

# **Implementing Earned Value Concepts on Commercial IT Projects A Practical Approach**

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Maximising Project Value**

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**(Publication Version)**

# Introduction

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1. What is Earned Value ?
2. Why Use Earned Value ?
3. The Key Benefit of Earned Value
4. Prerequisites for an Earned Value Management System
5. Achieving Integrated Project Reporting
6. How to Calculate and Plot Earned Value
7. The Cost Variance and Cost Performance Index
8. The Schedule Variance and Schedule Performance Index
9. Suggested Earned Value Approach for Commercial IT Projects
10. Suggested P&L Format
11. Predictive Uses of Earned Value: Earned Value IEAC Formulae
12. Example Project #1
13. Potential Issues with Earned Value
14. Benefits and Conclusions
15. Frequently Asked Questions (FAQs)
16. Additional Information and Lessons Learned



# What is Earned Value ?

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- ◆ The simplest way to think of Earned Value is to equate it with physical progress
  - ... Earned Value is also a measure of progress
  - ... there is a direct relationship between Earned Value and per cent complete
  
- ◆ It is expressed in a common unit of measure
  - Usually either dollars or hours
  - To facilitate variance analysis
    - which requires common units of measure

# Why Use Earned Value ?

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- ◆ Earned Value is the only project planning and control methodology which I know of, that **integrates** project
  - **Cost** performance
  - **Schedule** performance **AND**
  - **Technical** performanceinto a **single** methodology
- ◆ From which **objective** measures of project performance are readily available including
  - Variance metrics and indices (cost and schedule)
    - Which helps confirm project performance to date; and
    - Provides guidance into areas for corrective action
  - Formula based predictors of future performance

# The Key Benefit of Earned Value

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- ◆ Personal experience and the academic literature highlights that
  - Comparing plan versus actual costs especially for IT projects is not adequate for accurately establishing, assessing, monitoring and predicting project performance
  
- ◆ This “financial accounting” approach fails to consider the technical achievement (physical progress) realised to date
  - Progress achieved is implicitly equated to the costs expended
  
- ◆ This can be very dangerous for IT projects which
  - Are usually very “people intensive”
  - Often have deliverables which lack direct physical visibility
    - e.g. bespoke software development source code

# Personal Experience ....

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- ◆ In IT project recovery situations personally managed
  - There have been remarkably close correlations to planned versus actual costs (see Example Project #1)
  - The project has been seriously troubled, often for extended periods of time
  - And what seemed blindingly obvious in retrospect had not been detected in advance over that time
- ◆ In the common situation of concurrent IT project quality failure (process and product)
  - Very large costs can be incurred with little useful (re-useable) outputs in spite of the cost and effort expended

## To Emphasize the Point ...

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- ◆ A close correlation to planned versus actual costs, particularly on an IT project, may simply mean
  - That the planned number of people
  - Have sat on the planned number of seats
  - For the planned period of time
  - And incurred the planned (and expected) amount of costs over that time
- ◆ Planned versus actual costs provided **NO** information about
  - ***whether the planned amount of technical achievement or physical progress actually took place over that time***

# Earned Value Management Philosophy

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- ◆ Earned Value was developed by Government, initially the US Department of Defense (DoD) for managing very large, complex acquisition programs
- ◆ The (implied) Earned Value management philosophy is based on the management and control of **costs**
  - The Government Program Manager is measured on his or her conformance to the **cost** baseline
  - Earned Value is a **cost** based measure
- ◆ This has implications (to be discussed) for applying Earned Value to the commercial IT environment



# Why Calculate Earned Value ?

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- ◆ Once EV can be assessed with “reasonable accuracy”
- ◆ Virtually all Earned Value Variances, Indices and predictive formulae are **calculated** from the basic
  - Budgeted Costs or “Planned Values” [BCWS or PV]
    - Which includes Budgeted Costs at Complete [BAC]
  - Actual Costs [AC or ACWP]
  - Earned Value [EV or BCWP]
- ◆ A spreadsheet which automates the calculations and graphs the results allows the Project Manager to
  - Sanity check, analyse and understand the results
  - Objectively determine the adverse impacts affecting the project
  - Proactively plan and implement corrective actions

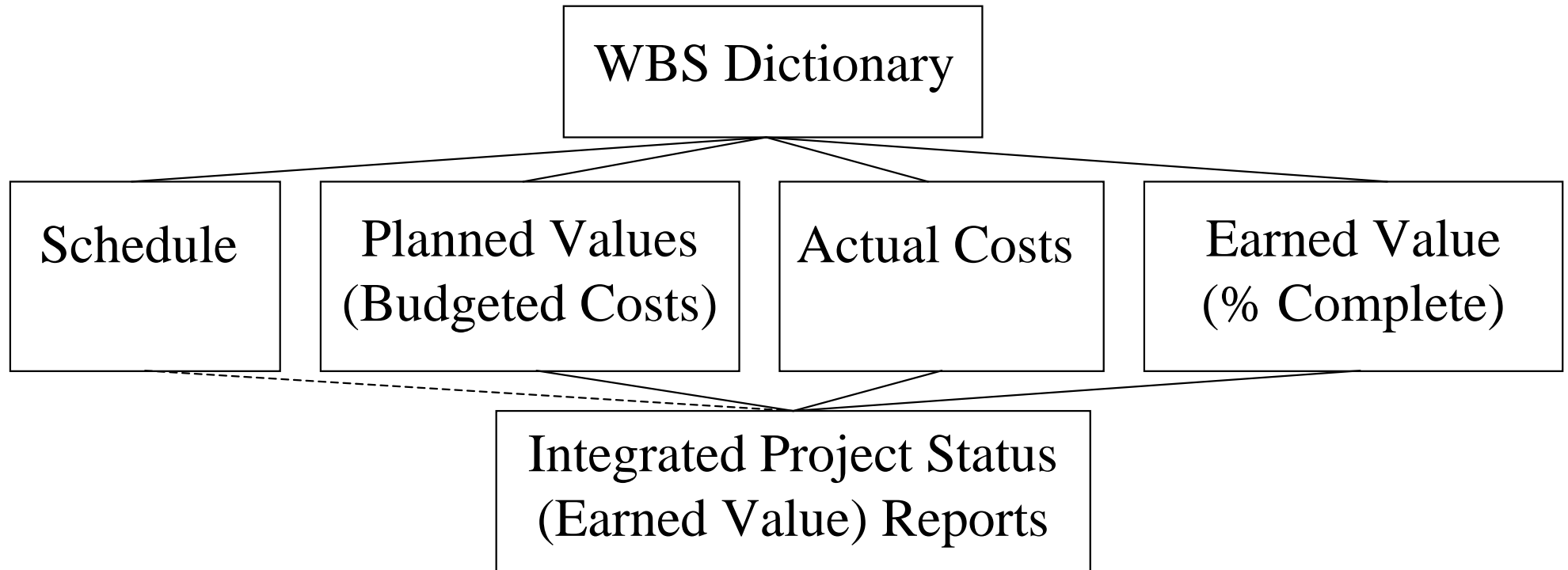
# Prerequisites for an Earned Value Management System (EVMS)

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- ◆ Project management fundamentals should be in place
  - Including a Work Breakdown Structure .....
- ◆ If being implemented on an organisational basis
  - senior management commitment is essential
  - Including a willingness to accept and act on the outputs and messages provided by the EVMS
- ◆ At the personal level, a willingness to try something new and potentially challenging
- ◆ **An “integrated project reporting system” is essential**
  - Preferably organisationally based

# Achieving Integrated Project Reporting

## Even in Un-integrated Corporate Environments



- ◆ The concept is to align project activities defined in the WBS into **both** the schedule and financial accounting and/or time recording systems
  - This should be within the Project Manager's control

# Achieving Integrated Project Reporting

Even in Un-integrated Corporate Environments continued ...

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WBS Dictionary

Schedule

Planned Values  
(Budgeted Costs)

Actual Costs

Earned Value  
(% Complete)

1) Initial schedule should be part of the Proposal.  
2) Detailed schedule development, update and monitoring should be part of the project planning, control and review processes

Project Proposal Cost  
+ Cost Re-estimates  
+ Authorised Changes  
+ Unauthorized Changes included in product  
= Planned Values

Should be obtained from the Corporate Accounting and / or Time Recording System(s)

Estimated by Project Manager and / or Team as part of project review and control processes

Integrated Project Status  
(Earned Value) Reports

# Project Planned and Actual Cost Curves: Data should be available from existing corporate sources

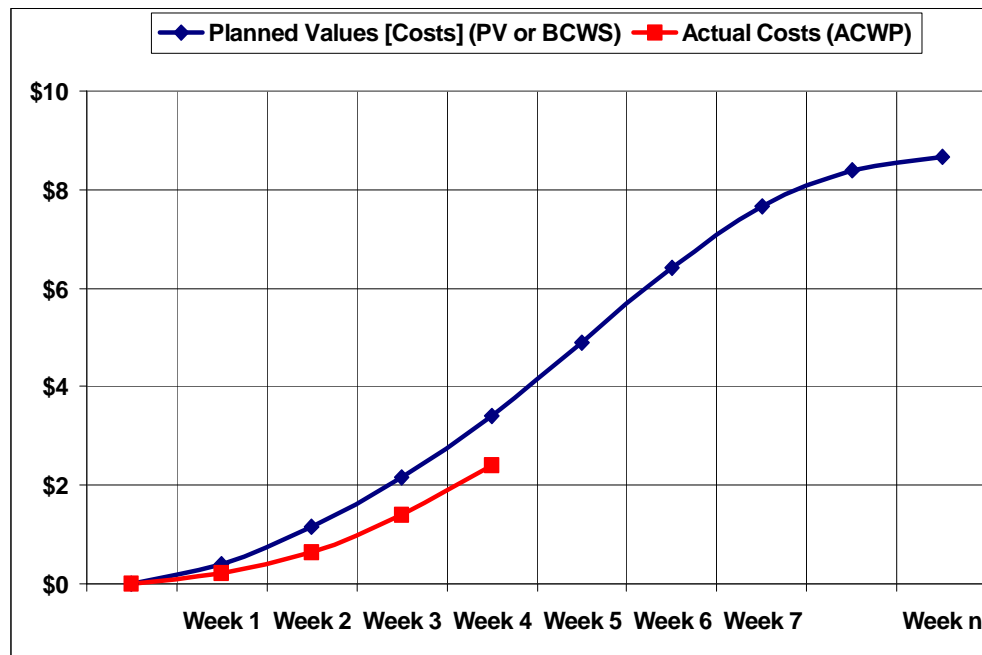
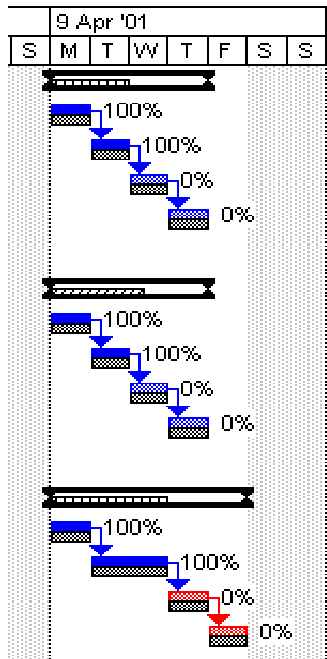
WBS Dictionary

Schedule

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Earned Value  
(% Complete)





# The Issue: How to Calculate and Plot Earned Value

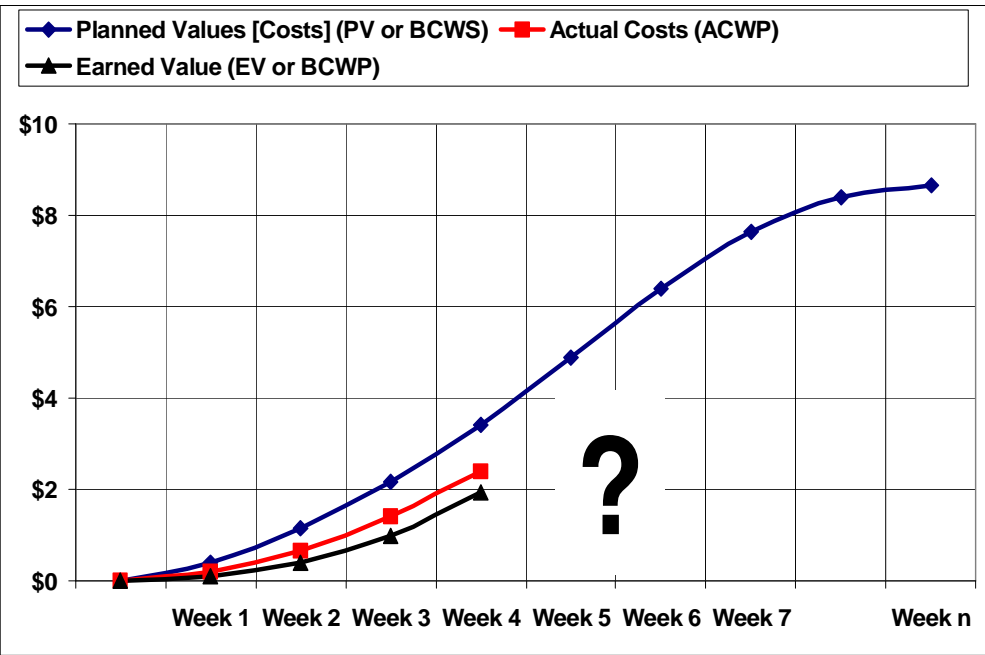
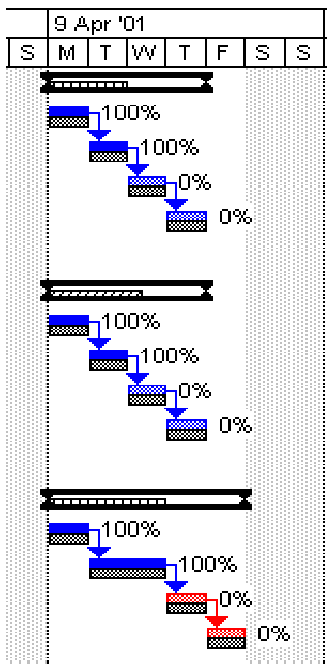
## WBS Dictionary

Schedule

Planned Values  
(Budgeted Costs)

Actual Costs

Earned Value  
(% Complete)



**The Issue:**  
 How to calculate and plot Earned Value:  
 a) *With minimum effort*  
 b) Without an Earned Value software package;  
 c) Without the perceived overheads associated with large, complex [DoD] acquisition contracts ?

# How to Calculate and Plot Earned Value:

## 1) “Classic” Earned Value

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- ◆ Bring all realised Earned Value amounts for each task to account for the period using the rules for EV accounting:
  - “0 – 100”
  - “50 – 50”
  - “Interim Milestone”
  - “Apportioned effort”
  - “% Complete”
  - “Level of Effort”
- ◆ Earned Value at the project level is the sum of all subordinate Earned Values achieved or realised
  - Project to Date: Earned Value<sub>cum</sub>
  - For the Period: Earned Value<sub>period</sub>

# How to Calculate and Plot Earned Value:

## 1) Classic Earned Value continued ...

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### ◆ Example Using Interim Milestone Method

- Planned Value for Task #1 = \$100
  - Task #1 is divided into 4 equally weighted intermediate deliverable milestones
  - Completing each intermediate milestone results in an Earned Value of \$25 being recognised

### ◆ Issues with “Classic” Earned Value

- Requires very significant levels of detailed project planning
  - This level of planning is usually considered an unjustifiable overhead, especially in the commercial IT sector
- Requires an Earned Value software package to implement
  - Which imposes its own costs and overheads



# How to Calculate and Plot Earned Value:

## 2) Weighted Average Method (to derive Percentage Complete)

- ◆ Assign a percentage of project total for the defined “WBS elements”
  - (WBS Element Planned Costs / Budget at Complete) \* 100
- ◆ Assess Percentage Complete for each “WBS element”
- ◆ The project “Weighted Average” Percent Complete is the sum of the
  - WBS element % complete x WBS element % of project total
- ◆ Transfer the “Weighted Average” Percent Complete into the Earned Value Reporting spreadsheet
- ◆ The greater the granularity of defined “WBS elements”, the more accurate the Project % Complete calculation will be

WBS Elements	% of Project	Status Dates						
		Wek1	Wek2	Wek3	Wek4	Wek5	Wek6	Wek7
Project Mngement	12.5%	50%	100%	150%	200%	250%	300%	350%
Sales & Distribution	12.0%	75%	120%	200%	250%	300%	400%	450%
Materials Mngement	11.0%		125%	150%	200%	225%	300%	350%
Production Planning	11.0%			100%	175%	225%	300%	400%
Financial Accounting	11.0%	150%	175%	250%	300%	350%	475%	500%
Integration Testing	2.0%							
Data Conversion	3.0%			50%	125%	125%	125%	200%
User Training	10.0%							
Cut-over to Live System	5.0%							
Og Change Mngement	2.5%			250%	250%	250%	250%	250%
Basis Suppt & Security	2.0%	50%	100%	150%	200%	250%	300%	350%
Post Implementation Support	3.0%							
Warranty	5.0%							
End User Documentation	10.0%							
<b>Percentage of Project Total</b>	<b>100%</b>							
<b>Project Percent Complete</b>		<b>33%</b>	<b>62%</b>	<b>109%</b>	<b>143%</b>	<b>17.0%</b>	<b>220%</b>	<b>255%</b>

# How to Calculate and Plot Earned Value:

## 3) Derive from Schedule “Percentage Complete”

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- ◆ Transforming the Earned Value formula

`% Complete =`

`Earned Value [EV] cum / Budget At Complete [BAC]`

results in

$$\text{BAC} \times \% \text{ Complete} = \text{EV cum}$$

- ◆ An illustrative example

`BAC = $1,000`

`Percent Complete cum assessed as being 50%`

`Earned Value cum = $1,000 x 50% = $500`

- \$500 is the Earned Value cum, expressed in dollars which represents the physical progress achieved to date by this project
- ◆ One technique is to use Microsoft Project (or other scheduling tool) calculated Percent Complete



# Microsoft Project Calculated Percent Completes

## 1) “Percent Complete”

- Calculated based on task  durations

## 2) “Percent Work Complete”

- Calculated based on task  resource loads  and duration
- Requires a resource loaded schedule

## ◆ Percent Work Complete is more accurate

- But “Percent Complete” is preferable to nothing
  - A personal view based on actual experience

ID	Task Name	% Complete	% Work Complete	Duration	Start	Finish	Resource Names	9 Apr '01							16
								S	S	M	T	W	T	F	
1	<b>Project Summary (Unresourced)</b>	<b>50%</b>	<b>0%</b>	<b>4 days</b>	<b>Mon 9/04/01</b>	<b>Thu 12/04/01</b>									
2	Task 1	100%	100%	1 day	Mon 9/04/01	Mon 9/04/01									
3	Task 2	100%	100%	1 day	Tue 10/04/01	Tue 10/04/01									
4	Task 3	0%	0%	1 day	Wed 11/04/01	Wed 11/04/01									
5	Task 4	0%	0%	1 day	Thu 12/04/01	Thu 12/04/01									
6															
7	<b>Project Summary (Resourced)</b>	<b>50%</b>	<b>60%</b>	<b>4 days</b>	<b>Mon 9/04/01</b>	<b>Thu 12/04/01</b>									
8	Task 5	100%	100%	1 day	Mon 9/04/01	Mon 9/04/01	Resource 1								
9	Task 6	100%	100%	1 day	Tue 10/04/01	Tue 10/04/01	Resource 1,Resource 2								
10	Task 7	0%	0%	1 day	Wed 11/04/01	Wed 11/04/01	Resource 3								
11	Task 8	0%	0%	1 day	Thu 12/04/01	Thu 12/04/01	Resource 4								

# Earned Value Derived From Percentage Complete

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- ◆ Is viewed as “more subjective” and less preferable by Earned Value purists and Earned Value theory
  - An “accuracy” versus “cost and overhead” trade-off decision
- ◆ Requires a “realistic” project schedule to be in place with
  - Regular (weekly) progress updates performed
  - Sufficient rigour and “sanity checking” to provide confidence in the accuracy of the Percent Complete result
- ◆ Personal experience suggests that
  - A “proper” schedule update is very difficult to manipulate
  - Using Earned Value results in greater care being taken with the task level Percentage Completes claimed
- ◆ **The Key Benefit: Allows Earned Value to be calculated without an Earned Value software package**

# WBS – Schedule Alignment

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- ◆ If the schedule is NOT aligned to the WBS and financial system
  - Earned Value reporting at the project level remains possible
- ◆ However, alignment permits Earned Value to be applied at a more granular (ie. Control Account - Work Package) level
  - This enables the specific areas causing variances to be determined more quickly and easily
  - And tracking specific corrective actions for effectiveness
- ◆ Once Earned Value is calculated and plotted in an Earned Value Reporting spreadsheet
  - EV Variances and Indices can be automatically calculated
  - To enable an objective assessment of the project status
  - To facilitate Variance analysis; and
  - Issues identification and corrective action

# The Cost Variance (CV) and Cost Performance Index (CPI)

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## ◆ CV = Earned Value - Actual Costs

- A negative CV indicates that the “physical progress” was achieved at a greater cost than forecast [unfavourable]
- A positive CV indicates that the “physical progress” was achieved at a lesser cost than forecast [favourable]

## ◆ CPI = Earned Value / Actual Costs

A CPI less than 1 indicates that the “physical progress” was achieved at a greater cost than forecast [unfavourable]

A CPI greater than 1 indicates that the “physical progress” was achieved at a lesser cost than forecast [favourable]

- ◆ The CV and CPI measures the efficiency which the physical progress was achieved compared to the Budgeted Cost Baseline
- ◆ Corrective action should focus on improving the productivity with which work is performed

# The Schedule Variance (SV) and Schedule Performance Index (SPI)

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## ◆ **SV = Earned Value - Budgeted Costs**

- A negative SV indicates that the “physical progress” was achieved at a slower rate than planned [unfavourable]
- A positive SV indicates that the “physical progress” was achieved at a faster rate than planned [favourable]

## ◆ **SPI = Earned Value / Budgeted Costs**

- A SPI less than 1 indicates that the “physical progress” was achieved at a slower rate than planned [unfavourable]
- A SPI greater than 1 indicates that the “physical progress” was achieved at a faster than planned [favourable]

- ◆ If Earned Value is using dollars as the unit of measure
  - Understanding a dollar based SV is often an issue

# How Does the “Schedule Variance” Relate to the “Real Schedule” ?

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- ◆ The SV is derived from cost accounting data
  - **Not the “real schedule”**
- ◆ The SV does not identify specific work performed
  - ie. Critical path versus non critical path work
  - **This requires detailed analysis of the “real schedule”**
- ◆ The SV does not measure time
  - **This requires detailed analysis of the “real schedule”**
- ◆ Even if a project is late the SV will converge and become zero when the project is completed
  - The Earned and Planned Values will become equal BUT
  - Check the CV and BAC for the impact of schedule delay !
- ◆ Corrective action should focus on improving the **timeliness** with which work is performed



# Schedule Variance: Strengths

- ◆ Provides reliable early warning
  - When large, early and unfavorable
  - Observations on 100's of [US] DoD contracts
- ◆ Reflects cost/schedule integration
  - Work breakdown structure
  - Performance measurement baseline

There is no cost variance but there is a large negative schedule variance



# Schedule or “Accomplishment” Variance

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- ◆ Abba suggests that a better term for the SV is “Accomplishment Variance”
  - It measures the volume of work accomplished versus the volume of work planned
  
- ◆ A large negative measure of the volume of work accomplished compared to the volume of work planned
  - Ought to raise the alarm bells over the project status
  
- ◆ NOTE: The CPI and SPI permits discussion of project cost / financial and “accomplishment” variances without disclosing actual dollar amounts

# Suggested EV Approach for IT Projects

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- ◆ **Limit Earned Value to the Services component**
  - Often the highest cost and risk component of an IT project
- ◆ **For non services components of project**
  - (e.g. hardware and software licenses)
  - Account for using standard financial practice
  - Cost Variances on these items are usually outside the Project Manager's control
- ◆ **Third party services depends on nature of engagement**
  - Fixed price: Account for as above for milestone based or periodic payments (with appropriate oversight mechanisms)
  - T&M work: EV recommended for large and/or critical work
    - A significant risk item for the prime contractor



# Suggested Project Profit and Loss Format

- ◆ Separate Professional Services from other P&L line items
  - The usual practice
- ◆ Subdivide P&L to show
  - Plan Costs (Baseline)
  - Actuals to Date
  - Estimates to Complete
  - Estimates at Complete
  - Estimated Variance At Complete
    - Actuals + ETC = EAC
- ◆ Show CRs and Risk separately
  - Highlights the degree of formal scope change;
  - Risk realisation; and
  - The P&L impact (+ or -)

Sample Profit and Loss Report  
For xyz Project as at xx/xx/yy

	Plan	Actuals to Date	Estimate to Complete	Estimate At Complete	Estimated Variance At Complete
<b>Professional Services</b>					
Revenue					
Line Items					
<b>Costs</b>					
Line Items					
<b>Gross Margin</b>					
<b>Gross Margin Percent</b>					
<b>Third Party Services</b>					
Revenue					
Line Items					
<b>Costs</b>					
Line Items					
<b>Gross Margin</b>					
<b>Gross Margin Percent</b>					
<b>Hardware</b>					
Revenue					
Line Items					
<b>Costs</b>					
Line Items					
<b>Gross Margin</b>					
<b>Gross Margin Percent</b>					
<b>Software Licenses</b>					
Revenue					
Line Items					
<b>Costs</b>					
Line Items					
<b>Gross Margin</b>					
<b>Gross Margin Percent</b>					
<b>Grand Totals</b>					
Revenue					
Costs					
<b>Gross Margin</b>					
<b>Gross Margin Percent</b>					

# Project P&L Format continued ...

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- ◆ A P&L format like this used in conjunction with Earned Value graphs, metrics and reports
  - Provides a clear and comprehensive project status in both commercial and delivery terms
  - Including the estimated final outcomes AND information to evaluate the “reasonableness” of projected outcomes
- ◆ **Focused Project Management of the cost baseline**
  - **Significantly improves the probability of achieving a satisfactory commercial outcome for a project**
- ◆ Recommended goals for Project Managers
  - (1) Achieve the approved cost baseline
  - (2) As adjusted by additional revenue generated from formal scope changes

# Predictive Uses of Earned Value: Earned Value IEAC Formulae

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- ◆ IEAC means Independent Estimate At Complete
  - EAC estimates based on a formula driven approach
- ◆ A generic IEAC formula ...

Actual Costs  
to date

What the project (theoretically) needs to  
achieve to complete  
The Budgeted Cost of Work Remaining

$$\text{IEAC} = \text{ACWP}_{\text{cum}} + \frac{(\text{BAC} - \text{EV}_{\text{cum}})}{\text{PF}}$$

A Performance  
Factor

# Predictive Uses of EV: Earned Value IEAC Formulae continued ...

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- ◆ **Performance Factors for the BCWR**
  - **CPI** (Discussed in the PMBOK) or **SPI**
    - US DoD studies suggest that the CPI cum and SPI cum are predictive of the final EAC
  - **80/20** (.8 x CPI) + (.2 x SPI)
    - This suggests the BCWR is 80% influenced by the CPI and 20% influenced by the SPI
  - **CPI \* SPI**
    - This estimates the most pessimistic outcome especially in situations of unfavourable cost and schedule performance
- ◆ An IEAC provides a simple, credible method for sanity checking the claimed EAC without a full “bottom up” (re)estimate, claimed Earned Value and % Complete

Source: Using The Earned Value Cost Management Report To Evaluate The Contractor's Estimate At Completion, David S. Christensen, Ph.D. Acquisition Review Quarterly—Summer 1999 <http://www.acq.osd.mil/pm/paperpres/chrcost.pdf>

# Predictive Uses of EV: Earned Value IEAC Formulae continued ...

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- ◆ The IEAC must also be used with caution
  - All performance factors are based on historic cumulative project performance
    - Which may not necessarily continue into the future
    - More recent project performance indices can be used if desired
  - The IEAC cannot compensate for future inaccuracies or omissions in the Budgeted Costs Baseline
    - ie. “missing” (unbudgeted) future work or additional unbudgeted work arising from issues or risk resolution
    - Until this work commences
- ◆ However, the IEAC provides
  - A useful sanity check of claimed project performance to date and the claimed EAC
  - An “early warning signal” of sub optimum performance



# ***Contracts at 15% complete point***

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***(Gary Christle)***

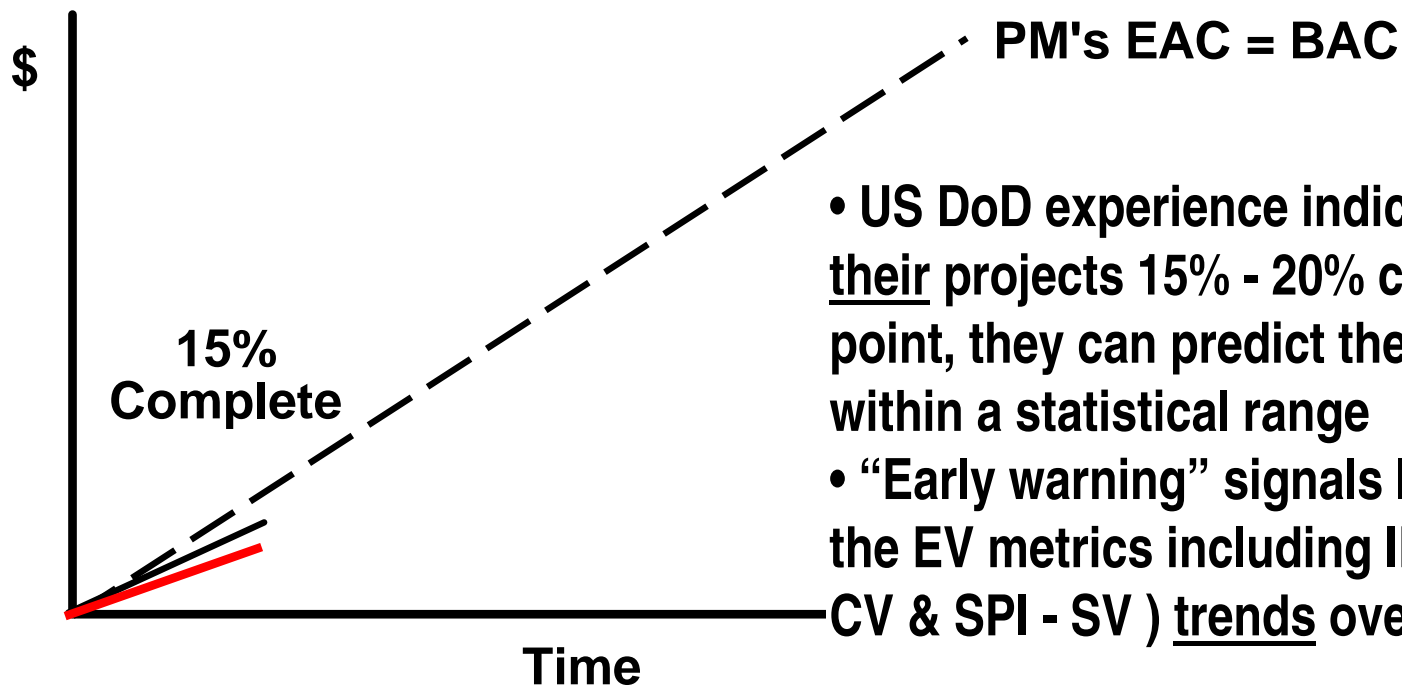
- **GIVEN:**
  1. ***Overrun at completion will not be less than overrun to date.***
  2. ***Percent overrun at completion will be greater than percent overrun to date.***
- **CONCLUSION:** ***You can't recover!!***
- **WHO SAYS:** ***More than ~~300~~<sup>700</sup> major DOD contracts since 1977.***
- **WHY:** ***If you underestimated the near, there is no hope that you did better on the far term planning.***

# Cost Risks Can Be Managed

(with an “early warning” signal)

## A key benefit of Earned Value

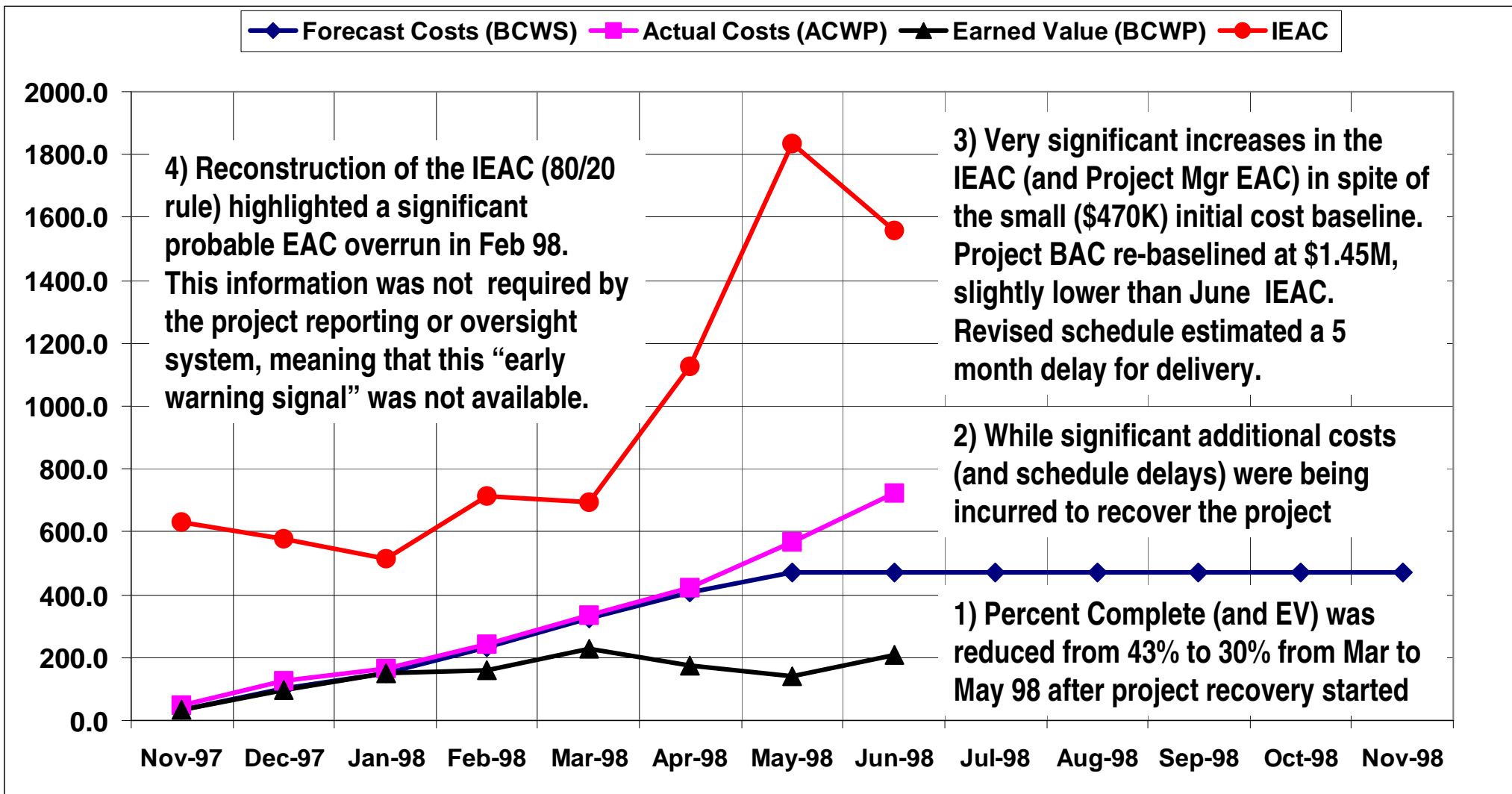
Identifying cost risk early in the project life cycle allows for corrective action with most of the cost budget still intact ....



- US DoD experience indicates that at their projects 15% - 20% completion point, they can predict the final EAC within a statistical range
- “Early warning” signals I use are the EV metrics including IEAC, CPI - CV & SPI - SV ) trends over time

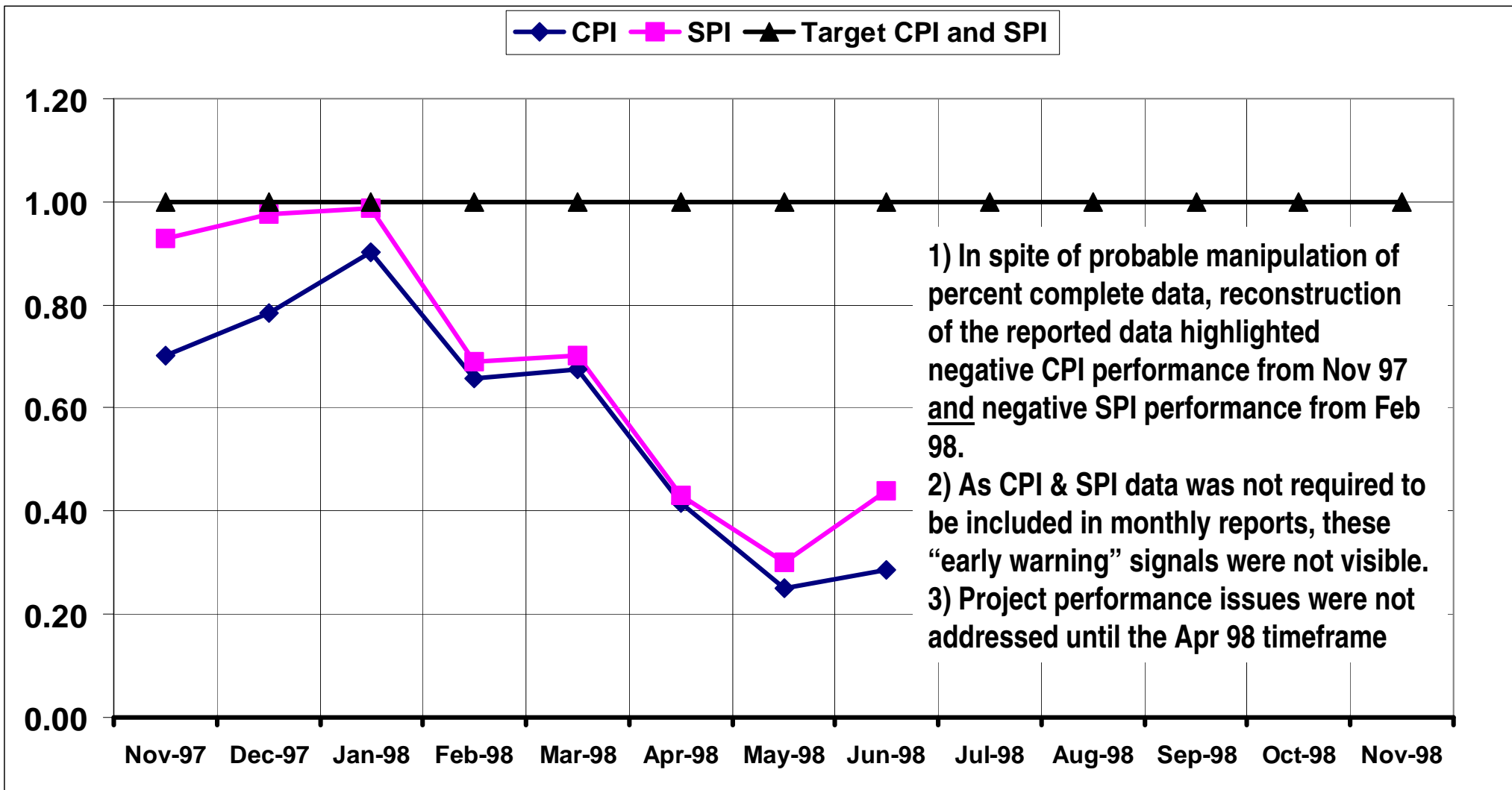


# Example Project #1 (IEAC S Curve)





# Example Project #1 (CPI & SPI)



# Potential Issues with Earned Value “Manipulation” of Earned Value Data

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## Surely Not !

4.14 CMACS data provided below shows, in respect of the contract sum attributable to each submarine, the proportion spent to June 1997:

Submarine	Percentage of funds expended
01 - Collins	98
02 - Farncomb	98
03 - Waller	97
04 - Dechaineux	96
05 - Sheean	91
06 - Rankin	87

4.15 Despite these high percentages there still seems much to be done to complete the submarines. *CMACS data indicate that HMAS Collins' CMACS packages were 87 per cent expended when it was launched in August 1993, and that later submarines will be launched after greater levels of expenditure. For example, data on submarine 05 - Sheean - shows its CMACS packages are 91 per cent expended. However, physical distribution drawings of December 1997 show Sheean's hull still in seven pieces indicating some of its systems are yet to be assembled fully, integrated into other sections of the submarine and set to work. (emphasis added)*

**The integrity of an EVMS is absolutely dependent on the integrity of the Earned Value calculations**

# Potential Issues with Earned Value

## Behavioural and Organisational Issues

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- ◆ The “Beach Inquiry” into Cancellation of the \$US 4 Billion US Navy A12 Stealth Fighter Program in 1991 highlighted “the abiding cultural problem” of
  - Interpreting information in the most favorable light
    - **“possibilities were always cast in a positive, optimistic, light”**
    - In spite of a growing body of evidence to the contrary
  - Preferring to defer dealing with unfavorable information
    - **“these leaders considered whether to bring news of adverse developments forward, but decided not to do so”**
- ◆ The report also highlighted that this “problem” was not unique to the military

Source: Memorandum For The Secretary Of The Navy 28 Nov 90, Subject: A-12 Administrative Inquiry; Chester Paul Beach Jr <http://www.suu.edu/faculty/christensend/beacha-1.pdf>

# Ten Benefits of EVMS

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1. It is a single management control system that provides reliable data
  2. It integrates work, schedule, and cost using a work breakdown structure
  3. *The associated database of completed projects is useful for comparative analysis*
  4. The cumulative cost performance index (CPI) provides an early warning signal
  5. The schedule performance index provides an early warning signal
  6. The CPI is a predictor for the final cost of the project
  7. *It uses an index-based method to forecast the final cost of the project*
  8. The “to-complete” performance index allows evaluation of the forecasted final cost
  9. The periodic (e.g., weekly or monthly) CPI is a benchmark
  10. The management by exception principle can reduce information overload
- 
11. Earned Value has developed a large body of public domain knowledge and Government case studies. These studies includes information that would be extremely sensitive and classified “commercial in confidence” in the private sector

# Conclusions

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- ◆ The presentation has sought to explain
  - The benefits of using Earned Value for commercial IT projects
  - Techniques which can be used to calculate Earned Value without an Earned Value software package and minimum overheads
  - Suggest methods for achieving “integrated project reporting” even in “un-integrated” corporate environments
    - Which can be applied at a personal level; or
    - As an incremental improvement at the Corporate level
- ◆ This presentation describes personal experience and practices gained over many years in a number of commercial IT companies
- ◆ ***I use Earned Value where I am obliged to or not because***
  - *I can objectively status, track and monitor overall project performance*
  - *Earned Value’s “early warning signals” allow me to position for or take corrective action, usually before others even realise there is an issue*



# Final Thoughts

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“The more you do of what you’re (already) doing, the more you’ll get of what you’ve (already) got”

Source: When Projects Go Wrong; Paul C Dinsmore PMP, PM Network, November 2001 at p16

The (software development) Solution Centre I work for is moving to Earned Value as quickly as we can because we’ve realised it’s the only way we can work out where these projects are really at ...

Source: Barry Smith, Senior Project Manager; Member PMI Sydney Chapter

# FAQ #1 Do you supply the Earned Value spreadsheet with the presentation ?

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## ◆ NO

- Use of the Earned Value worksheet requires training and familiarisation in its use
- An Earned Value short course has been run in Sydney sponsored by PMI Sydney Chapter
- Course duration is 1 day
  - 4 x 2 hour evening sessions
  - Or as a 1 day course

## ◆ Contact details

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# FAQ #2 Are there any papers on applying Earned Value to software development projects ?

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- ◆ There are many public domain papers on the applicability of Earned Value Management to software development projects either on or referenced by the US Defense Department Acquisition website at <http://www.acq.osd.mil/pm/paperpres/paperpres.html>
- ◆ **Comprehensive Bibliography of Earned Value Literature. Christensen, D (July 2002)** <http://www.suu.edu/faculty/christensend/ev-bib.html>  
A very extensive bibliography of Earned Value literature (published and un published)

## Recommended papers to get started are:

1. **Earned Value, Clear and Simple. Wilkens, Tammo T (1999)** [http://www.acq.osd.mil/pm/paperpres/wilkins\\_art.pdf](http://www.acq.osd.mil/pm/paperpres/wilkins_art.pdf)  
An 8 page paper which provides a comprehensive but “clear and simple” description of the elements of Earned Value and reasons for using an Earned Value Management System
2. **Earned Value Project Management--A Powerful Tool For Software Projects. Fleming & Koppelman (1998)** <http://www.acq.osd.mil/pm/paperpres/fleming1.pdf>  
A very readable 4 ½ page paper which summarizes the history of Earned Value and describes “10 musts” to implement Earned Value on all projects. Most of these “musts” should be implemented whether Earned Value is used or not !
3. **Practical Software Measurement, Performance-Based Earned Value (2001) Solomon, P** <http://www.stsc.hill.af.mil/crosstalk/2001/sep/solomon.pdf>  
A comprehensive 5 page paper which covers the issues and provides recommendations to enable accurate measurement of progress on software development projects.

# FAQ #2 Are there any papers on applying Earned Value to software development projects ?

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Specific links to some other software papers at this site include:

- ◆ **Statistical Process Control of Project Performance, (2002) Lipke W.H.**  
<http://www.stsc.hill.af.mil/Crosstalk/2002/mar/lipke.asp>
- ◆ **Software Project Planning, Statistics, and Earned Value (2000) Lipke, W, Jennings M**  
<http://www.stsc.hill.af.mil/crosstalk/2000/dec/lipke.asp>
- ◆ **Applying Management Reserve to Software Project Management Lipke, W. H. (1999)**  
[http://www.acq.osd.mil/pm/paperpres/lipke/lipke\\_art.html](http://www.acq.osd.mil/pm/paperpres/lipke/lipke_art.html)

Walt Lipke is the deputy chief of the software division at the Oklahoma City Air Logistics Center. He has 30 years of experience in the development, maintenance, and management of software for avionics automated testing. Lipke has written a number of public domain articles on advanced techniques applicable to software development and Earned Value. His organization is certified to Level 4 of the SEI's CMM.

- ◆ **16 Critical Software Practices for Performance-Based Management by Jane T. Lochner (1999)** <http://www.stsc.hill.af.mil/Crosstalk/1999/Oct/Lochner.asp>
- ◆ **Using Earned Value for Performance Measurement on Software Development Projects (1995) Christensen, D** <http://www.suu.edu/faculty/christensend/EVonSWprojects.pdf>

Included as a “historic” reference paper on applying Earned Value to software projects

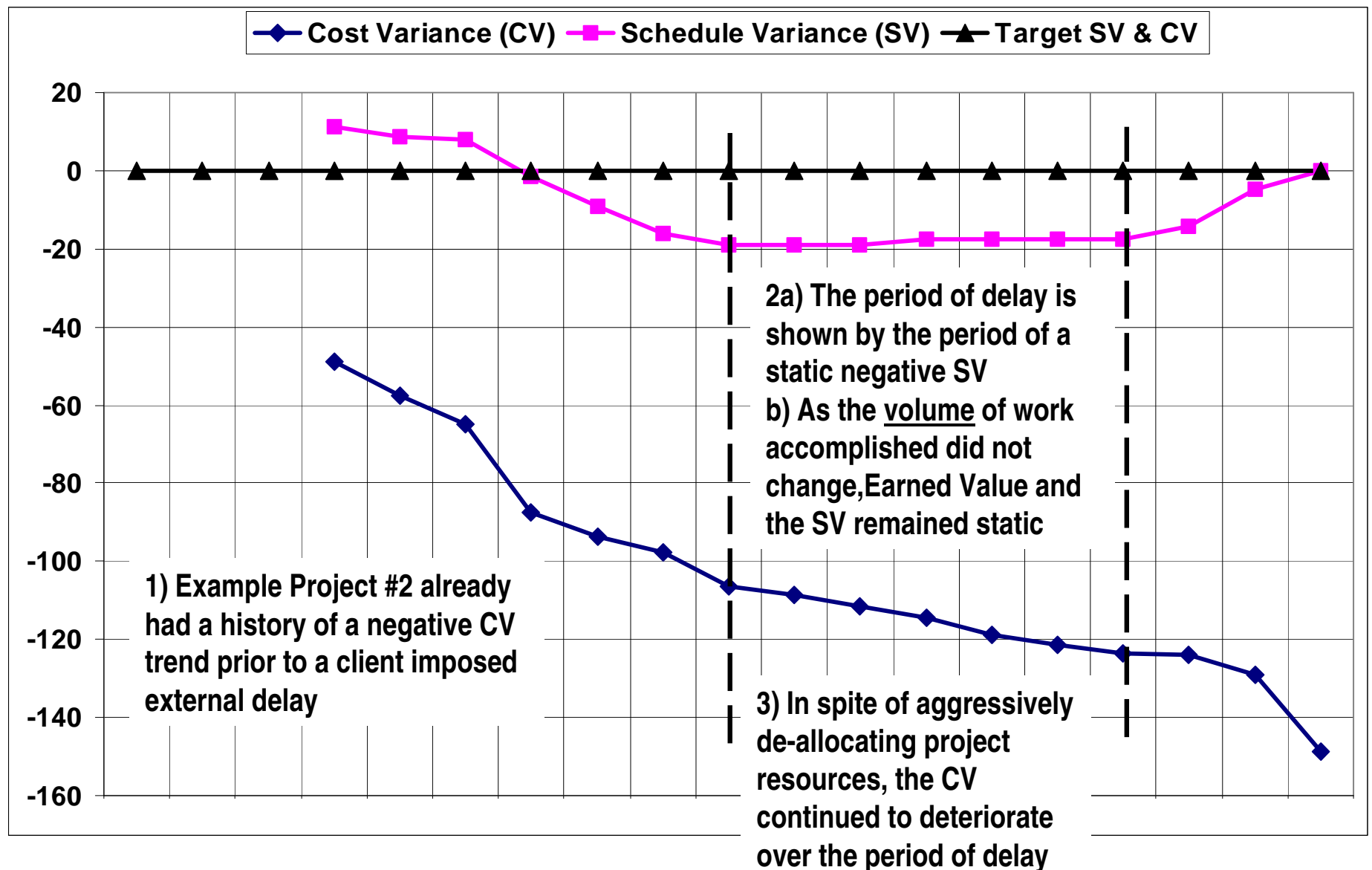
# FAQ #3 What are some the “lessons learned” from using Earned Value on IT Projects ?

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- ◆ **Lesson #1:** Schedule delays incurs additional project costs
  - A project will almost certainly bear some costs during the delay period
- ◆ **Lesson #2:** Schedule compression incurs additional project cost
  - Work cannot be scheduled and resourced in an optimum fashion
  - Schedule compression almost inevitably results in inefficiencies due to resource loading and rework
- ◆ **Lesson #3:** Schedule delay AND compression to make up for lost time will definitely result in significant adverse cost impacts
- ◆ **Lesson #4: Earned Value enables objective quantification of the costs of delay and / or schedule compression**
  - These “lessons learned” might appear “obvious”; BUT
  - There have been any number of examples in my commercial IT sector experience of schedule actions being agreed with clients without any (prior) thought of appropriate recompense

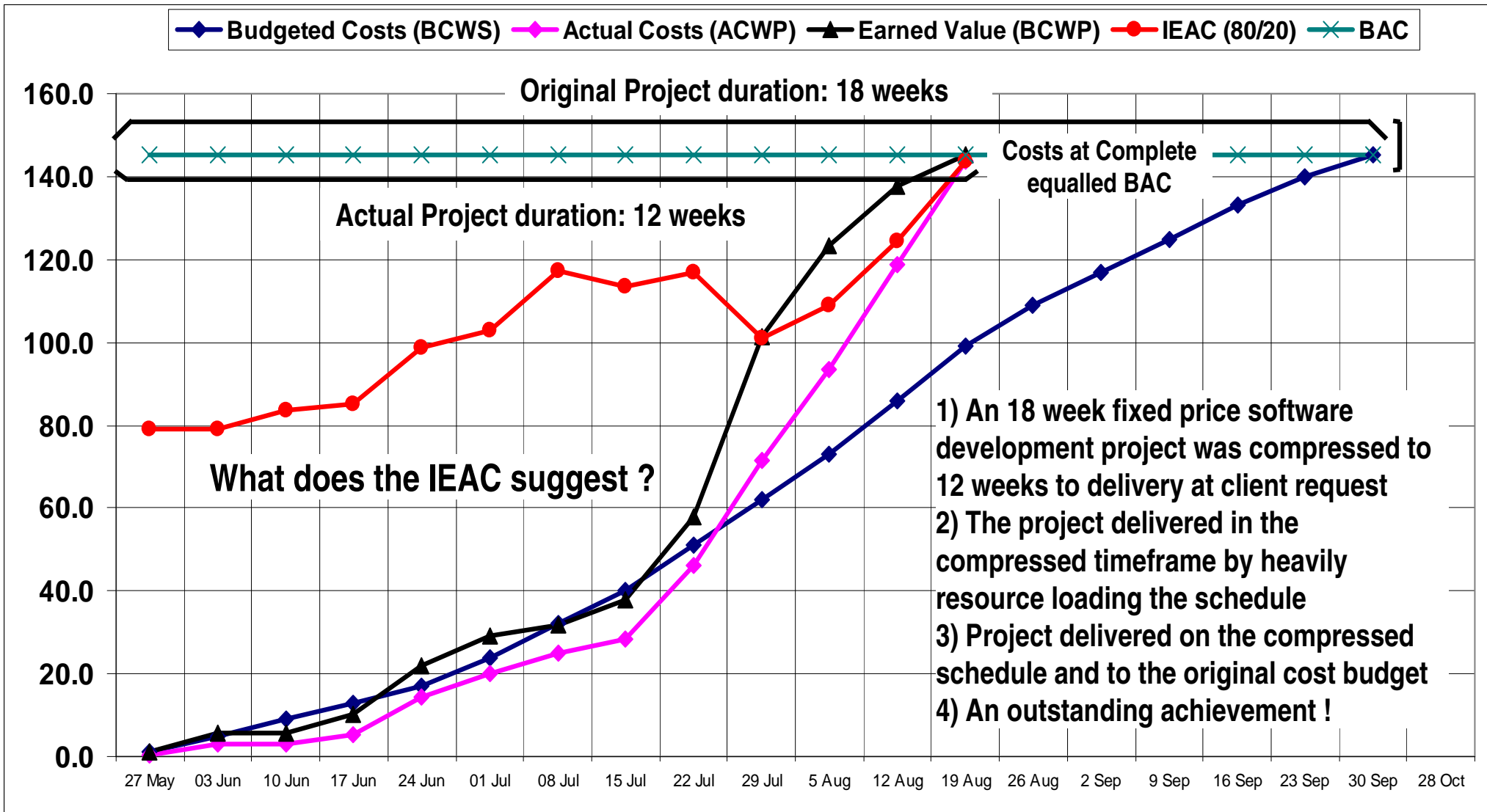
# Example Project #2: Schedule delay costs money

## EV enables objective quantification of the cost of delay



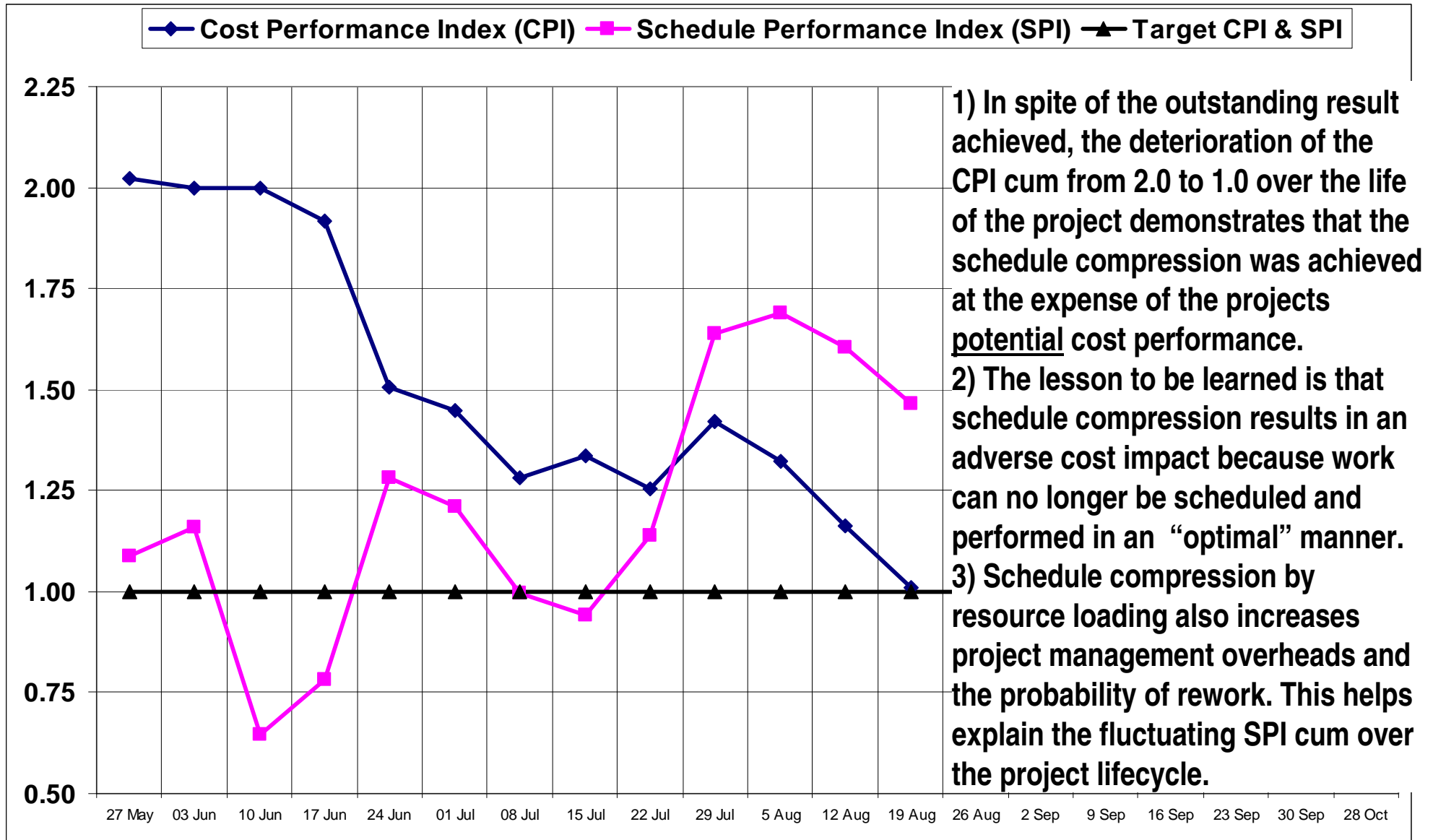
# Example Project #3 Schedule compression costs money

## EV enables objective quantification of the cost of compression



# Example Project #3 Schedule compression costs money

## EV enables objective quantification of the cost of compression





## FAQ #4 What is the relationship between Earned Value and Quality ?

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- ◆ There is no direct relationship between Earned Value and quality
  - Earned Value does not include quality metrics
- ◆ However, Project Quality Control and Quality Assurance processes, methods and metrics are very important and should be documented in the Project Plan **and implemented** on the project !
- ◆ The consequences of quality failure, both process and product will become evident in the Earned Value metrics
  - Adverse Cost and Schedule Variances

# FAQ #5 What is the relationship between Earned Value and Risk Management ?

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- ◆ There is a **direct** relationship between Earned Value and Risk Management
- ◆ Earned Value's, IEAC formulae are a credible method of providing “early warning signals” for the management of project “cost risk”
- ◆ The Earned Value methodology provides for a “Management Reserve” (MR) and can also provide for “risk and contingency” budgets
  - MR is a reserve **for uncertainties** for **in-scope but unforeseen work**
  - MR is a budget **not** (usually) controlled by the Project Manager
    - Requires permission to draw down on as risks are realised
  - Risk/Contingency **is** (often) controlled by the Project Manager
- ◆ ***“Pragmatic” Earned Value implementations need not make these distinctions*** (ie. implement a single risk budget)
- ◆ The overriding principle is that “unbudgeted” work should not be included in the Earned Value calculations as this distorts the EV measures
  - Eg. Including “un-allocated” MR / Risk in EV calculations will **understate** the Cost Variance