727	0.900	0.750	0.600	1.000
	CPIc	xxx	xxx	0.800	0.800	0.818	0.804	0.818	0.822	0.812	0.816	0.810	0.805	0.808
	SPI(t)p	xxx	0.000	0.800	1.486	1.314	0.775	0.450	0.975	0.700	0.450	1.950	0.500	0.600
	SPI(t)c	xxx	0.000	0.400	0.762	0.900	0.875	0.804	0.829	0.813	0.772	0.890	0.855	0.833
	SPIp	xxx	0.000	0.800	0.457	1.433	0.675	0.600	1.550	3.200	0.900	3.000	xxx	xxx
	SPIc	xxx	0.000	0.400	0.444	0.840	0.783	0.745	0.842	0.912	0.911	0.968	0.984	1.000
	IEAC(t)	xxx	xxx	25.00	13.13	11.11	11.43	12.44	12.07	12.31	12.95	11.24	11.70	12.00
Critical Path 1-4-8-10	CPIp	xxx	xxx	0.800	0.800	0.833	0.600	xxx	0.800	0.667	xxx	0.714		
	CPIc	xxx	xxx	0.800	0.800	0.815	0.781	0.781	0.787	0.763	0.763	0.753		
	SPI(t)p	xxx	0.000	0.800	1.600	2.000	0.600	0.000	1.700	1.300	0.000	2.000		
	SPI(t)c	xxx	0.000	0.400	0.800	1.100	1.000	0.833	0.957	1.000	0.889	1.000		
	SPIp	xxx	0.000	0.800	1.600	2.000	0.600	0.000	1.200	1.600	0.000	2.000		
	SPIc	xxx	0.000	0.400	0.800	1.100	1.000	0.833	0.925	1.000	0.900	1.000		
	IEAC(t)	xxx	xxx	25.00	12.50	9.09	10.00	12.00	10.45	10.00	11.25	10.00	xxx	xxx

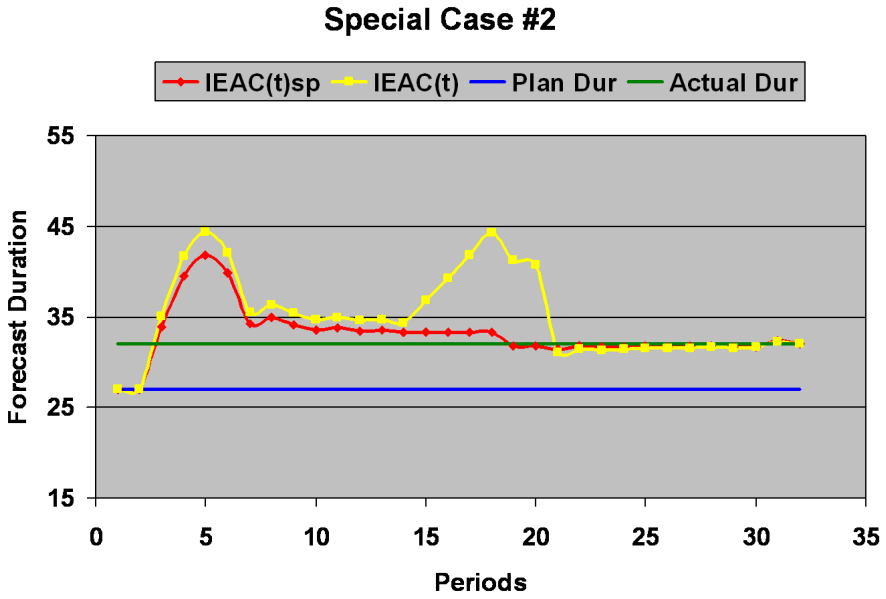
Capabilities

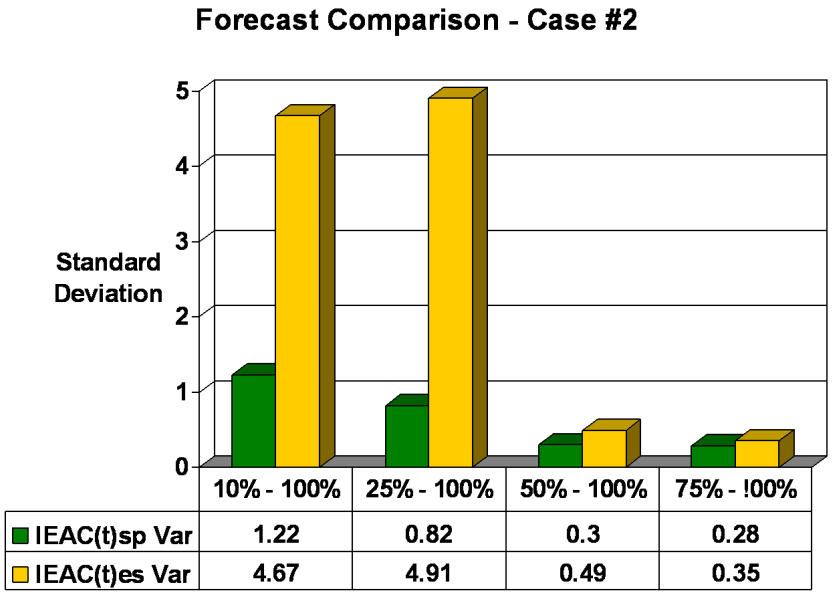
- Detail Analysis – Schedule Adherence
  - Identifies out of sequence performance
  - Isolates tasks - constraints/impediments & rework
  - Facilitates calculations - EV_R & rework forecast, EV_{eff}



Capabilities

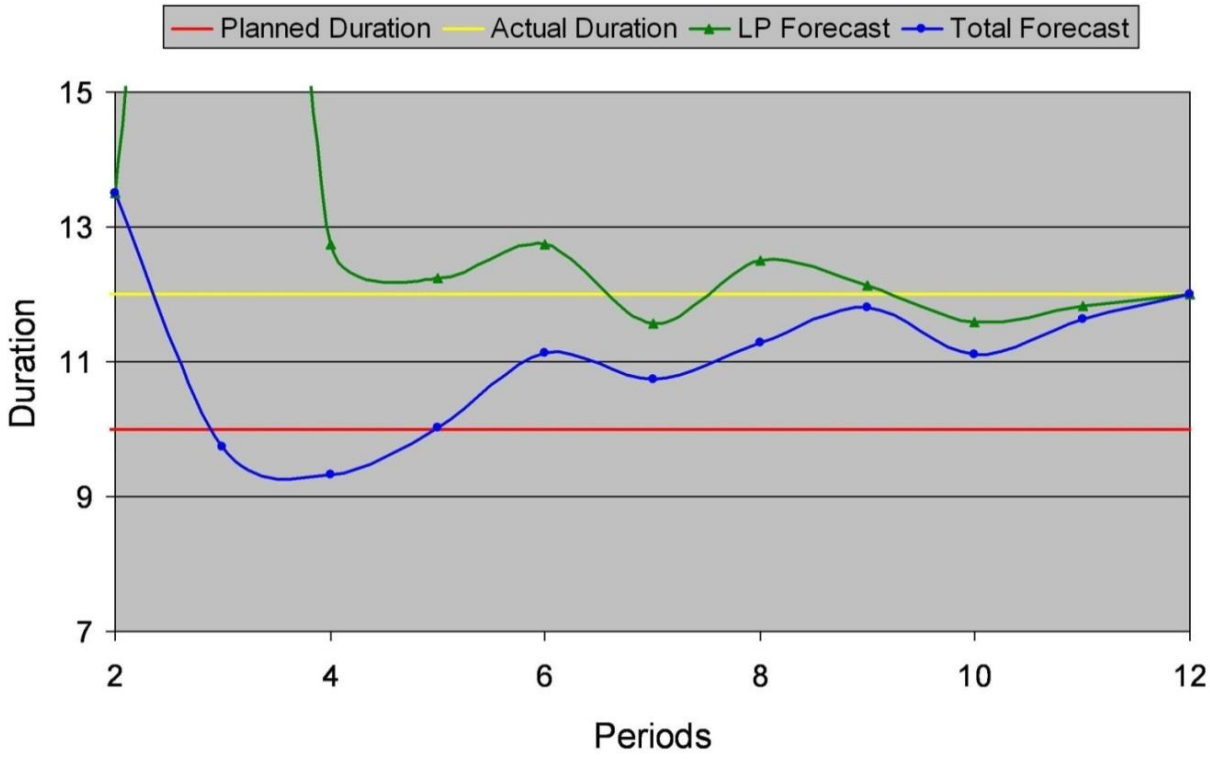
- Discontinuous performance – stop work & downtime
  - Accommodates and improves forecasting





Capabilities

- Schedule Topology
  - Longest path concept improves forecasts for parallel networks



Affirmation

- Simple theory
- Initial prototype
- Independent confirmation
  - Trials
  - Testing
  - Usage
- EVM Tools
- Educators/Researchers
- Awards

Affirmation

- Simple theory
- Initial prototype
- Independent confirmation
  - Trials

"The retrospective analysis of ES using my own EVM projects' data, … has confirmed with remarkable precision the accuracy of the ES concept and ES metrics …when compared to their historic EVM counterparts."

- Henderson (2003)

- Awards

Affirmation

- Simple theory
- Initial prototype

"The results reveal that the earned schedule method outperforms, on the average, all other forecasting methods."

- Vanhoucke & Vandevoorde (2007)

  - Testing

"This research finds Earned Schedule to be a more timely and accurate predictor than Earned Value Management."

- Capt. Kevin Crumrine (2013)

- Educators/Researchers
- Awards

Affirmation

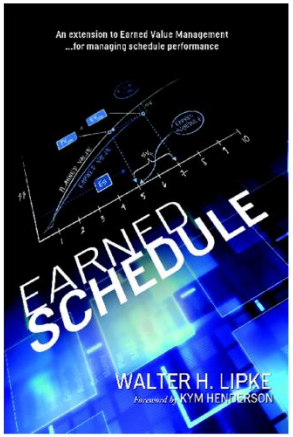
Evidence of Earned Schedule Usage			
Application	USA	Lockheed-Martin Boeing Booze-Allen-Hamilton Government & Defense	Projects are generally extremely large, running for a decade or more and costing in excess of $1 Billion.
	Australia UK Belgium Kazakhstan India	Private & Defense Network Rail & Defense Fabricom (GDF-SUEZ) Petroleum Development Building Construction	
University Coursework	USA	George Washington University, Drexel, University of Houston, University of Nevada (Reno), West Virginia University, Pennsylvania State University	
	non-USA	University of Ghent (Belgium), Australian National University	
Books	USA	*Earned Schedule* by Walter H. Lipke *Project Management Theory and Practice* by Dr. Gary L. Richardson *The Earned Value Maturity Model* by Ray W. Stratton *A Practical Guide to Earned Value Management, 2nd Edition* by Charles & Charlene Budd *Project Management Achieving Competitive Advantage* by Jeffrey K. Pinto *Practice Standard for Earned Value Management* by Project Management Institute	
	non-USA	*Measuring Time: Improving Project Performance Using Earned Value Management* by Dr. Mario Vanhoucke *Earned Schedule - an emerging Earned Value technique* issued by UK APM EVM SIG	

Resources

- Earned Schedule Website

  http://www.earnedschedule.com/

  - Papers, Presentations, Calculators, Terminology
- PMI® *Practice Standard for Earned Value Management*, 2nd Edition
- *Earned Schedule* book (English, Japanese, Portuguese)
  - Print
  - ePub (Nook & iPad)
  - Kindle
  - PDF



Resources

- Read two articles …to begin
  - “Schedule is Different”
  - “Further Developments in Earned Schedule”
- Scan the Calculators …experiment with them
  - ES Calculator (v1b & vs1b)
  - ES-LP Calculator
  - P-Factor Calculator
  - Statistical Forecasting Calculator
  - SA Index & Rework Calculator
  - Prediction Analysis Calculator

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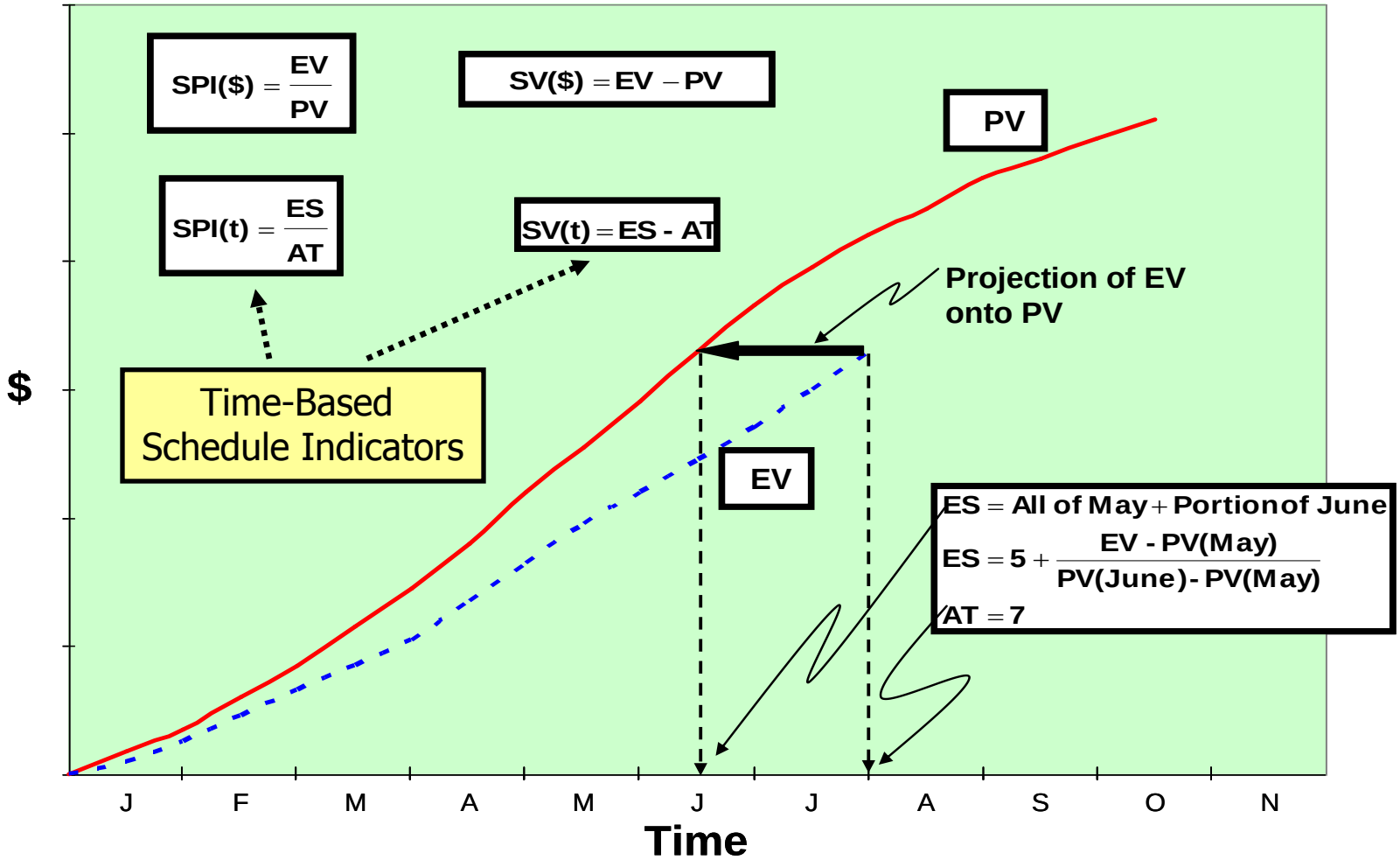
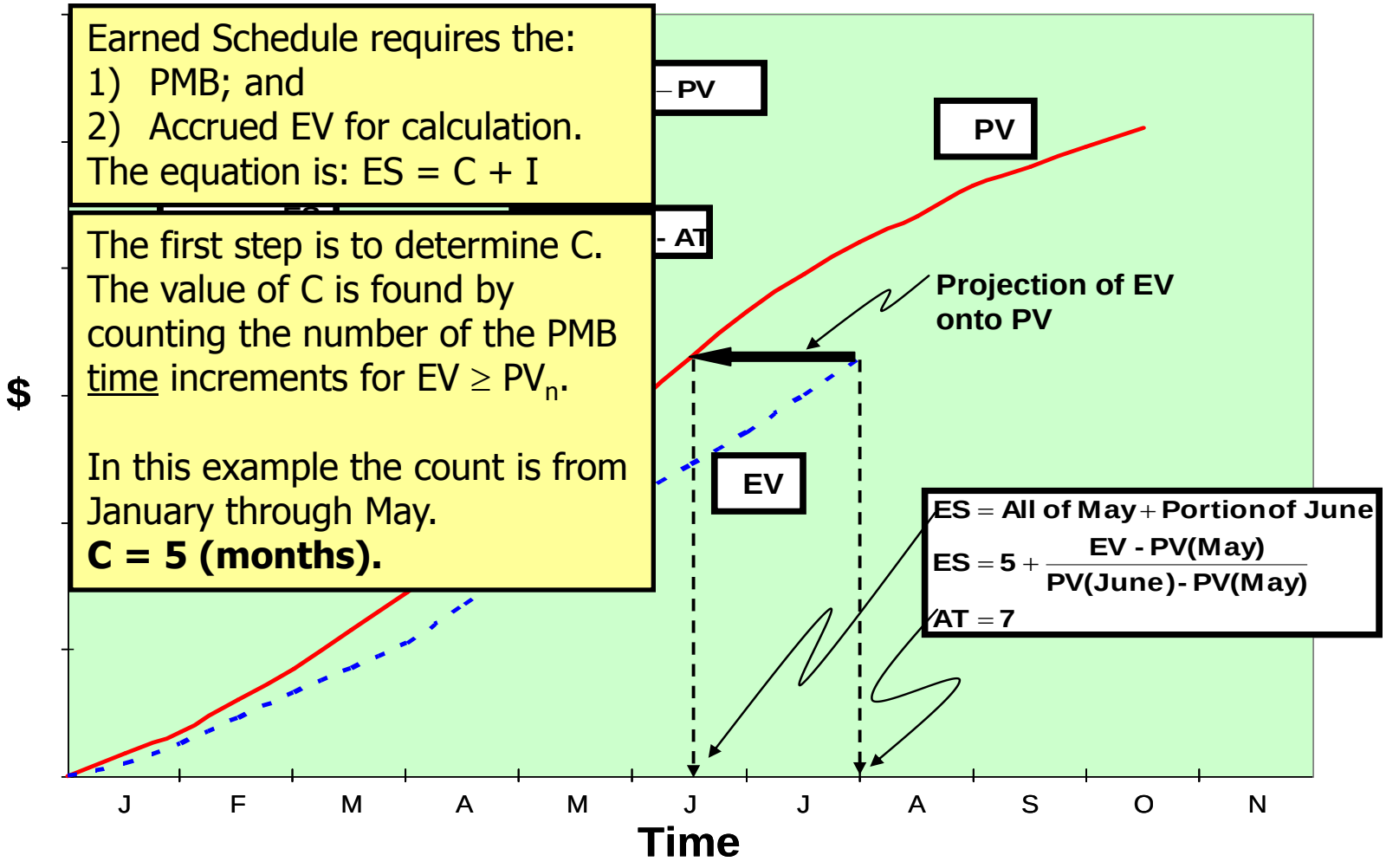
ES COMPUTATION

ES Computation Example



ES Computation Example



ES Computation Example

Thus far, ES = 5 + I (months).
In the small box at the lower right, is the equation for calculating I.
For the example, let
1) EV = 100
2) PV_5 (May) = 90
3) PV_6 (June) = 110.

Let's calculate I:
I = (100 – 90) / (110 – 90) = 0.5

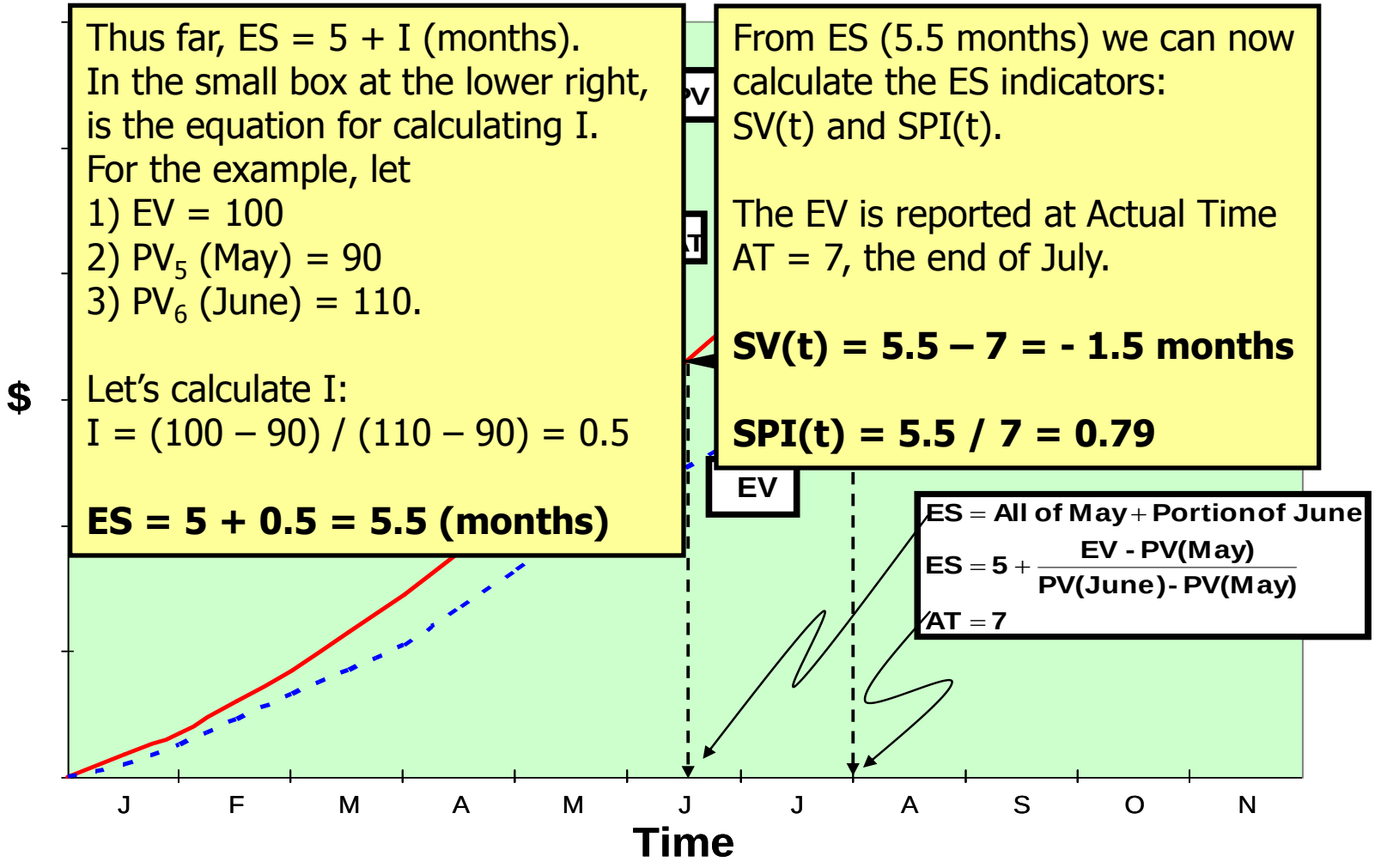
ES = 5 + 0.5 = 5.5 (months)

From ES (5.5 months) we can now calculate the ES indicators: SV(t) and SPI(t).

The EV is reported at Actual Time AT = 7, the end of July.

SV(t) = 5.5 – 7 = - 1.5 months

SPI(t) = 5.5 / 7 = 0.79



Earned Schedule Terminology

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

SUMMARY

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
  - SPI(t) & SV(t) behave similarly to CPI & CV
  - IEAC(t) = PD / SPI(t) behaves similarly to IEAC = BAC / CPI

Summary

- Schedule performance analysis – much easier and possibly better than “bottom-up” methods
- Application is growing in both small and large projects
- Practice recognized by PMI in EVM Practice Standard
- Resource availability enhanced with ES website and Wikipedia
- Research indicates ES superior to other methods

Hopefully you are encouraged to – Give ES a try!


Thank You!!
TM