EXTENDING EVM and SCHEDULING BEST PRACTICE METRICS

for more confident predictions of future project performance

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Project Governance and Control Symposium 2015

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PRESENTATION OUTLINE

1. INTRODUCTION
2. TRADITIONAL EVM - Overview
3. TRADITIONAL EVM – Performance Analysis
4. TRADITIONAL EVM – Deficiencies in Treatment of Schedule
5. EXTENDING EVM – to deliver early warning of future problems
6. SCHEDULE ADHERENCE
7. EXAMPLES OF EXTENDED EVM APPLICATIONS
8. IMPLEMENTING EARNED SCHEDULE
9. SUMMARY
10. CONCLUSION
11. QUESTIONS

INTRODUCTION

DMO IS THE LARGEST PROJECT ORGANISATION IN AUSTRALIA

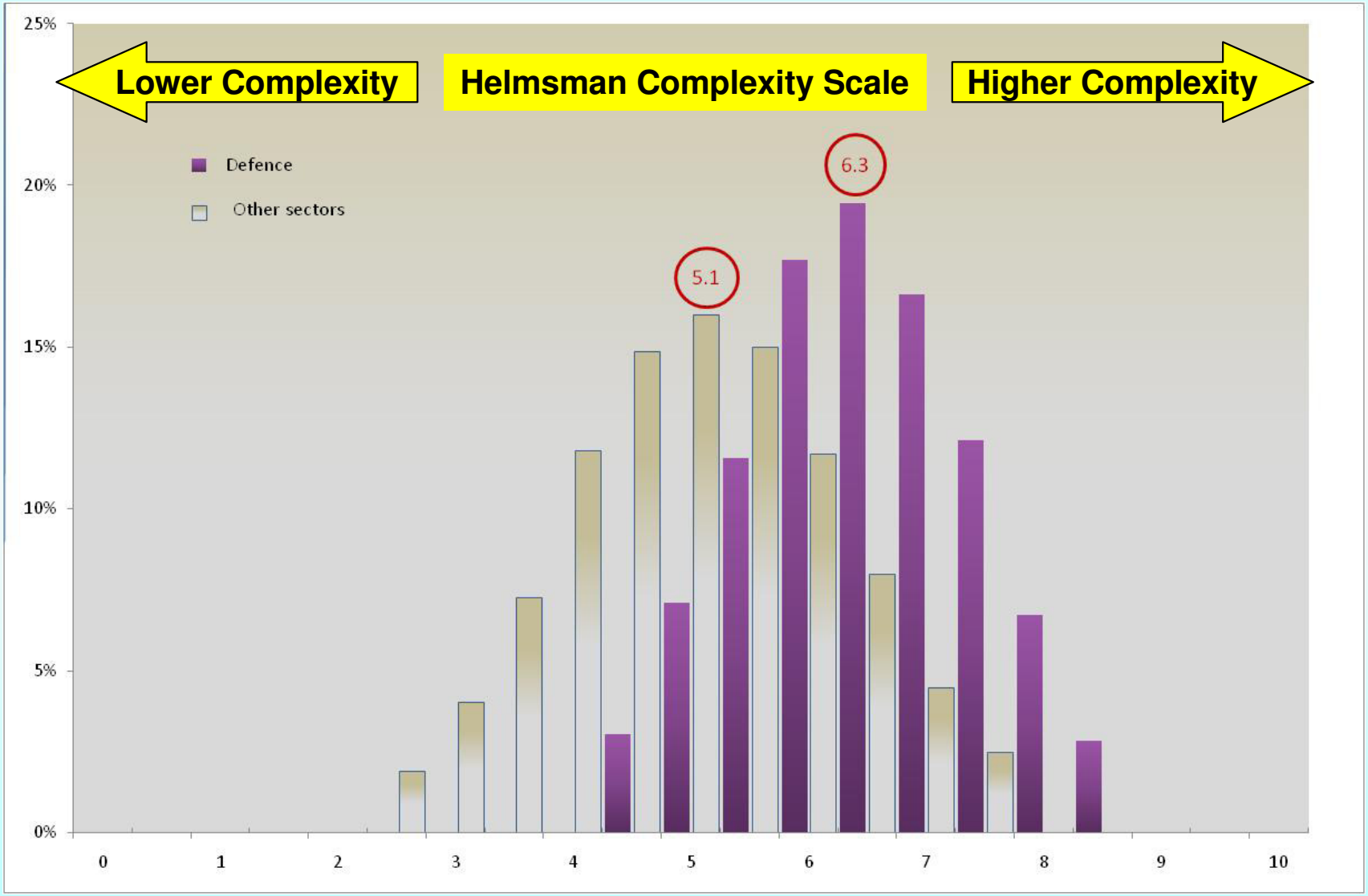
- **Present:**
  - 2013/14 budget : $9.7 billion,
  - over 180 major capital equipment projects
  - over 70 minor projects,
  - sustains and upgrades over 100 existing fleets of equipment.

- **Future:**
  - 2014 to 2017: Managing $43 billion acquisition and sustainment
    (approx 55 % to be spent in Australia).

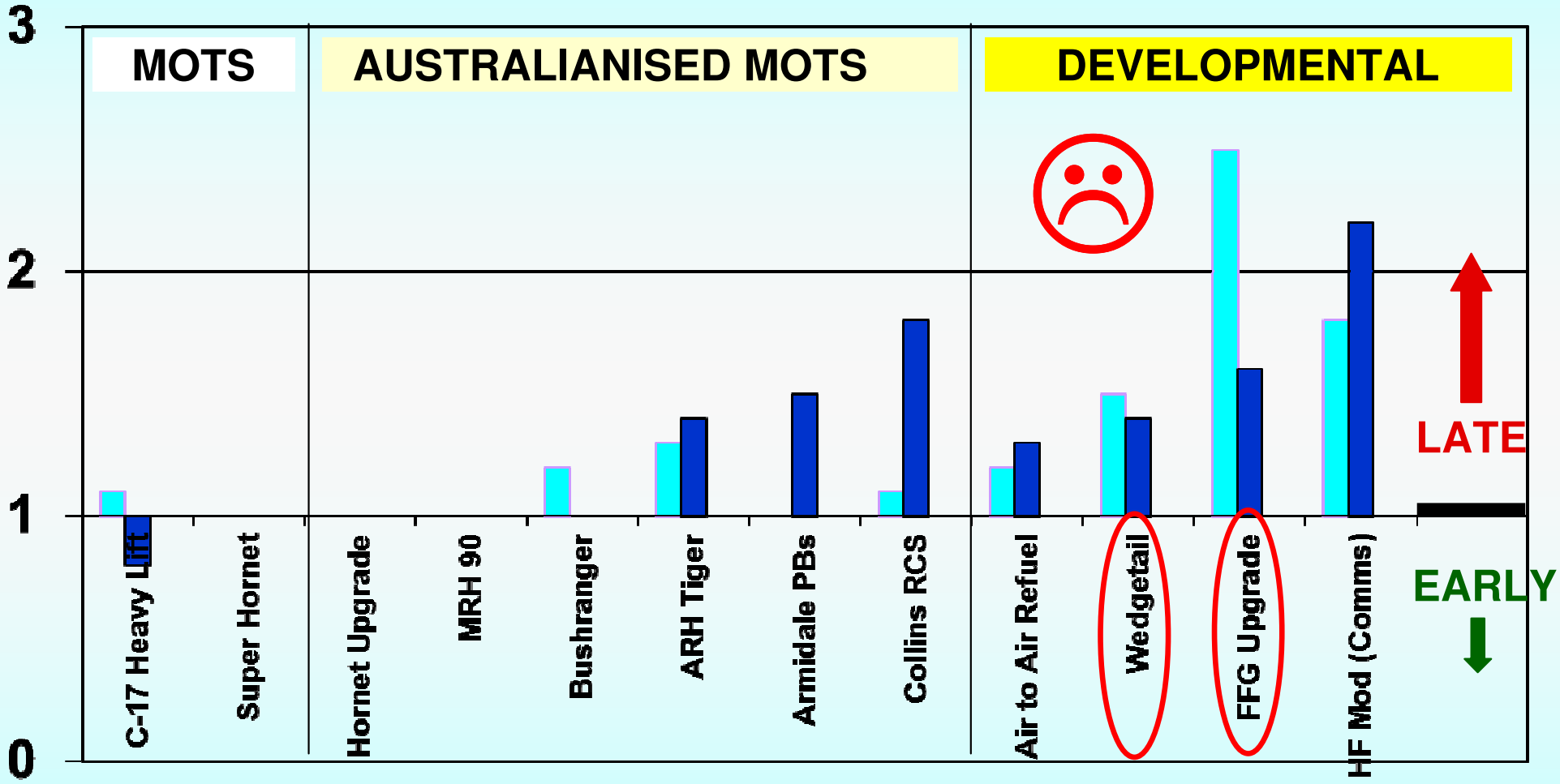
  - Latest Defence Capability Plan:
    - 111 projects, or phases of projects
    - Value approx $153 billion.

COMPLEXITY OF DEFENCE PROJECTS

Defence Projects are a level more complex than those in other Australian organisations



Schedule Variance Factors by Project Type



Source: *DMO 2008-09 Major Projects Report – ANAO Report No. 13 2009-10, pg 119*

Fast Frigate Upgrade Project

Refer to Project website & Janes for description

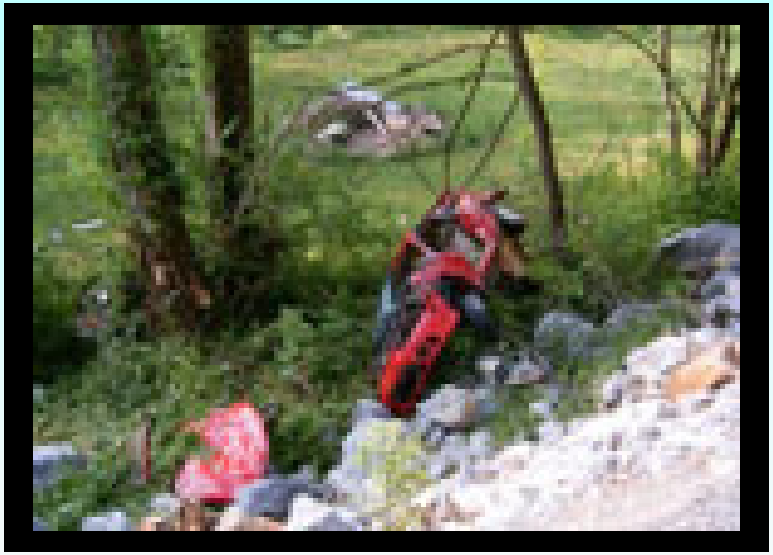
Airborne Early Warning and Control Project

Refer to Project website & Janes for description

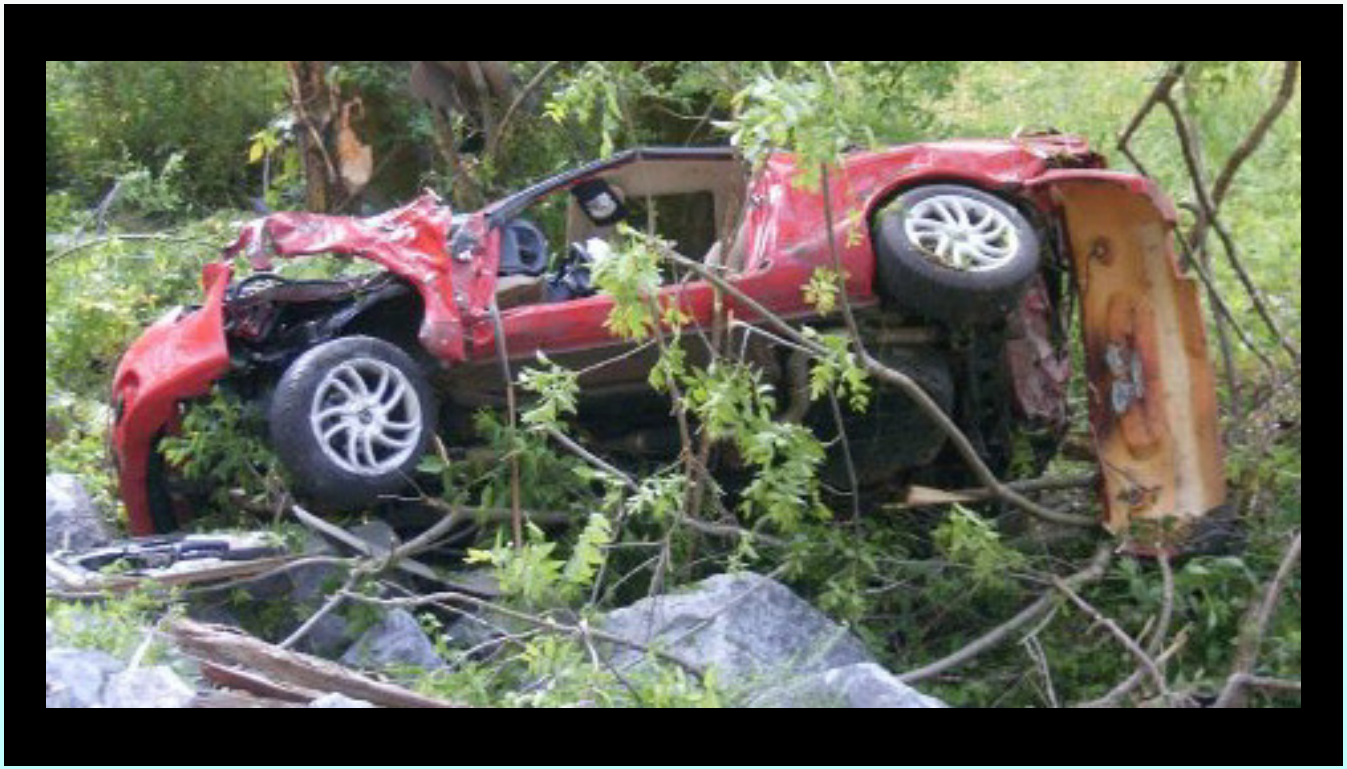
A Bright New Shiny Project All Ready to Roll

Heading Down the Interstate on a Journey of Delivery

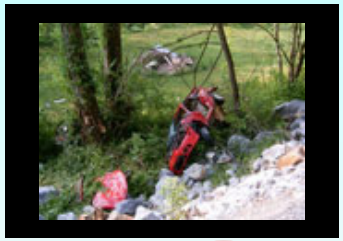
A straight run from Conceptville through to Productville !!!



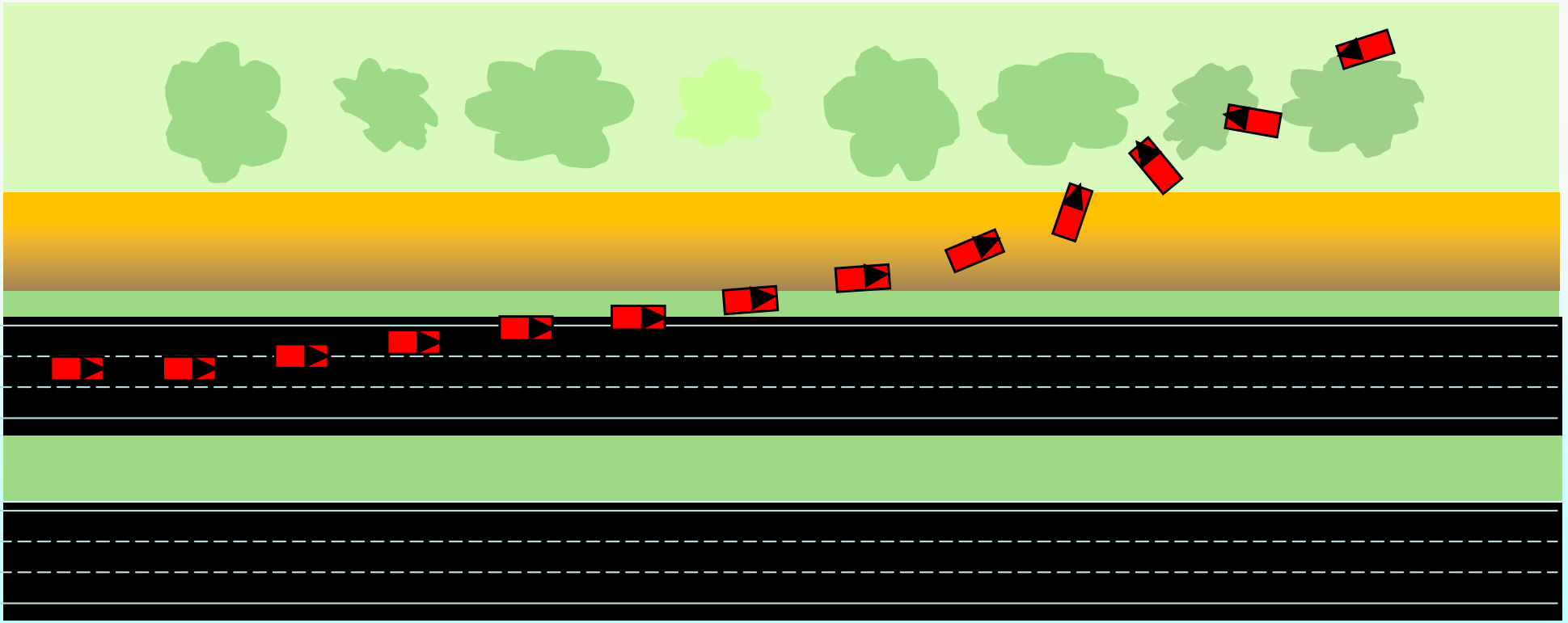
And We've Ended Up Here ???



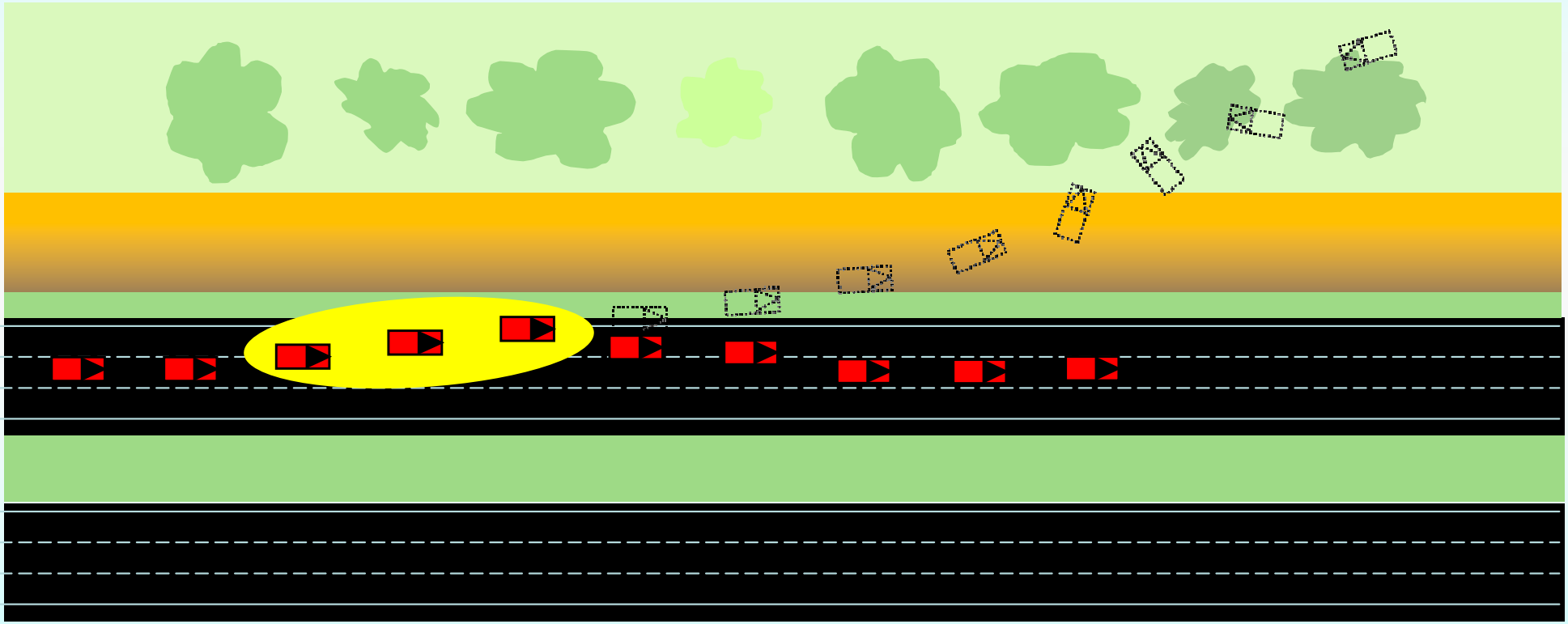
How the Heck Does This Happen ???



~~Drugs~~, ~~Alcohol~~, ~~Impatience~~, Overload, Inattention, Poor Skills, ~~Mechanical Failure~~



What If We Had Reliable Lane Departure Warning???



Traditional EVM – The foundation for meaningful project performance metrics

PROJECT BADNESS VERSIONS:

- PRODUCT = NOT TO SPEC (OR IS ?)
- COST = OVER BUDGET (OR NOT ?)
- **SCHEDULE = GONE WEST (OR NOT ?)**

Origins of EVM:

- Management by feeling, anecdote and experience,

  →became scientific management

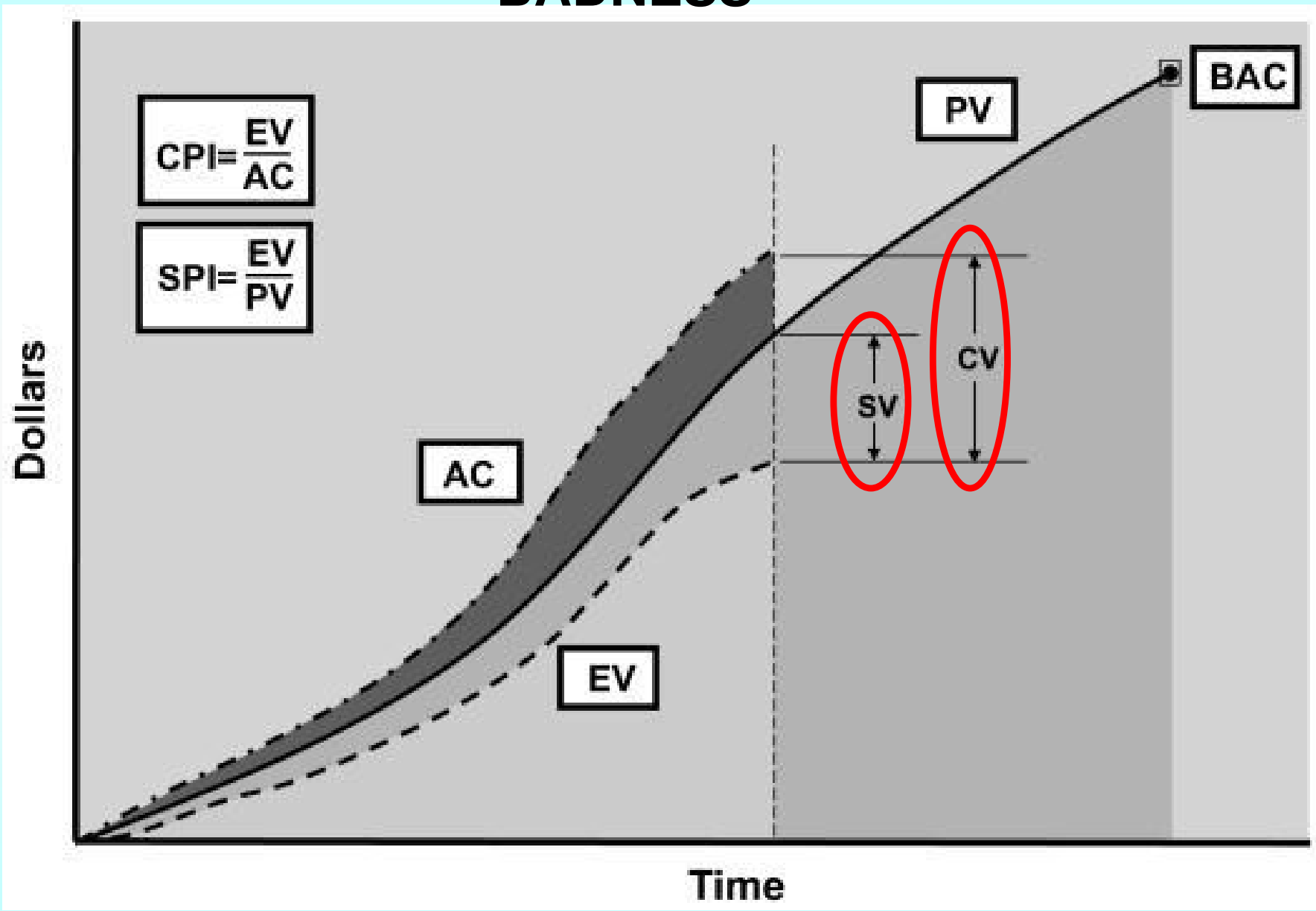
- Project Management by anecdote and experience, morphed through Gantt Chart and Critical Path Management

  →to arrive at

  Earned Value Management

Traditional EVM – Brief overview of cost and schedule performance analysis

HOW TRADITIONAL EV IDENTIFIES PROJECT BADNESS



(Source: Lipke W., Earned Value Basics 2003, p.2)

WHY ???

This behaviour is explained by looking at the Schedule Variance (SV) and the Schedule Performance Index (SPI) formulas.

These metrics consist of two parameters: EV and PV, and …..

…… at the end of the project, EV always equals the budget at completion (and thus equals the PV), it follows that the SPI always returns to one and the SV becomes zero !!!!

(Source: Lipke W., 2003, p.3)

Schedule Variance = Earned Value – Planned Value

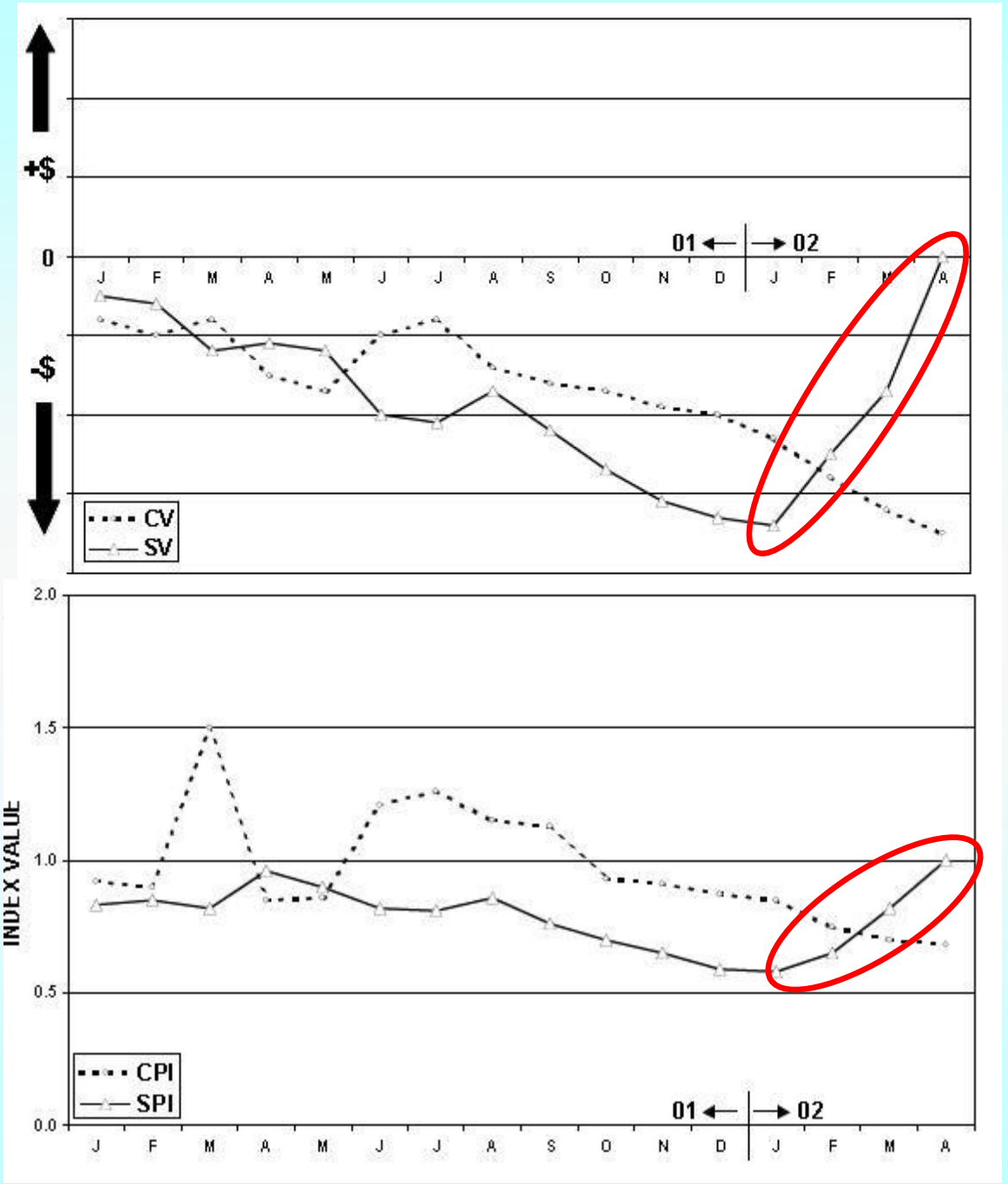
(= zero at completion)

Schedule Performance Index (SPI) $= \frac{\textbf{Earned Value}}{\textbf{Planned Value}}$

(= 1.000 at completion)

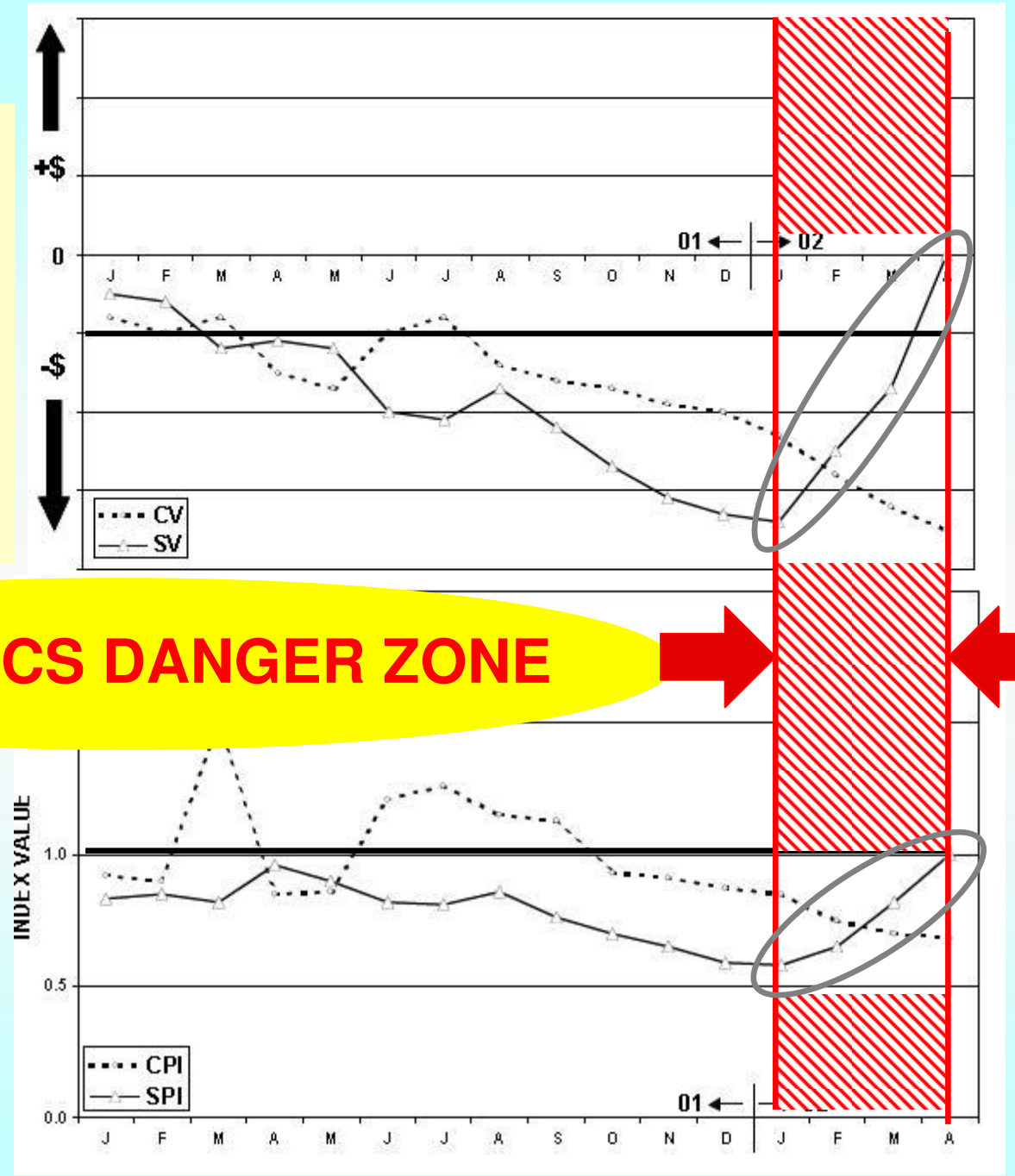
(Source: Def Sup AS 4817-2006)

DEFICIENCIES IN TRADITIONAL EVM SCHEDULE TREATMENT



(Source: Lipke W., 2003, p.3)

SCHEDULE UNDER TRADITIONAL EVM:



THE METRICS DANGER ZONE

BEST SCHEDULE RELATED QUOTE:

"THE SCHEDULE IS VALID AND ROBUST,
HOWEVER WE DO ACKNOWLEDGE IT'S RUNNING
AN ELEVATED LEVEL OF COMPLETION RISK."

(Source: not MontyPython or Black Adder)

AND ABOUT THE PRODUCT:

"IT IS WHAT IT IS."

(Source: neither MontyPython or Black Adder)

"WE'RE HERE TO DELIVER A PRODUCT, NOT RUN A COLLECTION OF SCIENCE EXPERIMENTS FOR YOU"

AND ABOUT THE PRODUCT:

"IT IS WHAT IT IS."

(Source: not MontyPython or Black Adder)

"WE'RE HERE TO DELIVER A PRODUCT, NOT RUN A COLLECTION OF SCIENCE EXPERIMENTS FOR YOU"

(Source: Acceptance Test Failure Review Meeting)

Extending Traditional EVM –
to deliver early warning of future performance problems

EARNED SCHEDULE SPEAK

(a near common language with traditional EVM)

	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)

Earned Schedule Formulae

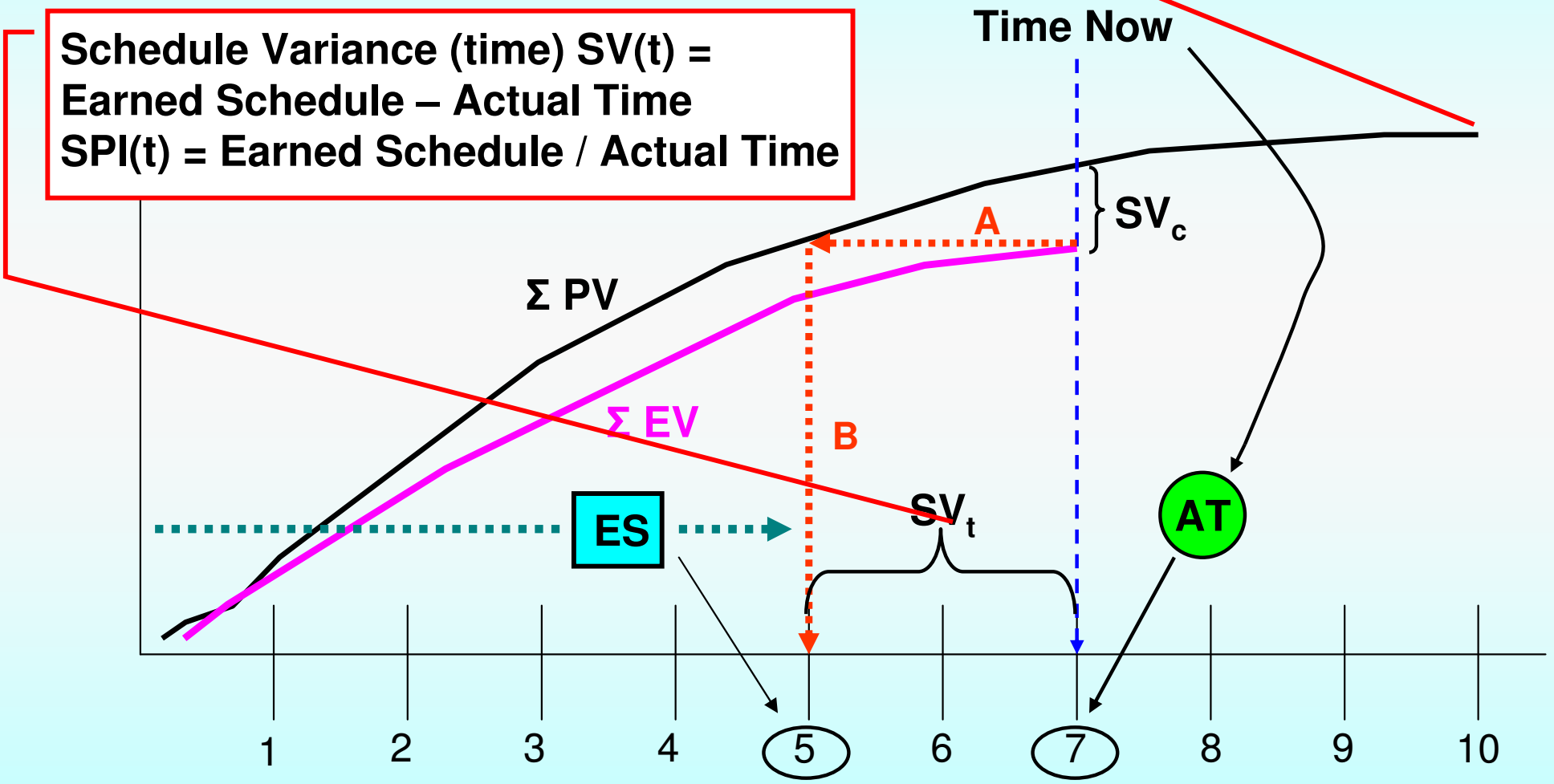
Metrics	Earned Schedule	ES_{cum}	ES = C + I number of complete periods (C) plus an incomplete portion (I)
	Actual Time	AT_{cum}	AT = number of periods executed
Indicators	Schedule Variance	SV(t)	SV(t) = ES – AT
		SV(t)%	SV(t)% = (ES – AT) / ES
	Schedule Performance Index	SPI(t)	SPI(t) = ES / AT
	To Complete 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

Earned Schedule Concept

(more Walt Lipke)

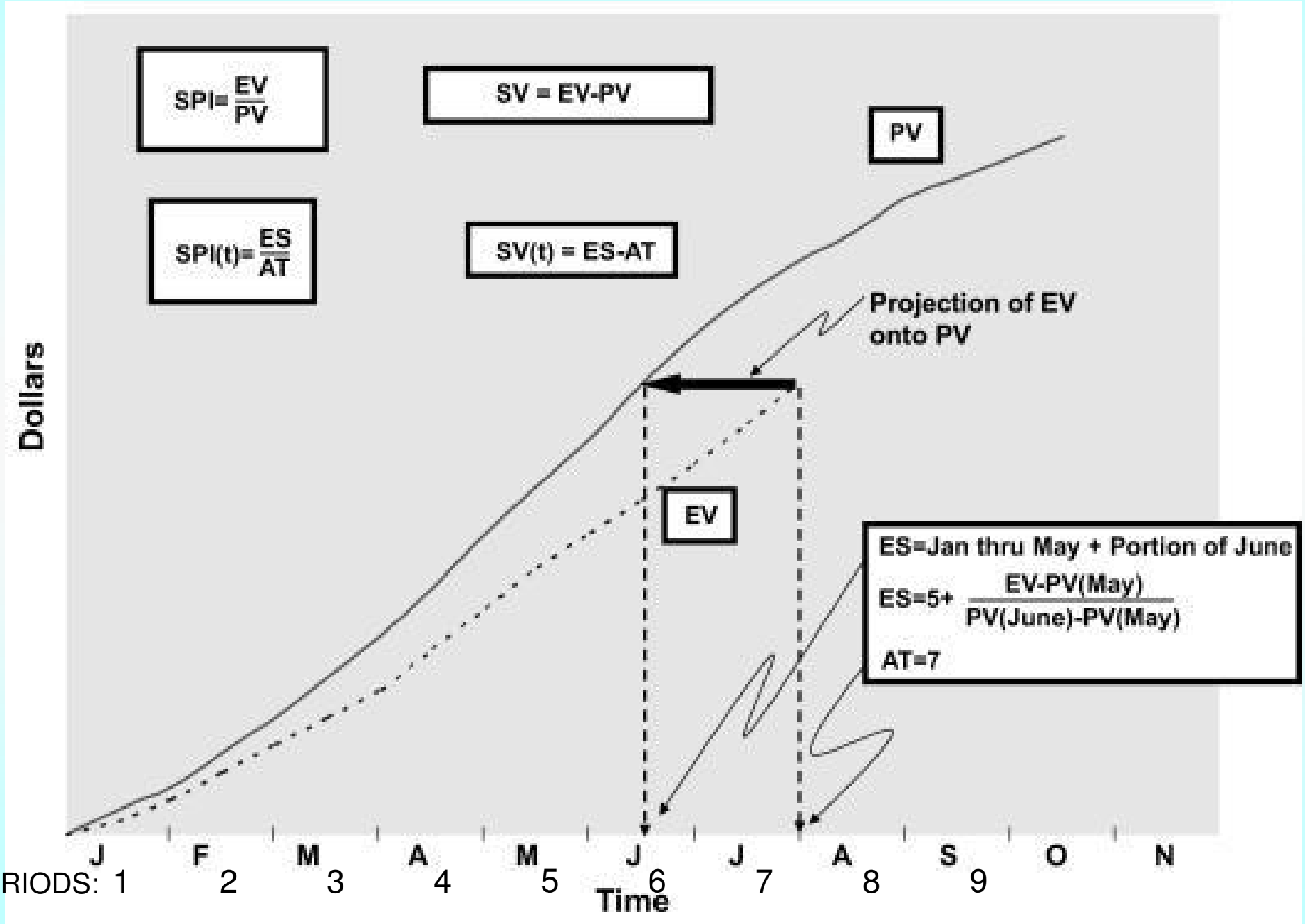
Statistically Predicted Project Duration = PD / SPI(t)

Schedule Variance (time) SV(t) = Earned Schedule – Actual Time
SPI(t) = Earned Schedule / Actual Time



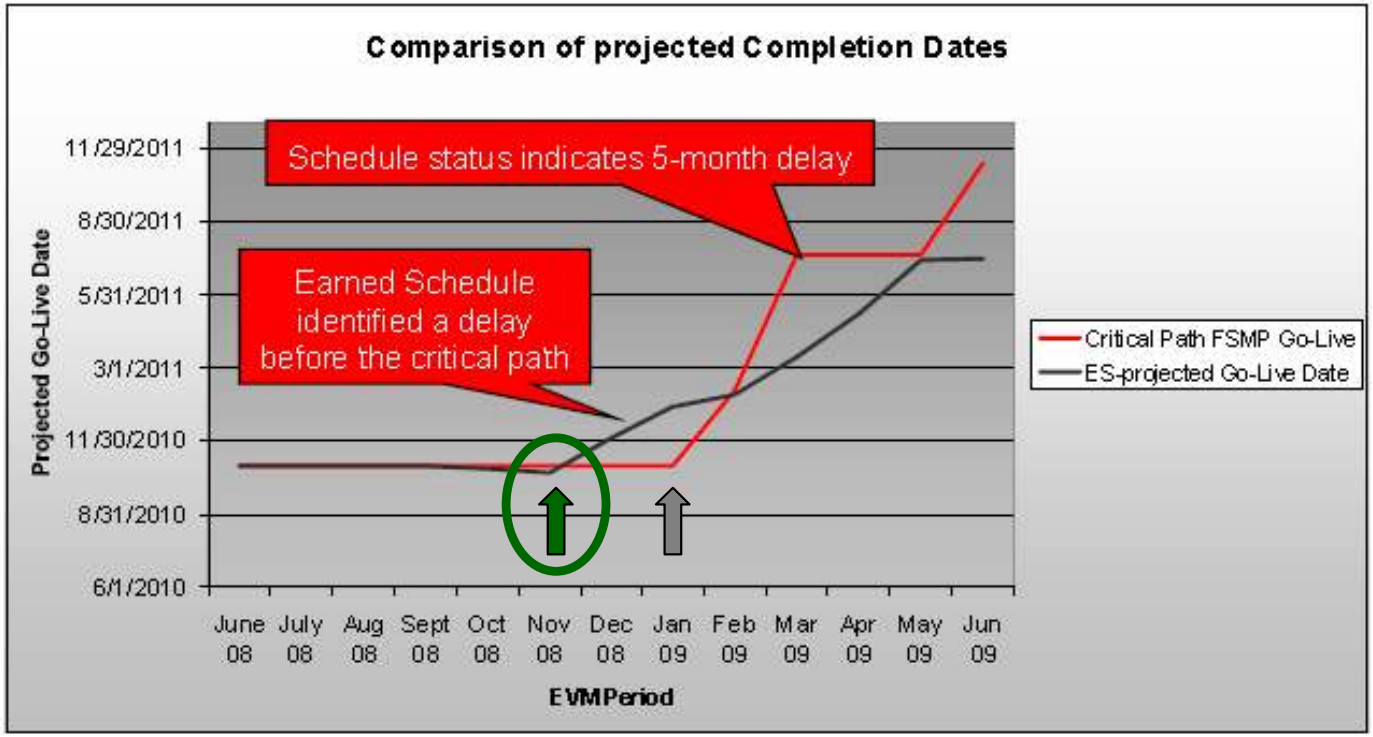
For the above example, ES = 5 months …that is the time associated with the PMB at which PV equals the EV accrued at month 7.

EARNED SCHEDULE EXPLAINED



EARNED SCHEDULE
PREDICTIVE ABILITY COMPARED

Un-named US Federal Govt Agency Program Data



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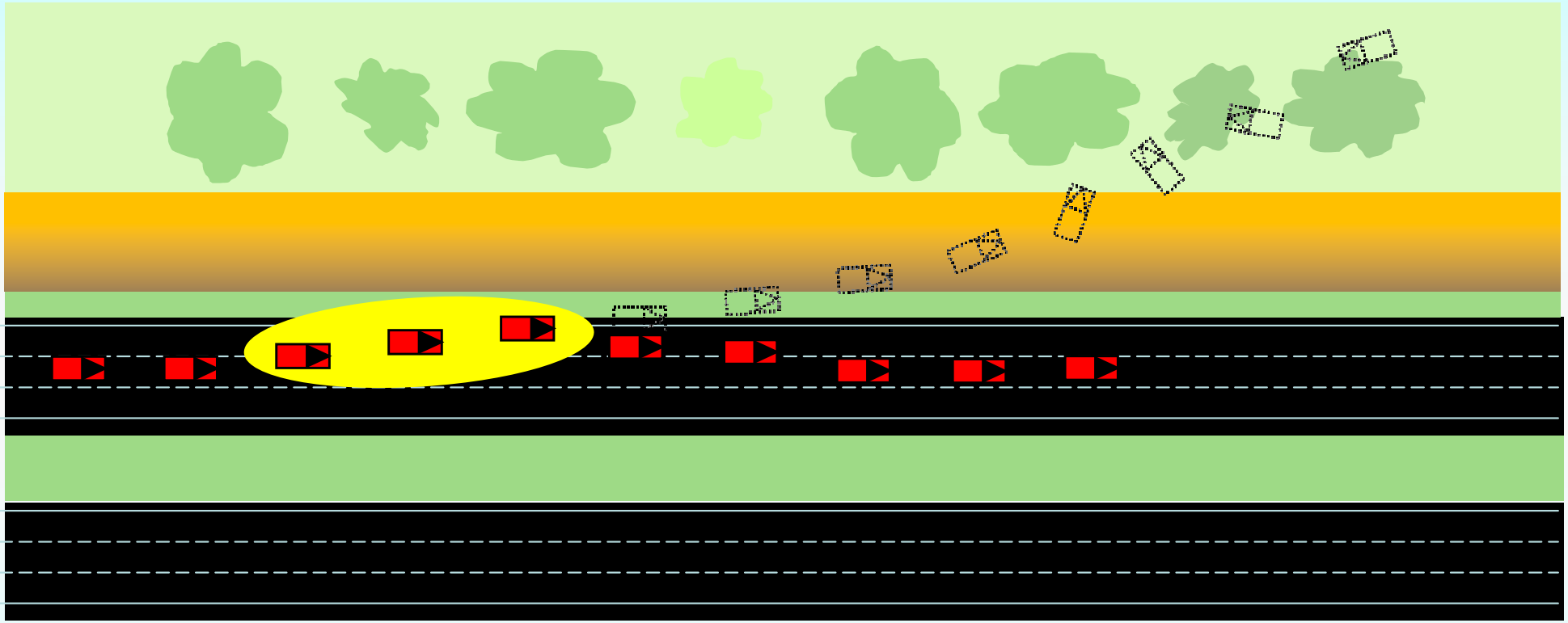
USA IPMC Conference 2009: Michelle Jones et. al.
(Booze Allen Hamilton data)

PAUSE FOR CONTEMPLATION

"CRITICAL PATH
IS ONLY THE CRITICAL PATH
WHILE EVERYTHING ELSE
PLAYS NICELY"

Schedule Adherence –
Lipke's P Factor

Reliable Lane Departure Warning

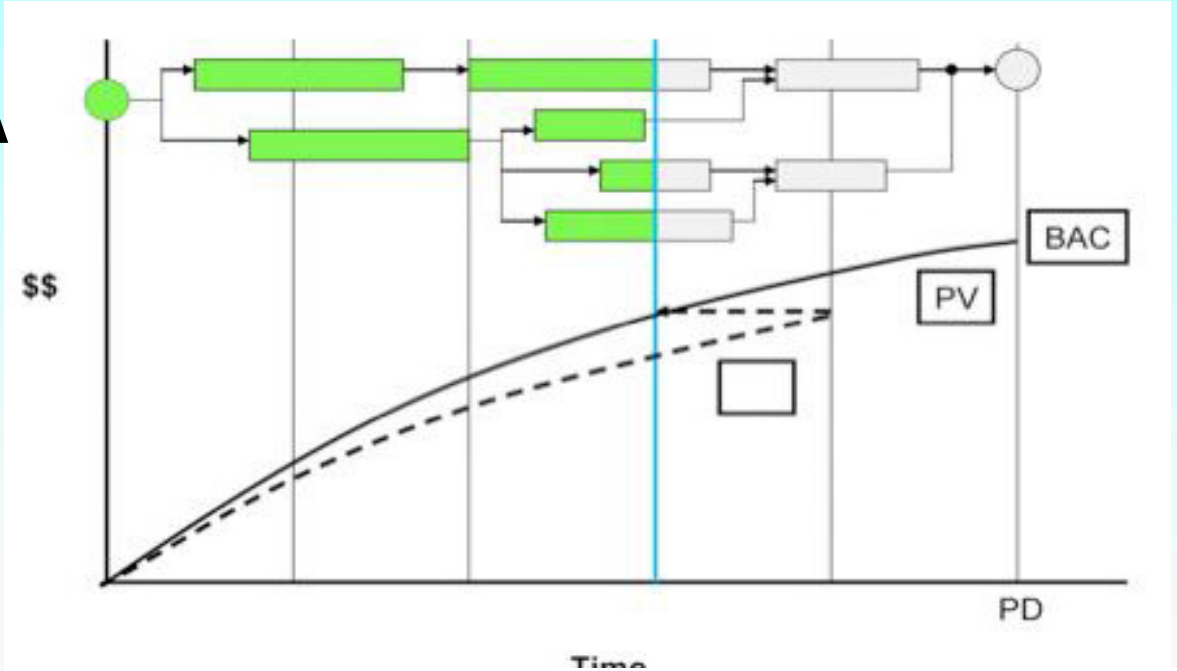


EARNED SCHEDULE + LIPKE'S "P" FACTOR

LIPKE'S "P" FACTOR

“P” FACTOR MEASURES SCHEDULE ADHERENCE

A



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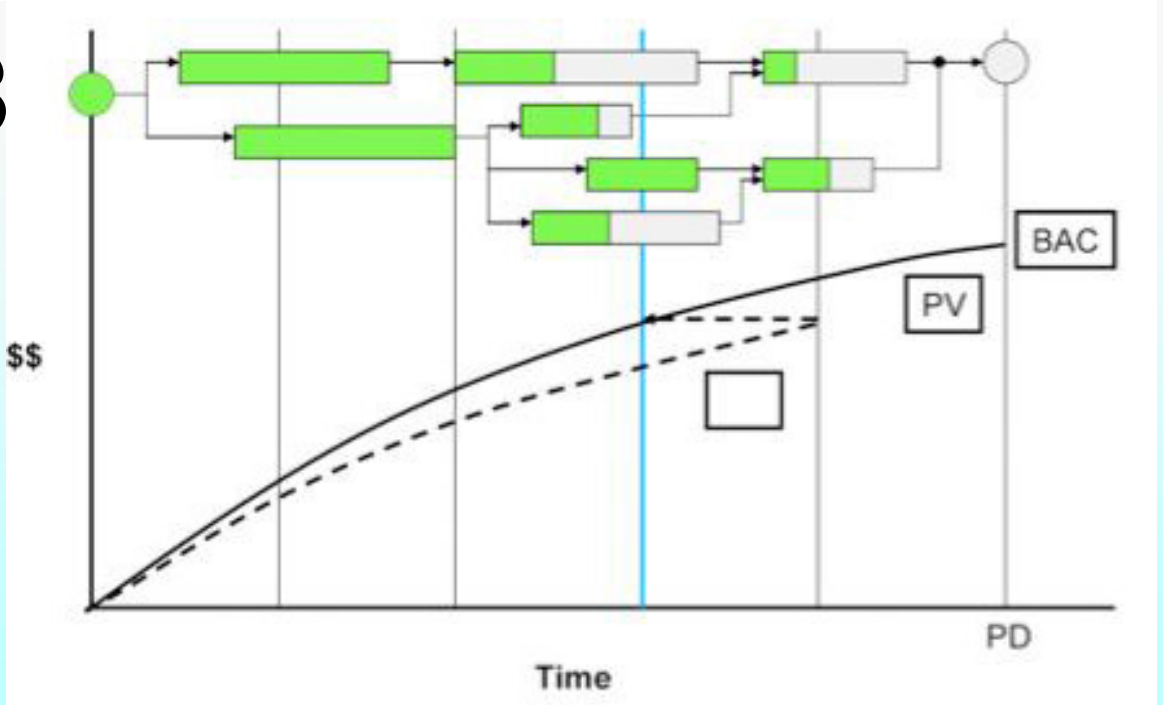

“P” FACTOR MEASURES SCHEDULE ADHERENCE

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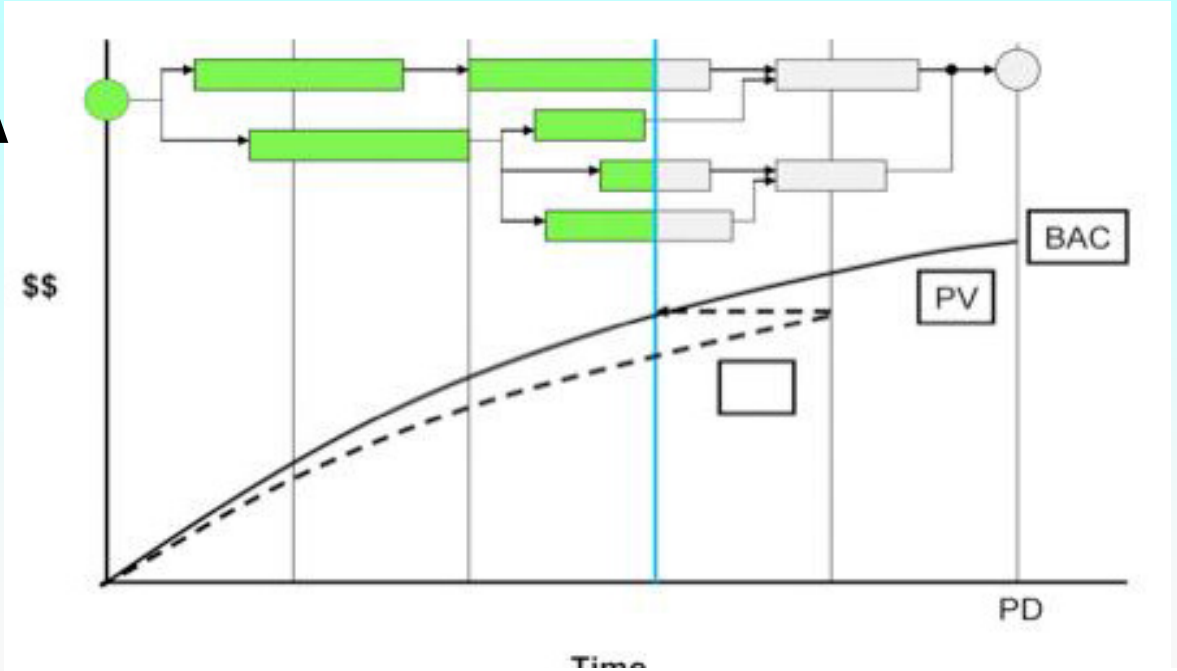

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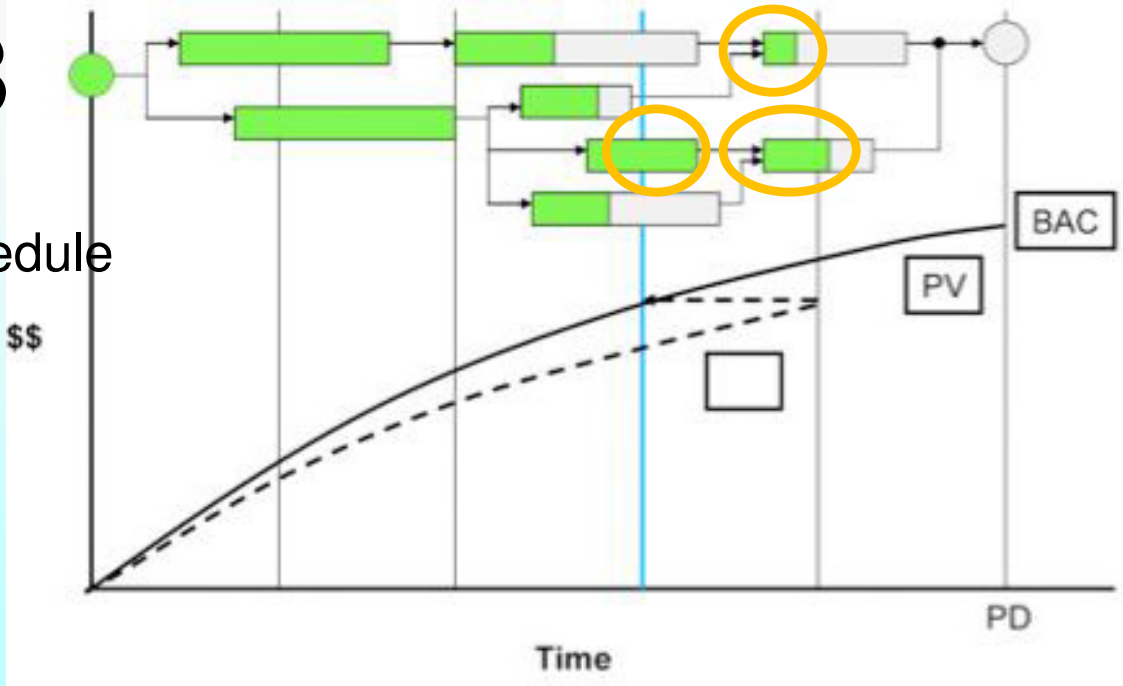
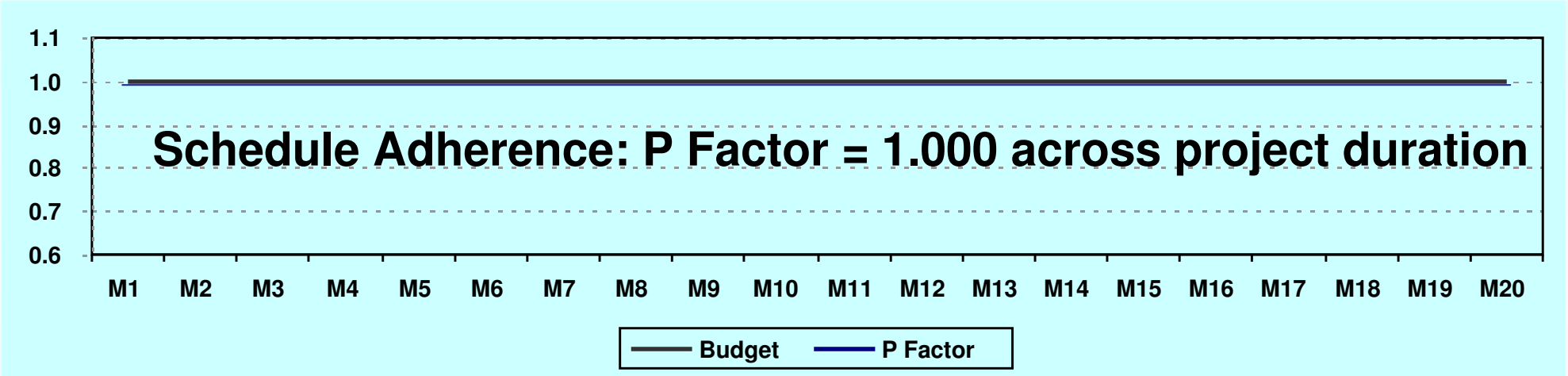
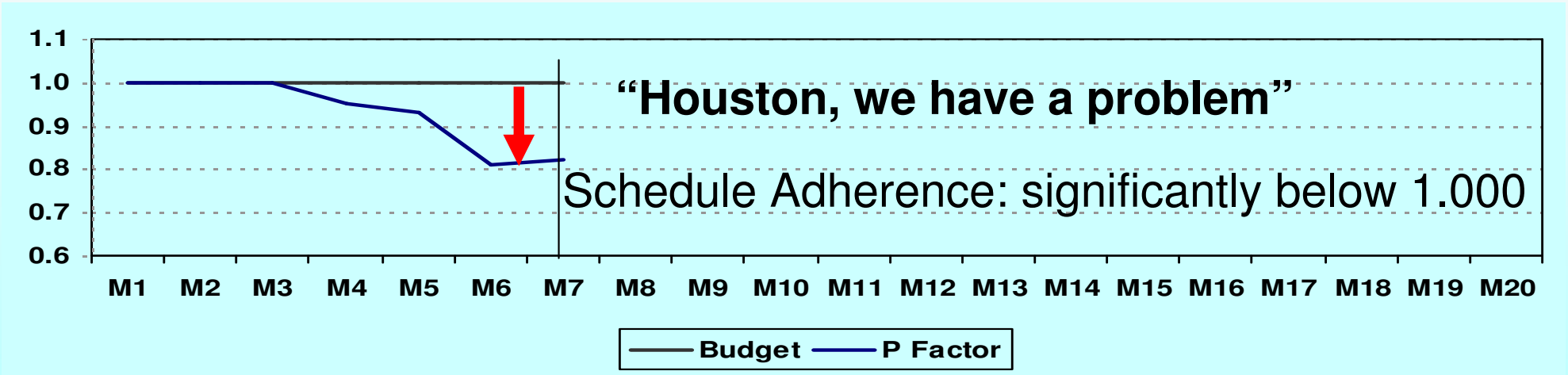


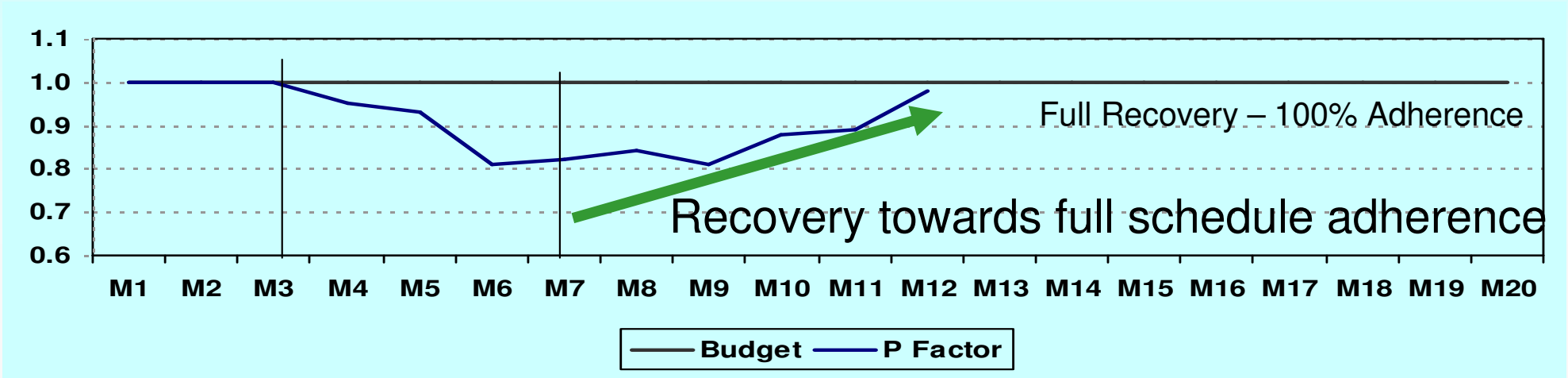
“Out of Sequence” Earned Schedule

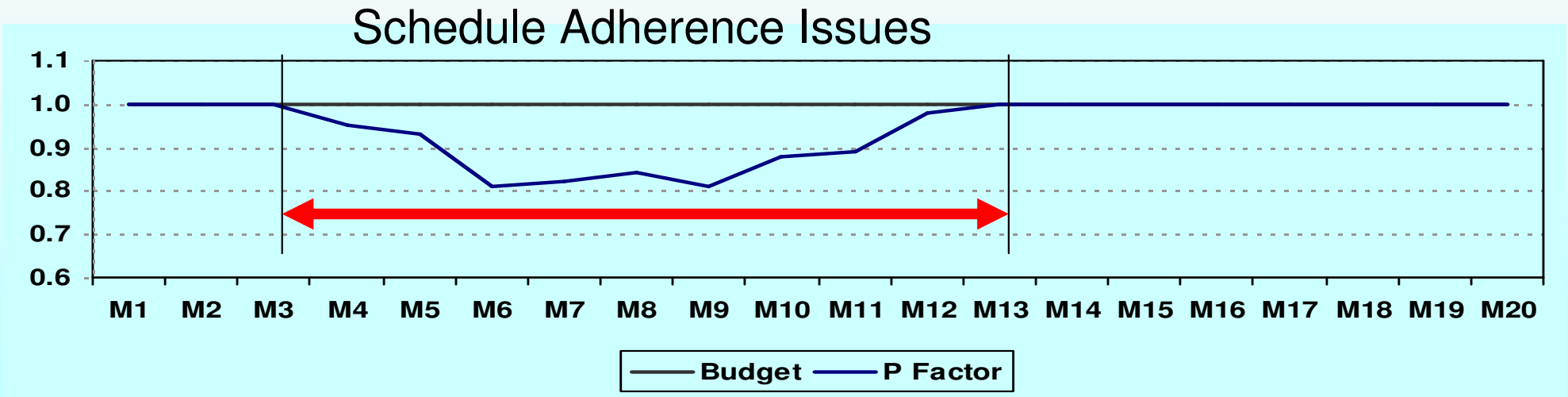
P Factor Metric – Schedule Adherence



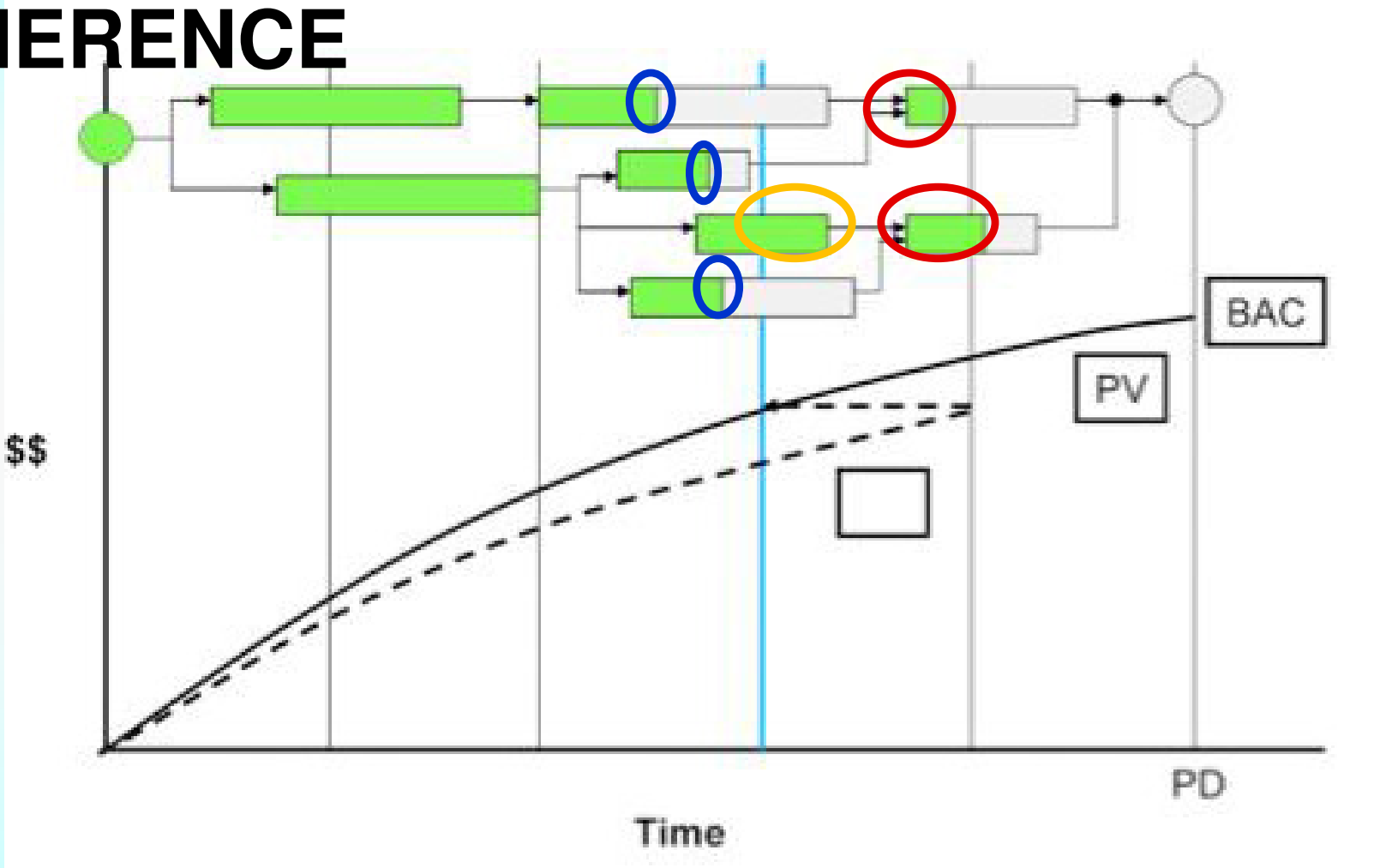


P Factor Metric – Schedule Adherence





“P” FACTOR MEASURES SCHEDULE ADHERENCE



“Blockage” Risk

“Out of Sequence” Risk

OUT OF SEQUENCE RISK

- Gaming the system or preserving schedule ??
  (How have you structured your milestones?)
- Schedule preservation / progress at what risk
  - Will it conform ?
  - Have preceding events changed the requirement
  - ????

BLOCKAGE RISK

- Gaming the system or genuine issue ??
- Underlying Technical Issue (Scientific Resolvability ??)
- Underlying shortage of technical resources (specialists ??)
- Underlying Materiel Delay – Why
  - Contract dispute
  - Delivery Delay (Transport, availability obsolete spec ?)
  - Sourcing Issue
  - Other ????

IMPLEMENTING EARNED SCHEDULE

Public Domain Resources –
and where / how to begin

IMPLEMENTATION: Beginning

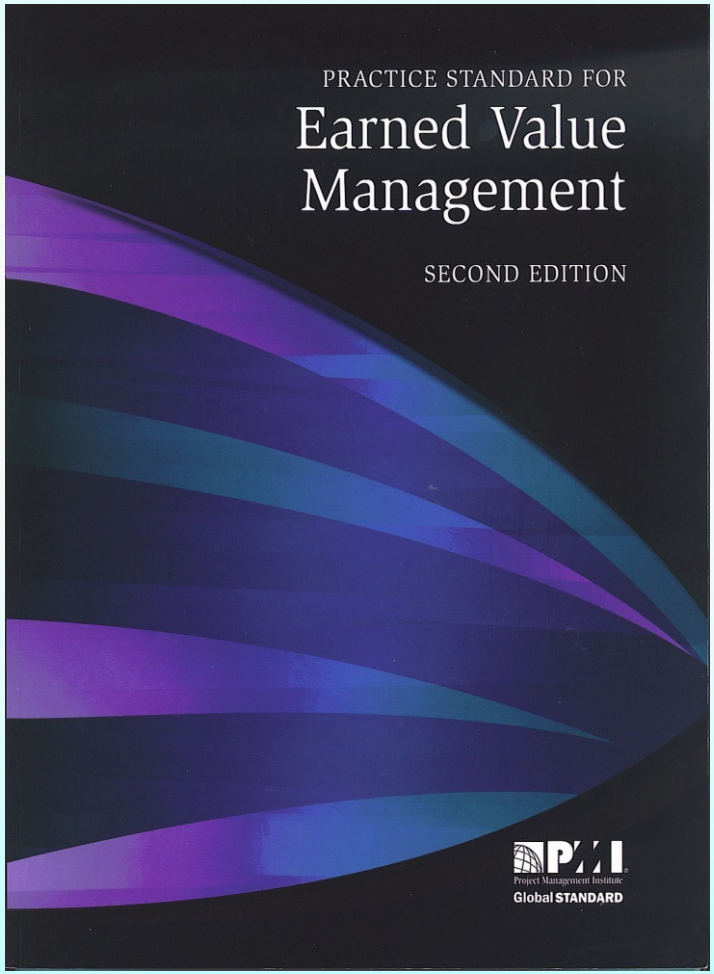
- Read articles *…to begin*
  - "Performance analysis of Earned Value Management in the construction industry"
  - "Schedule is Different"
  - "Further Developments in Earned Schedule"
- Explore the Earned Schedule website
  - www.earnedschedule.com
  - Papers, Presentations, Calculators, Terminology
- Scan the Calculators ……. and *experiment with them*
  - ES Calculator v1a
  - P-Factor Calculator
  - Statistical Prediction Calculator
  - SA Index & Rework Calculator

IMPLEMENTATION: Hard Documentation

PMI EVM Practice Standard

- Inclusion of *Earned Schedule* into PMI EVM Practice Standard, 2nd Edition (2011)

- Appendix D, "Schedule Analysis Using EVM Data," provides ES theory and practical application to example project.

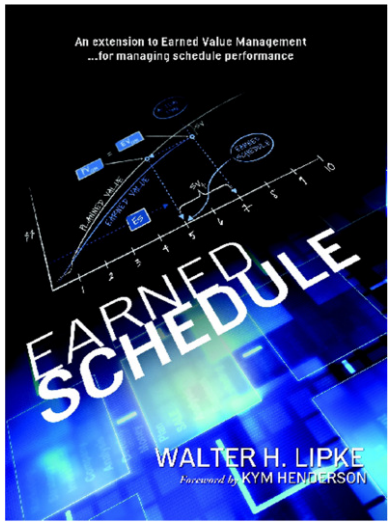


IMPLEMENTATION: Available Resources

- Earned Schedule Website
  http://www.earnedschedule.com/

- Wikipedia references Earned Schedule
  http://en.wikipedia.org/wiki/Earned_Schedule

- *Earned Schedule* book (English, Japanese, Spanish)
  - Print
  - ePub (Nook & iPad)
  - Kindle
  - PDF



IMPLEMENTATION: Strategy & Sequence

- If you're already using EVM
  … *take the next step to ES*
- Try it on archived project data
  … *check the ES analysis against what occurred*
  … *gain confidence*
- Prototype ES on a few projects
  … *get comfortable with the analysis*
- Train others in ES and expand the application in the organization
  … *discuss with analysts and managers*
  … *work out the problems*
- Integrate into organization's EVM application policy

IMPLEMENTATION: EVM-ES Tools

- Initially, augment the EVM tool in use
  - ES calculators
  - Henderson's spreadsheet set
- Research the available tools - *request a trial period*
  - Project Flight Deck
    - MS Project add-on, inexpensive yet includes advanced features
  - OR-AS
    - Sophisticated, research oriented, expensive
  - SuperTech – EV Engine
    - Basic EVM & ES …includes more financial analysis

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CONCLUSIONS

1. **SCHEDULE MANAGEMENT IS CRITICAL**
   ..... SO WE NEED TO METRIC IT BETTER

2. **ES IS EASY TO EXPLAIN AND IMPLEMENT**
   ..... BECAUSE THE DATA IS ALREADY THERE

3. **ES & P FACTOR HAVE MUCH TO OFFER**
   ..... BECAUSE THEY'RE INTELLECTUALLY ROBUST
   (AND DON'T SKEW)

4. **ALL ES NEEDS IS TO BECOME KNOWN**
   ..... BECAUSE IT'S SO USEFUL IT WILL SELL ITSELF

QUESTIONS
???

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for more confident predictions of future project performance

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