

Earned Value Management
Presentation at the Utah Section of AACE
1 March 2011

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Agenda

1. Intro
2. History of EVMS
3. How widespread?
4. EVMS ABCs
5. Something you haven't ever seen-CPT
6. AACE EVP Certification
7. Recommended 1st Stops

What?

- ▶ **Earned Value Management (EVM)**
 - ▶ Earned Value Management Systems (EVMS) = integrated project management
 - ▶ It is the management tool that integrates work scope with schedule and budget resources
 - ▶ A performance management baseline is established
 - ▶ Work progress is measured as "earned value" (EV) - a yardstick
 - ▶ Schedule and cost variances are isolated and reported to the project manager for corrective action
 - ▶ Allows projects to be managed better - on time, on budget
 - ▶ EVMS is not a specific system or tool set, but rather, a set of guidelines that guide a company's management control system
 - ▶ EVMS best business practices documented in [ANSI/EIA Std 748-98](#)
- ▶ **EVMS** = refers to internal mgmt ctrl systems that meet guidelines
- ▶ **EVM** = overall method of managing projects w/ EV processes
- ▶ **EV** = budgeted resources earned when work accomplished

How Widespread is EVM?

- ▶ Used by DOD since the 1965 with creation of Minuteman Earned Value:

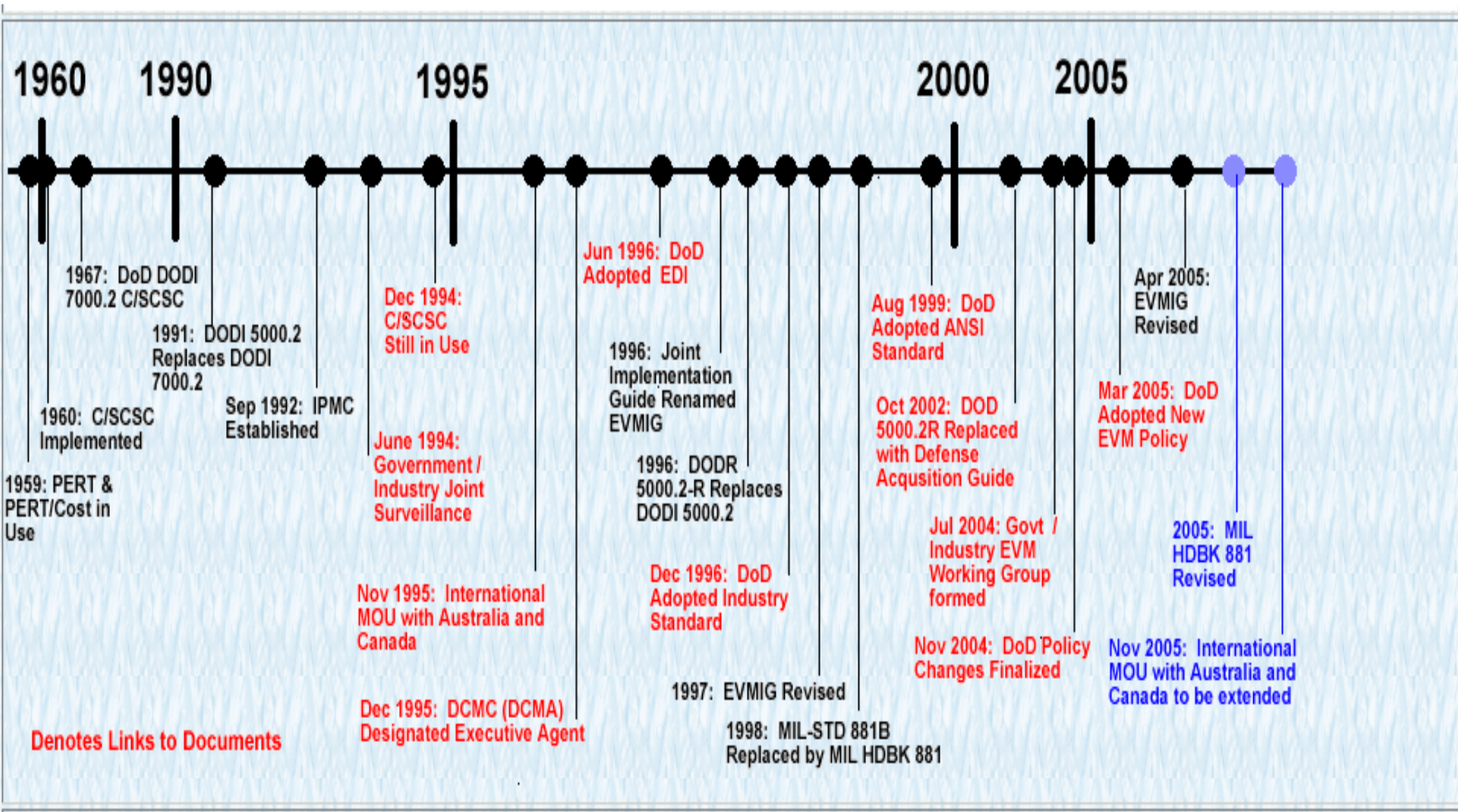
Jim Morin (EV Pioneer): “The DoD-wide C/SCSC was the third earned value system. The first was Minuteman Earned Value, which was the basis for the Air Force’s Cost/Schedule Planning and Control System(C/SPCS), which, in turn, was the basis for C/SCSC.” <http://www.pmforum.org/library/second-edition/2009/PDFs/dec/SE-Morin-HowItAllBegan.pdf>

Interview with Jim Morin, Earned Value Pioneer-Fall2010 Measurable News pg25:

http://www.pmi-pm.org/pages/measurable_news/documents/MN2010Issue4Final.pdf

- ▶ Required per Gov’t OMB Circular A-11 part 7.....
- ▶ NASA
- ▶ DOE
- ▶ EPA
- ▶ FAA
- ▶ Construction Industry first commercial adopters
- ▶ Internationally spreading across globe
- ▶ PMBOK 2004 helped advance EVM practice
- ▶ International EVM Standard - ISO/PC236->ISO21500?

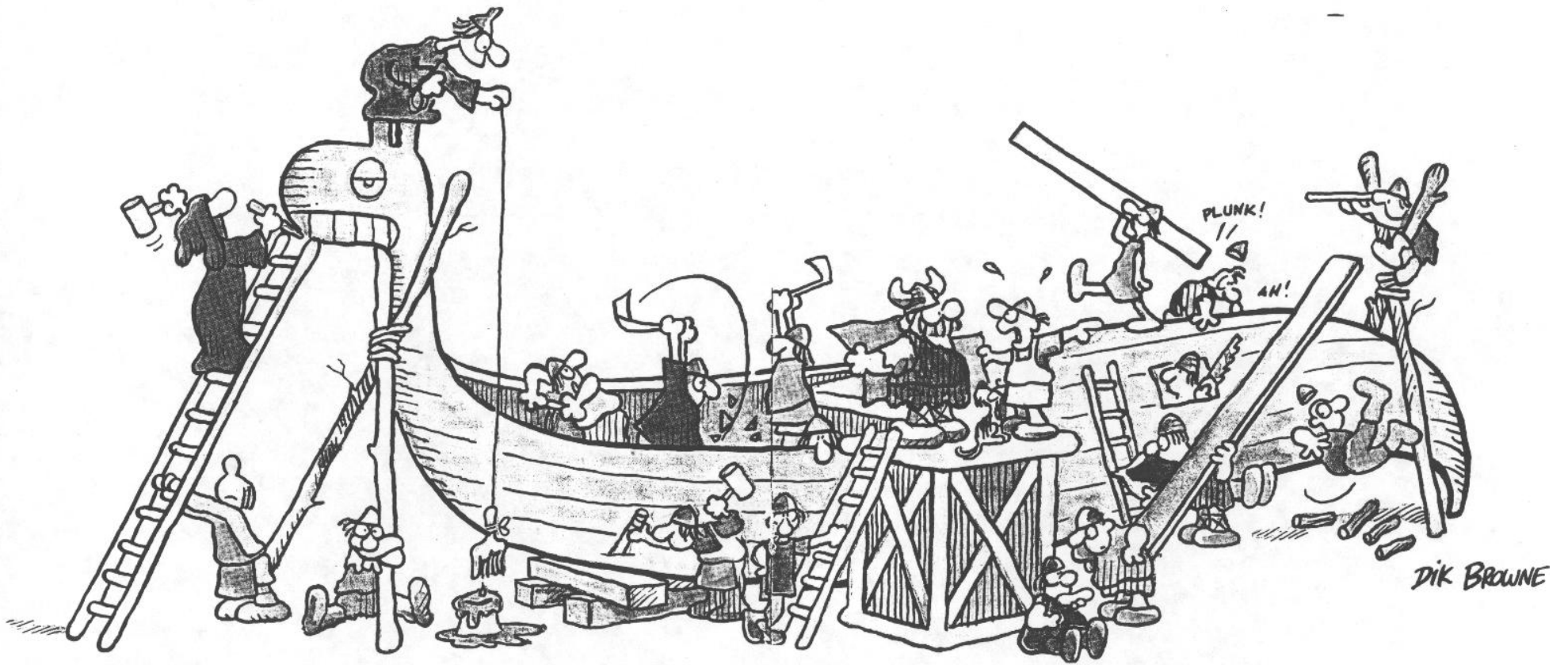
EVM HISTORY





Revised EVM Policy/Guidance: New Application Thresholds

<u>Contracts</u>	<u>Thresholds</u>	<u>Requirements</u>
Cost or Incentive Equal to Or Above Threshold	$\geq \$50M$	<ul style="list-style-type: none">- Compliance with industry EVM standard- <u>Formal EVM system validation</u>- Contract Performance Report- Integrated Master Schedule- Integrated Baseline Reviews- Ongoing surveillance
Cost or Incentive Equal to Or Above Threshold	$\geq \$20M$	<ul style="list-style-type: none">- Compliance with industry EVM standard- <u>No formal EVM system validation</u>- Contract Performance Report (tailored)- Integrated Master Schedule (tailored)- Integrated Baseline Reviews (scope tailored)- Ongoing surveillance
Cost or Incentive Less Than Threshold	$< \$20M$	<ul style="list-style-type: none">- EVM optional (risk-based decision)- Cost-benefit analysis required



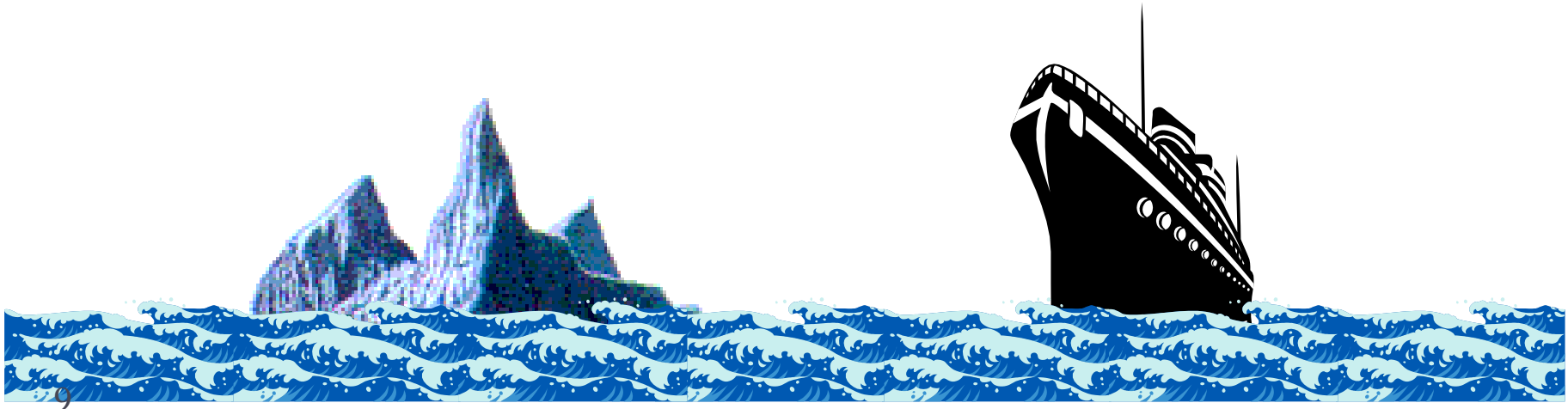
EVMS Defined

- ▶ EVMS is:
 - ▶ a management tool that integrates work scope with schedule and budget
 - ▶ performance measurement and management
 - ▶ how am I doing against my baseline plan?
 - ▶ sound project management, useful to
 - ▶ program manager
 - ▶ contractor
 - ▶ Customer (government, owner, etc....)
 - ▶ early warning/identification of cost & schedule issues

Why do we need Early Warning?

**Course corrections are easier
when you have time to make
small adjustments**

**It's too late when you're this
close to the iceberg!**



Essence of EVMS

All work scope for the project must be planned...into a baseline plan to measure accomplishments.

As elements of work are completed, their values are earned.

Work progress is quantifiable as Earned Value, which measures both cost and schedule performance in financial terms.

Variances from the plan require analysis and a corrective action.

Program Manager ultimately responsible for
Earned Value (Performance) of Program

EVMS PRINCIPLES

- ▶ Establish Formal Plan for Execution of Contract
- ▶ Establish Baseline Plan and Control
- ▶ Measure Performance Using
 - ▶ Planned Value
 - ▶ Earned Value
 - ▶ Actual Costs
- ▶ Provide Data to Enable Variance Analysis, Trend Analysis, Corrective Action, and Estimates of Costs at Completion
- ▶ Provide Decision-Making Data to Management
- ▶ Indicate Work Progress
- ▶ Relate Cost/Schedule/Technical Accomplishments
- ▶ Provide Data in Detail and in Summary

Earned Value Terms

The following earned value terms can apply at program, WBS element, cost account levels & work package levels

Budget at Complete (BAC)	Total budget for a program, WBS element or cost account
Spend Plan	Time phased budget (budget spread over time), also termed Budgeted Cost of Work Scheduled (formerly BCWS)
Actuals	Funds expended to date for a given budget, also termed Actual Costs of Work Performed (formerly ACWP)
Earned Value (EV)	Value of work completed for a given budget measured in terms of \$s, also termed Budgeted Cost of Work Performed (formerly BCWP)
Cost Variance (CV)	Earned Value - Actual Costs (difference between work completed and money spent, measure of cost performance)
Schedule Variance (SV)	Earned Value - Spend Plan (difference between work completed and work planned to be completed, measure of schedule performance)
Cost Perf Index (CPI)	Earned Value / Actual Costs (ratio of work completed to money spent, a cost productivity metric)
Schedule Perf Index (SPI)	Earned Value / Spend Plan (ratio of work completed to work planned to be completed, a schedule productivity metric)
Estimate to Complete (ETC)	Estimate of costs remaining to complete the work, can be a “grass roots” estimate or can be calculated, one formula: $(BAC - EV) / CPI$
Estimate at Complete (EAC)	Total costs expected for a given budget (Actuals + ETC)
To Complete Perf Index (TCPI)	CPI for future work (work remaining / funds required or $[BAC - EV] / ETC$)

EVMS Benefits

- *Single, common performance measurement system*
- *Consistent management reporting on all programs*
- *Data which is timely, valid, and auditable which can be used to base management decisions*
- *Early identification of problems*
- *Practical level of summarization*
- *Isolation of problem areas*
- *Management of work progress*
- *Indication of work progress*
- *Cost, schedule and technical performance based on well defined performance measurement criteria*
- *Reduces performance subjectivity*
- *Good business sense*

Organize

Plan

Authorize

Measure

Status

Report

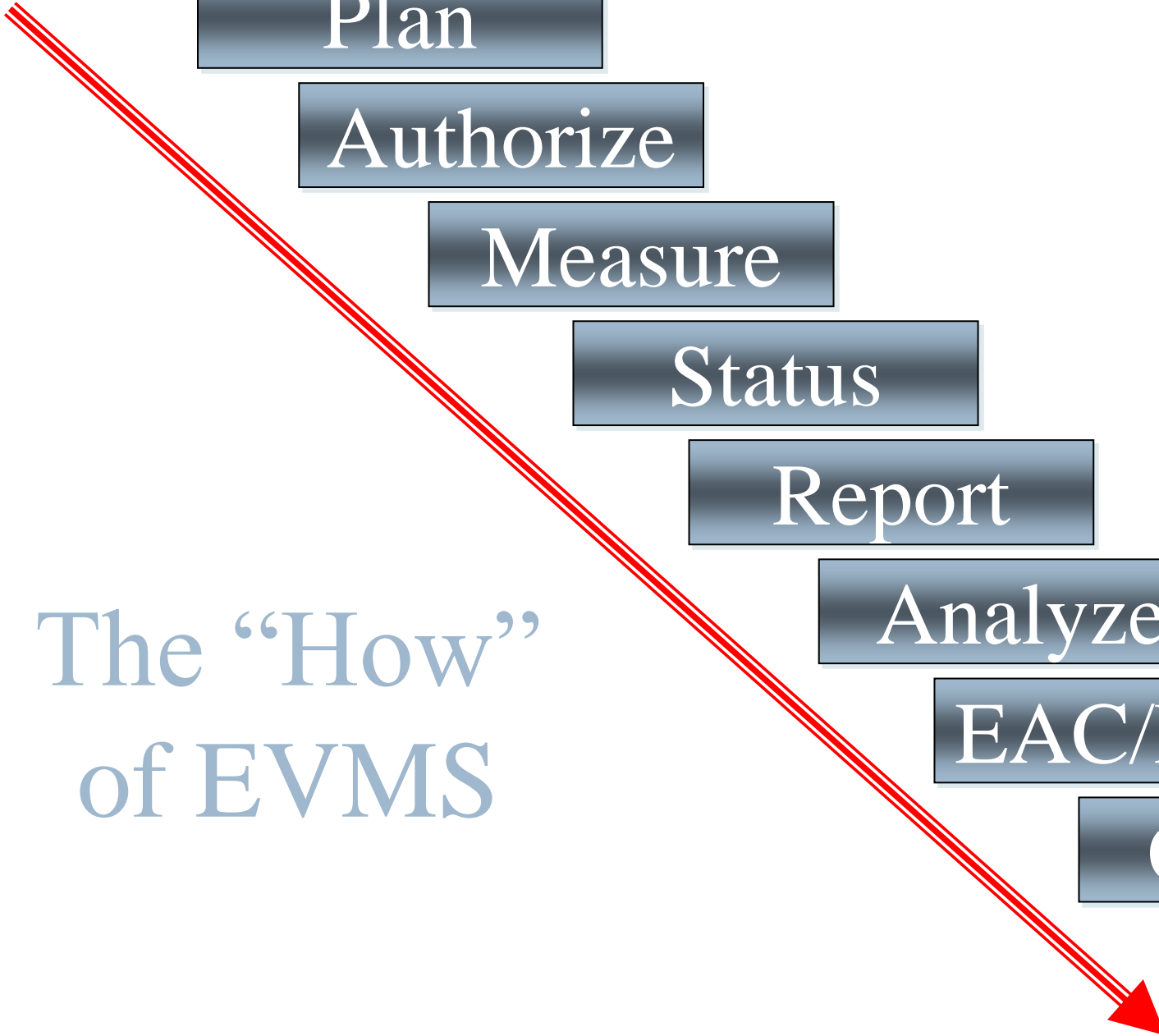
Analyze

EAC/LRE

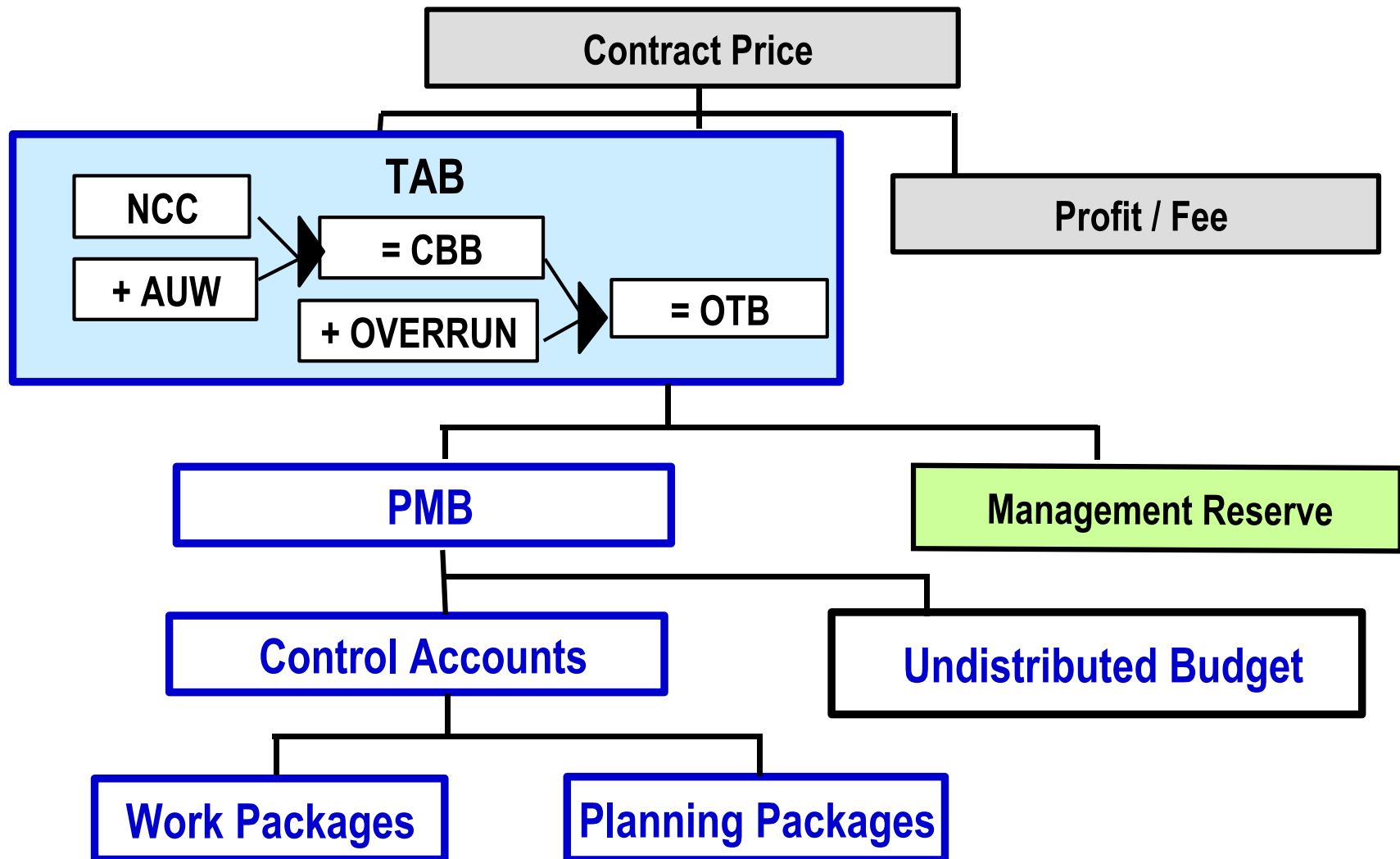
Change

Review

The “How”
of EVMS

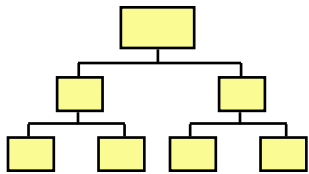


Budget Element Breakdown

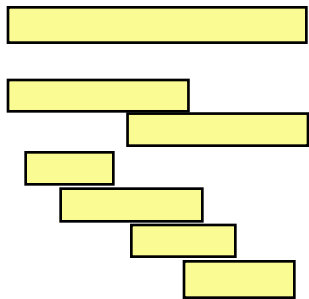


ESTABLISH THE BASELINE AN ITERATIVE 3-STEP PROCESS

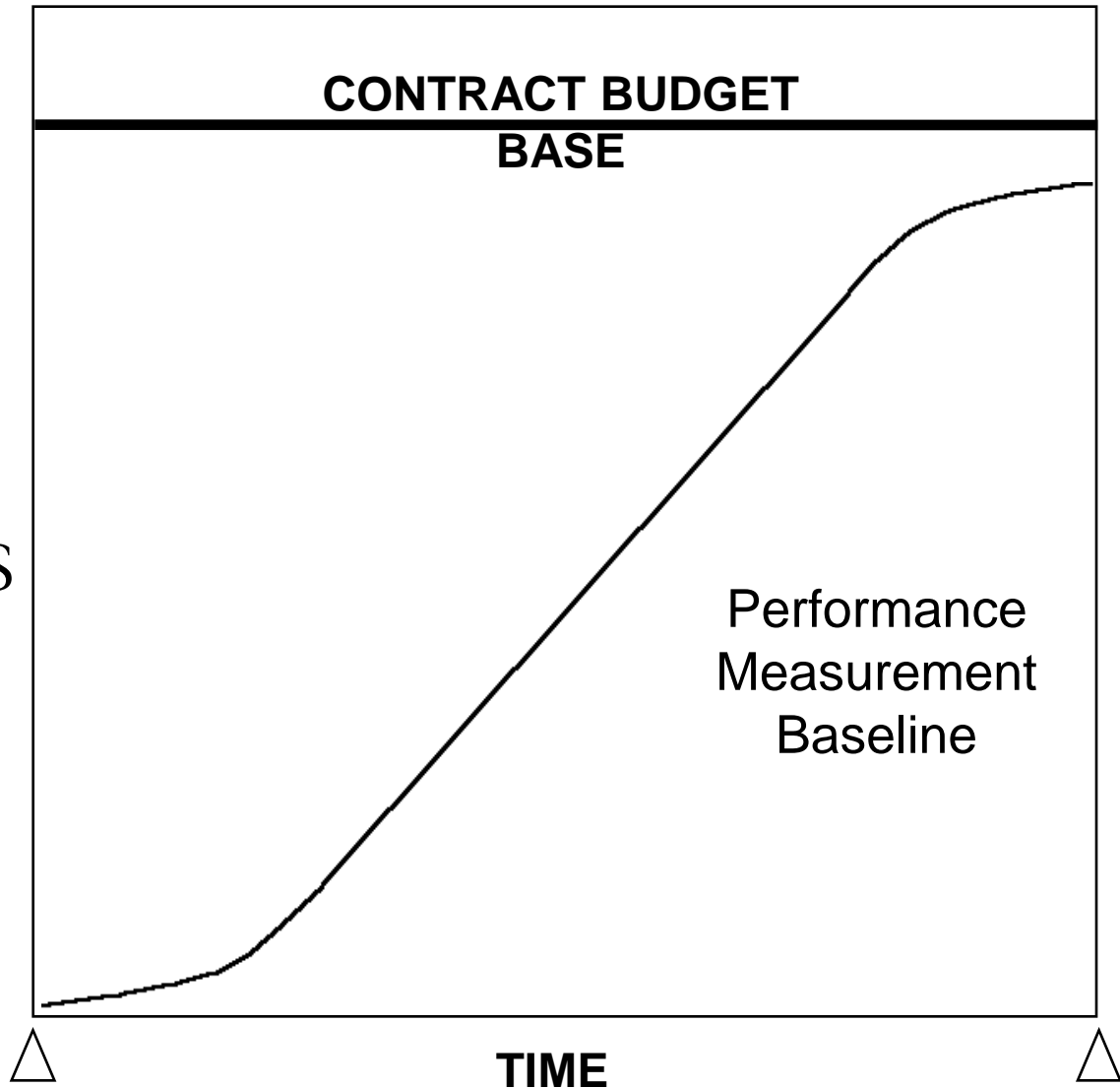
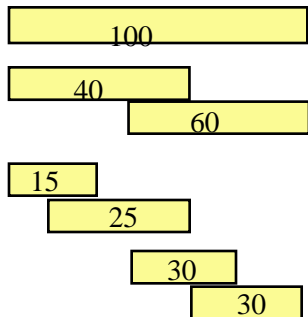
1. DEFINE THE WORK



2. SCHEDULE THE WORK

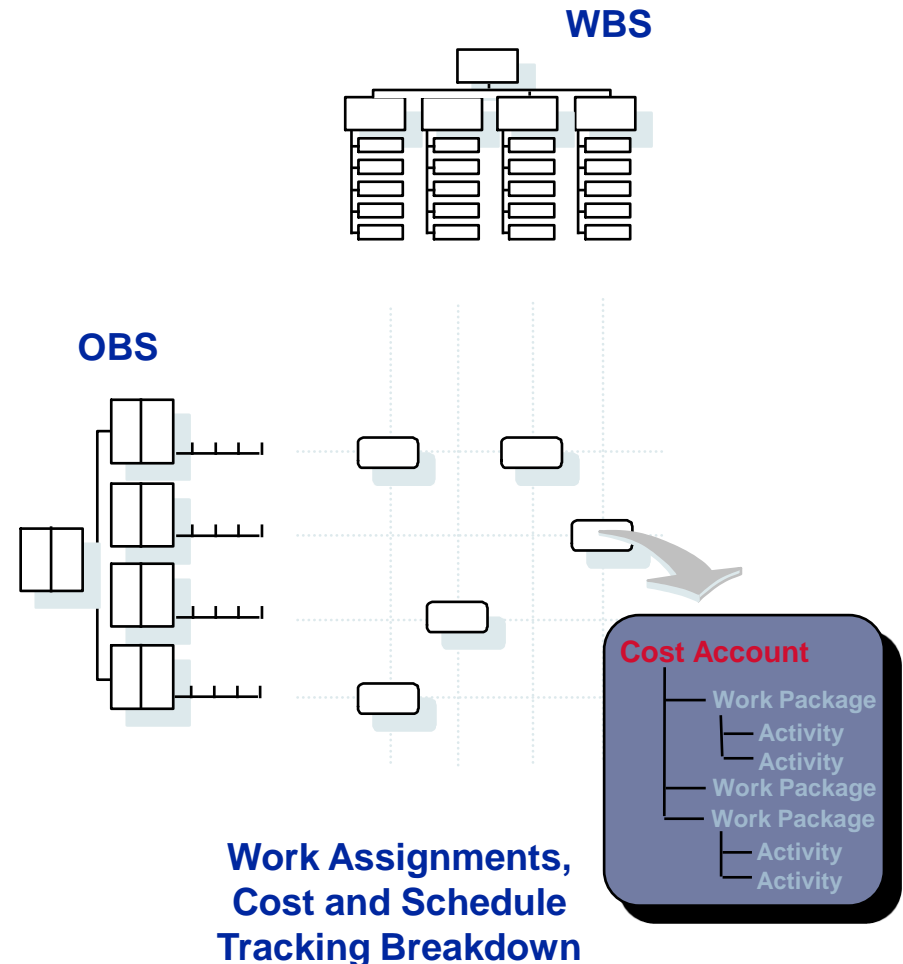
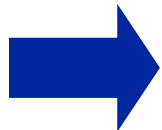


3. ALLOCATE BUDGETS

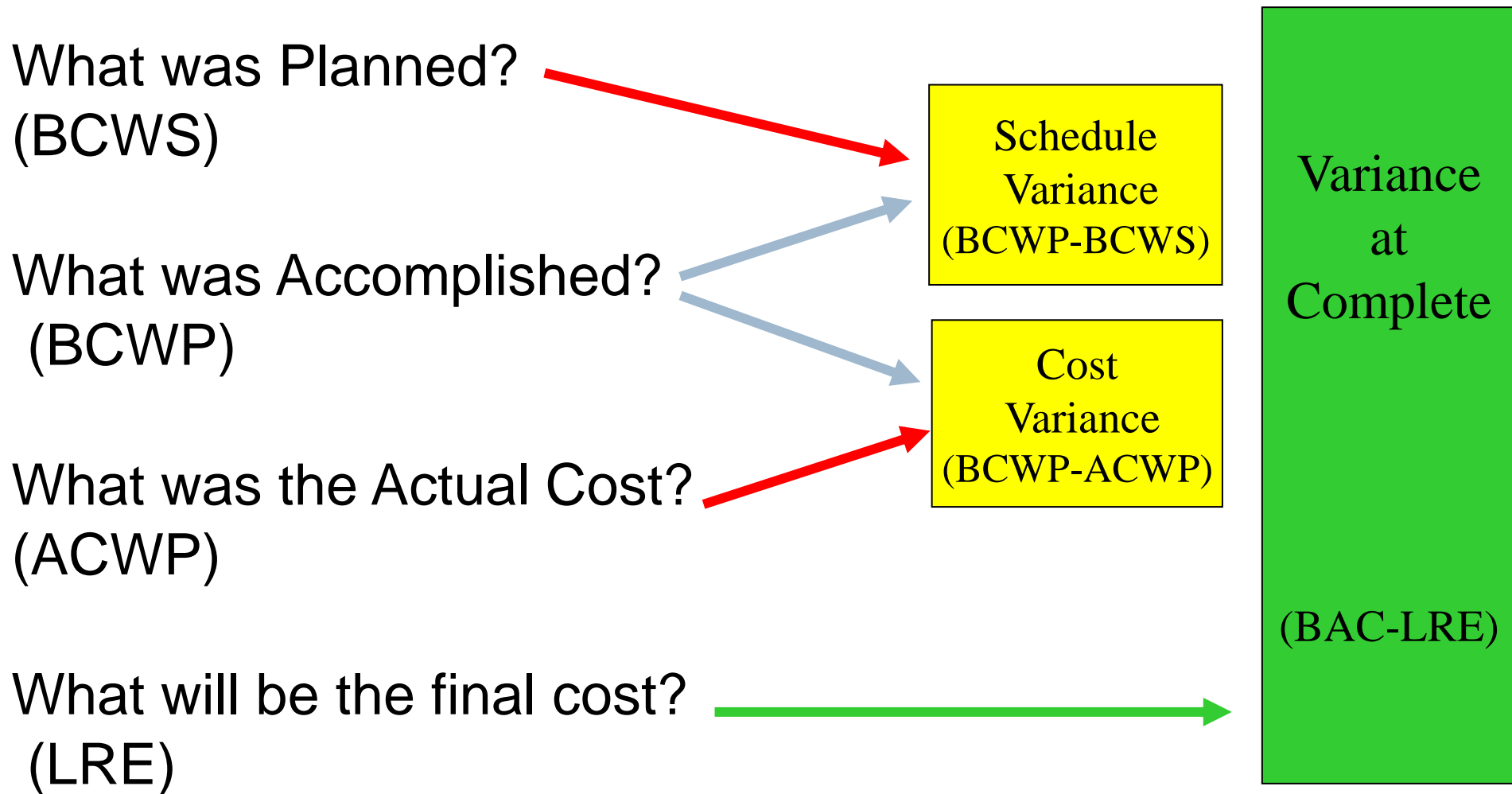


Program Planning Defines Statusing

- ▶ Each area of assigned work is then broken down into appropriate levels for detailed cost and schedule planning and tracking
- ▶ Sufficient granularity must exist so that:
 - ▶ **cost and schedule statusing can accurately be accomplished**
- ▶ Statusing type is selected, some are:
 - ▶ % Complete
 - ▶ 0 - 100% or 0-50-100%
 - ▶ LOE (Level of Effort)
- ▶ Specific statusing criteria is established for each work package (what is done to earn what percentage)

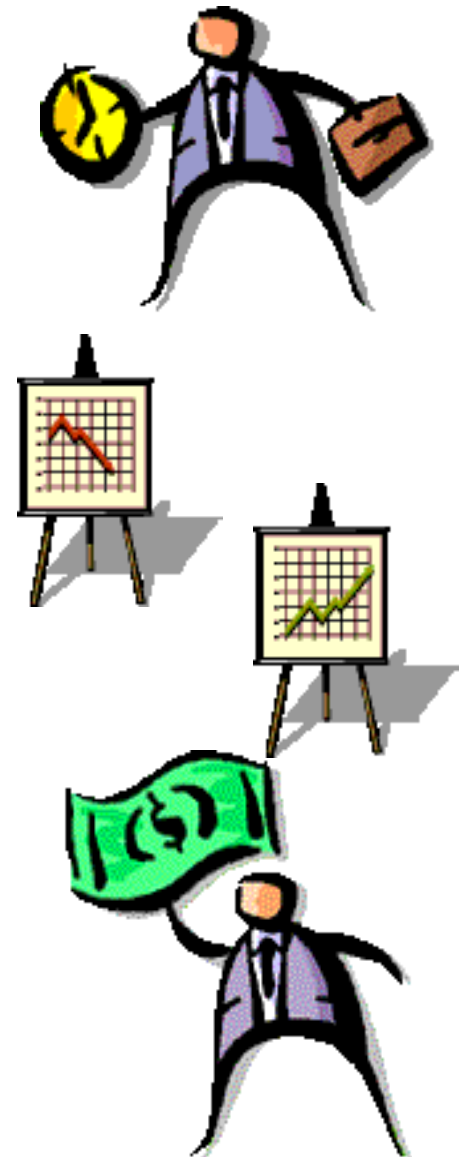


How to do Performance Measurement

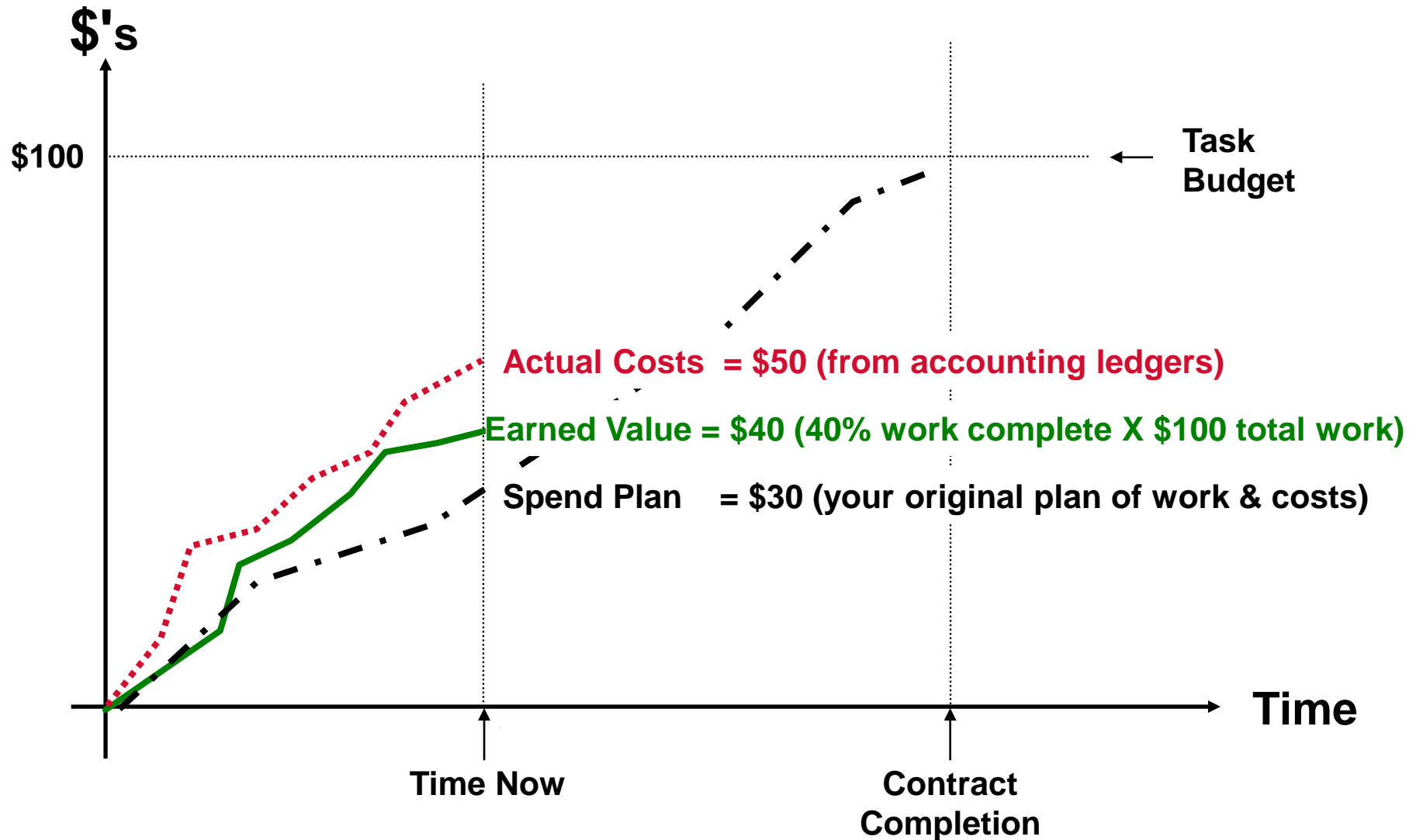


Earned Value Example

- ▶ **A Program Task:**
 - ▶ Has a \$100 budget
 - ▶ Has 40% of the work completed
 - ▶ Has spent \$50 to date
 - ▶ Was planned to spend \$30 as of this date
- ▶ **What is the status of this task ?**
 - ▶ Cost Status ?
 - ▶ Schedule Status ?
 - ▶ What will happen in the future ?

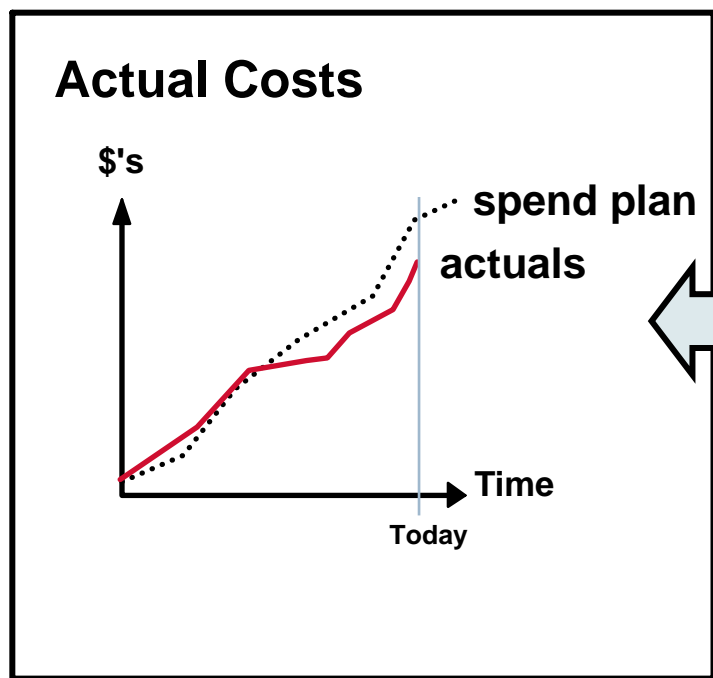


Earned Value Example

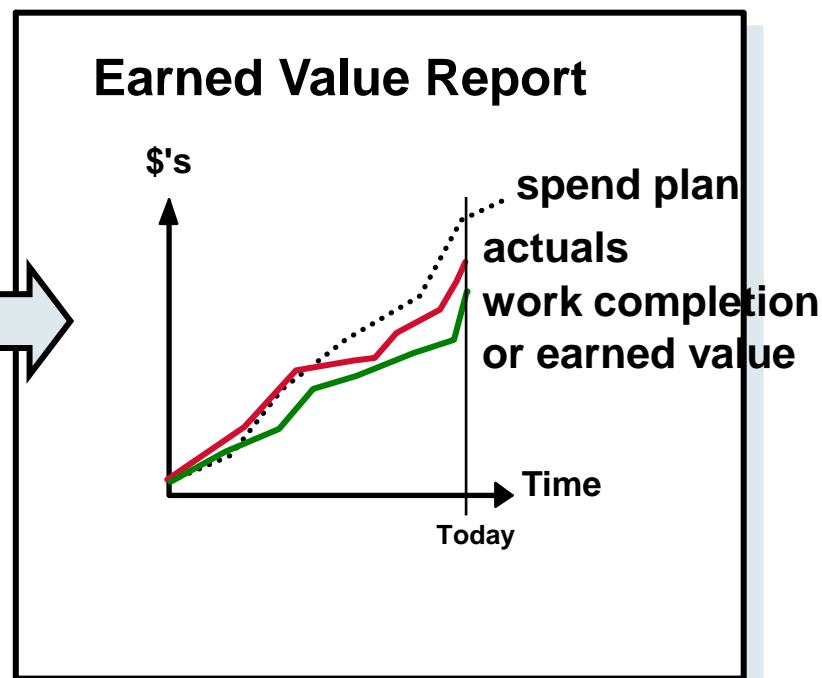


Actual Costs versus Earned Value

Tracking Actual Costs



Earned Value Reporting



Same Project
Same Status

The program is under running planned costs and most of the work is complete

Different Conclusion

This program is overrunning costs and is significantly behind schedule

Cost Variance

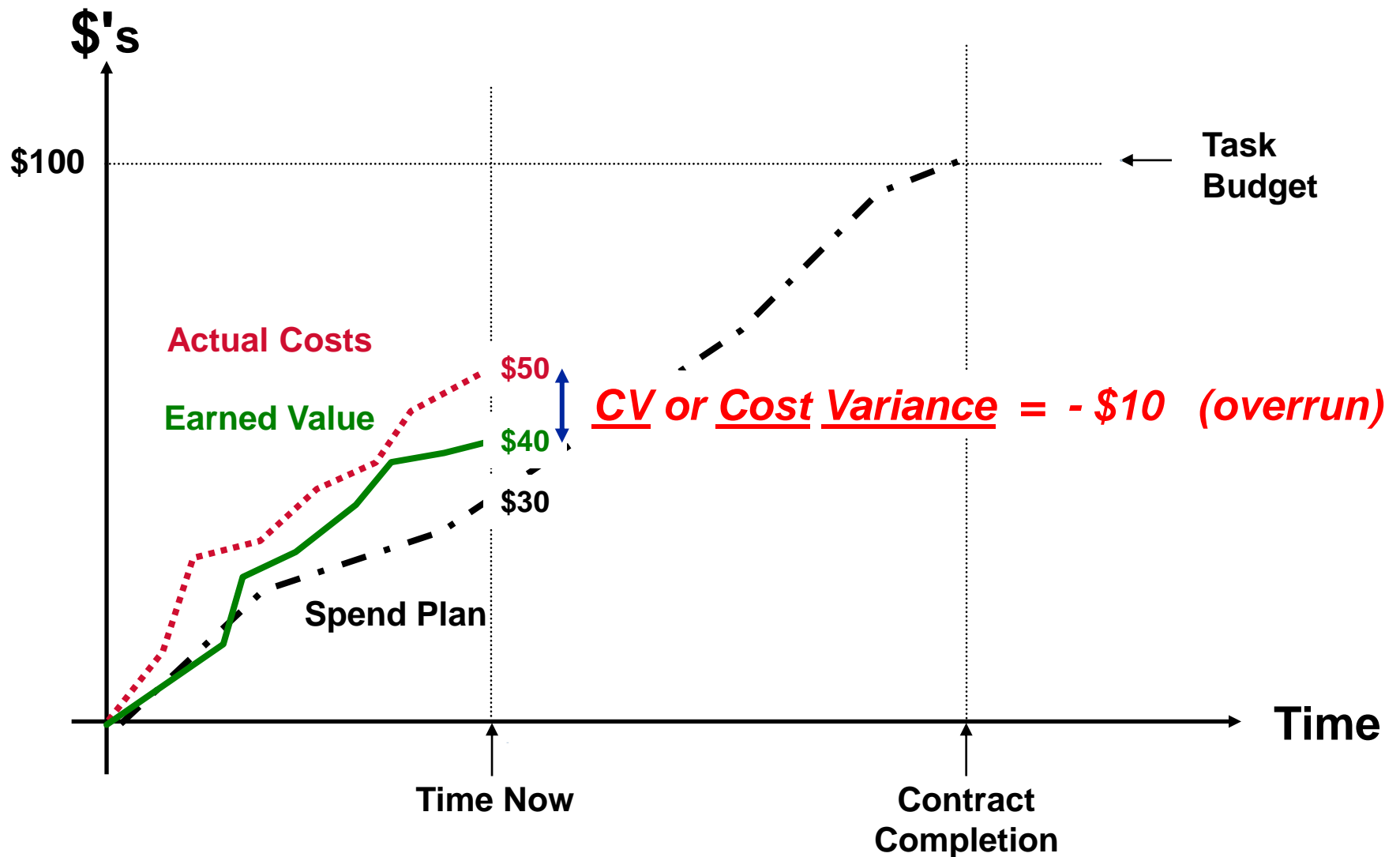
CV = Earned Value - Actuals

- ▶ Cost Variance provides visibility of cost performance of program work by comparing the value of work completed to the money spent to date.
- ▶ Example: A task is budgeted to cost \$100. The task is underway, has been statused at 40% complete and shows cumulative to-date charges of \$50. The cost variance is:

\$40	Earned Value (\$100 budget x 40% work completed)
- \$50	<u>Actual Costs</u> (from accounting ledgers)
- \$10	Cost Variance or CV

This task is overrunning, half the money is spent but only 40% of the work is completed

Cost Variance (CV) Example



Schedule Variance

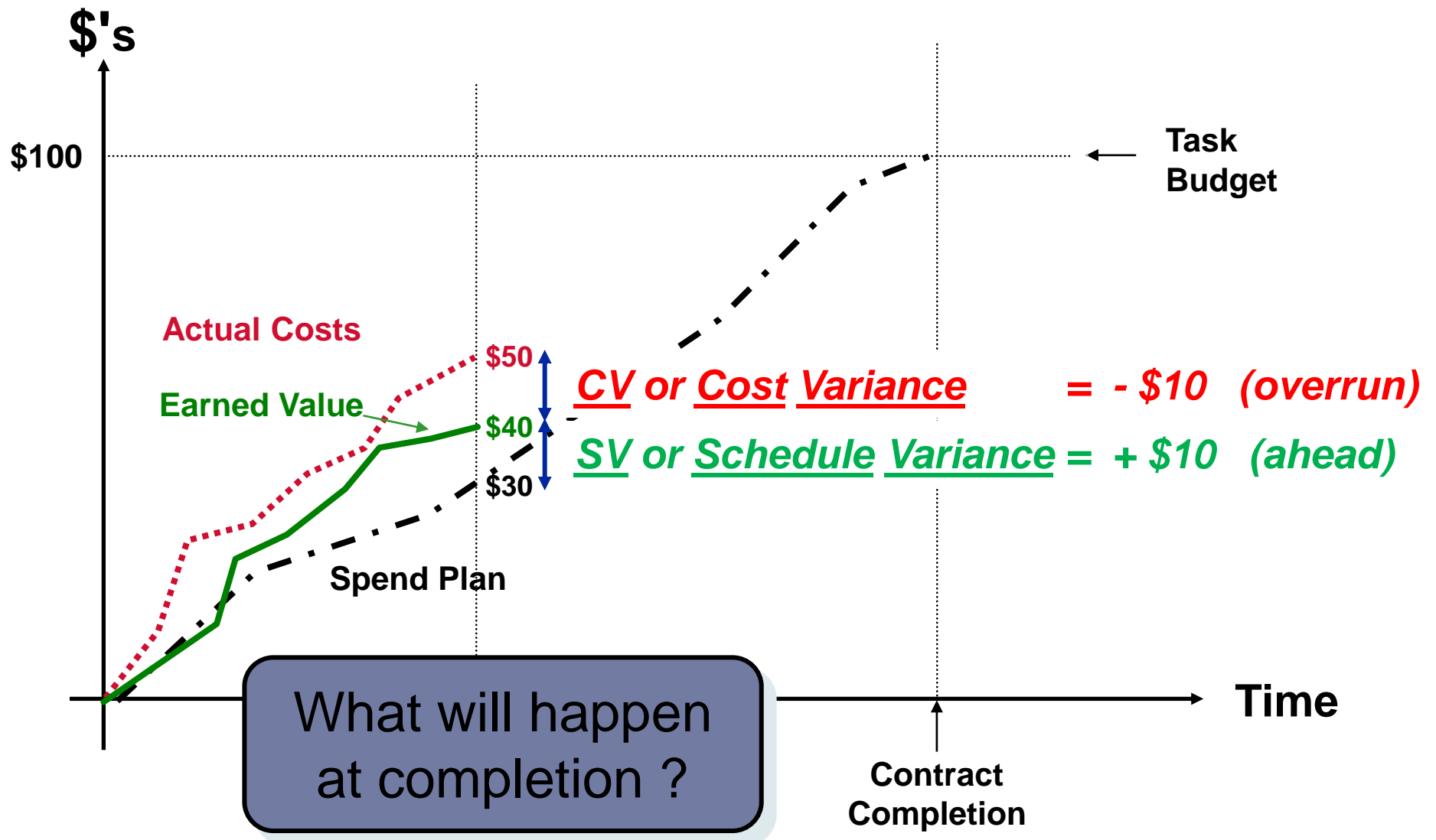
SV = Earned Value - Spend Plan

- ▶ Schedule Variance provides visibility of the schedule status of program work by comparing the spend plan (planned expenditures & planned work) to the value of work completed.
- ▶ Example: A task is budgeted to cost \$100. The task is underway, has been stasured at 40% complete and the spend plan shows that \$30 of work was planned to have been completed by this date.

\$40	Earned Value (\$100 budget x 40% work completed)
<u>- \$30</u>	<u>Spend Plan</u> (work scheduled to be completed to-date)
+\$10	Schedule Variance or SV

This task is ahead of schedule

Schedule Variance (SV) Example



Cost Performance Index (CPI)

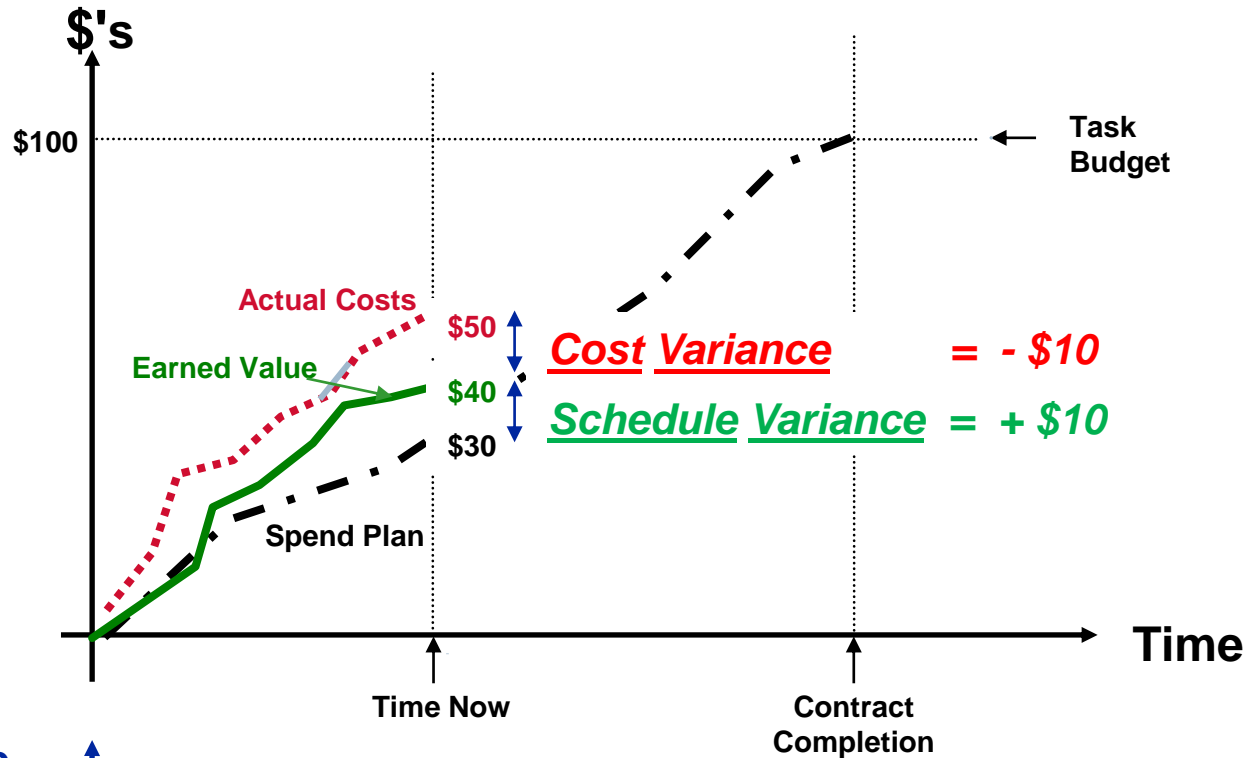
CPI = Earned Value / Actual Costs

- ▶ **COST PERFORMANCE INDEX (CPI)** provides visibility of demonstrated productivity relative to planned productivity. This is accomplished by tracking the ratio of the value of completed work (earned value) to actual costs.
- ▶ **Example:** A task is budgeted to cost \$100. The task is underway, has been statused at 40% complete, and shows cumulative to date charges of \$50. The CPI is:

$$\frac{\$40}{\$50} = \frac{\text{Earned Value} \quad \text{Budget } (\$100) \times \% \text{ complete } (40\%)}{\text{Actual Costs} \quad \text{Actual Cost Accumulated To Date}}$$

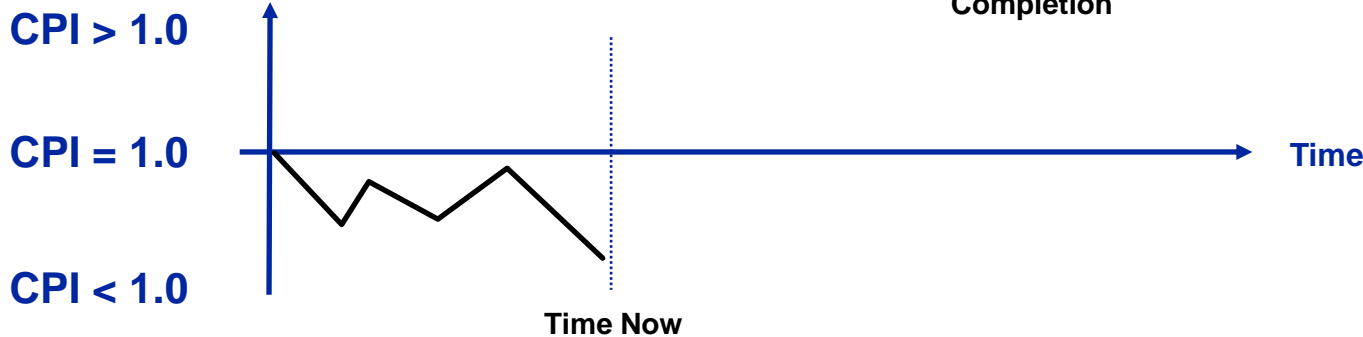
In this example **CPI = 0.80** meaning work is being performed at a productivity level which is **80%** of the planned productivity level

Cost Performance Index - CPI



In this example we are consistently performing at a productivity level lower than planned (plan = 1.00). Additionally, the trend looks negative.

What is your assessment of costs for this work at completion ?



Schedule Performance Index (SPI)

SPI = Earned Value / Spend Plan

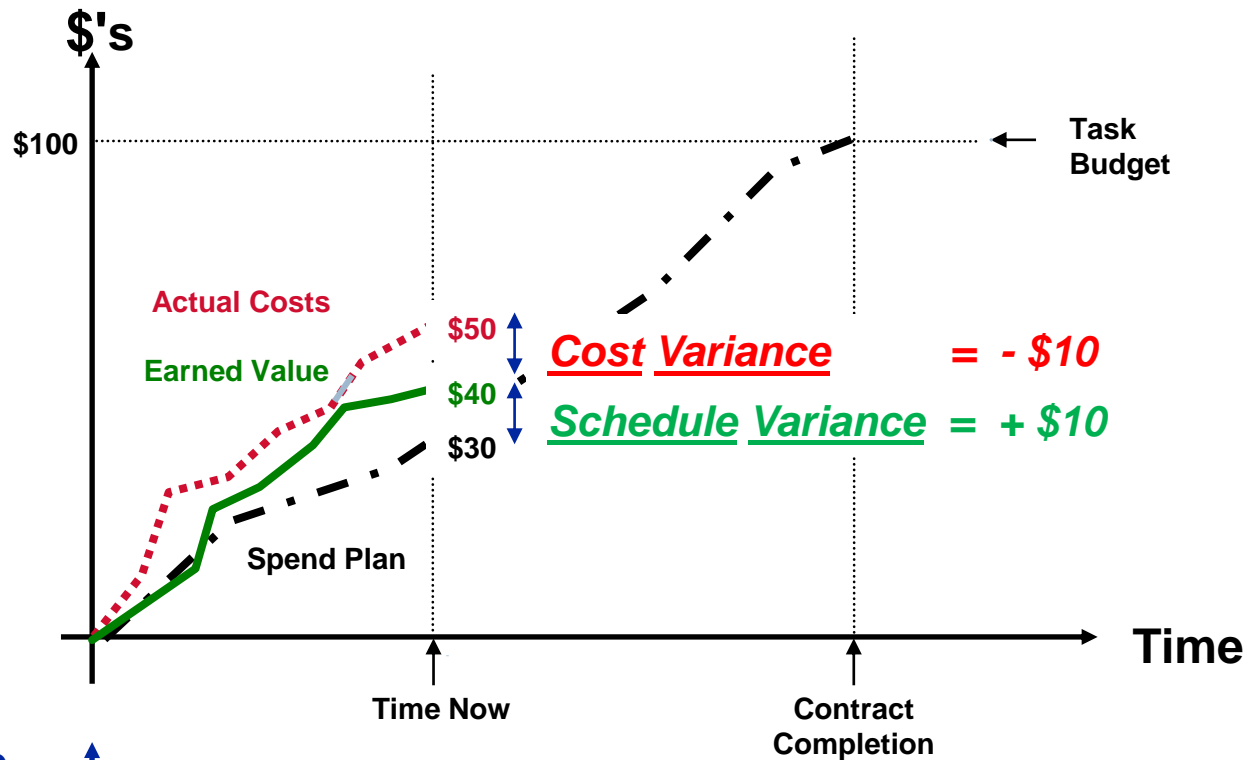
- ▶ SCHEDULE PERFORMANCE INDEX (SPI) provide gross visibility of schedule status by comparing the value of completed work (EV) to planned expenditures (spend plan)
- ▶ Example: A task is budgeted to cost \$100. This task is underway, has been statused at 40% complete, and shows a cumulative to-date spend plan of \$30.

$$\frac{\$40}{\$30} = \frac{\text{Earned Value (budget [\$100] x \% complete [40\%])}}{\text{Spend Plan Time Phased Budget as of statusing date}}$$

In this example SPI = 1.33

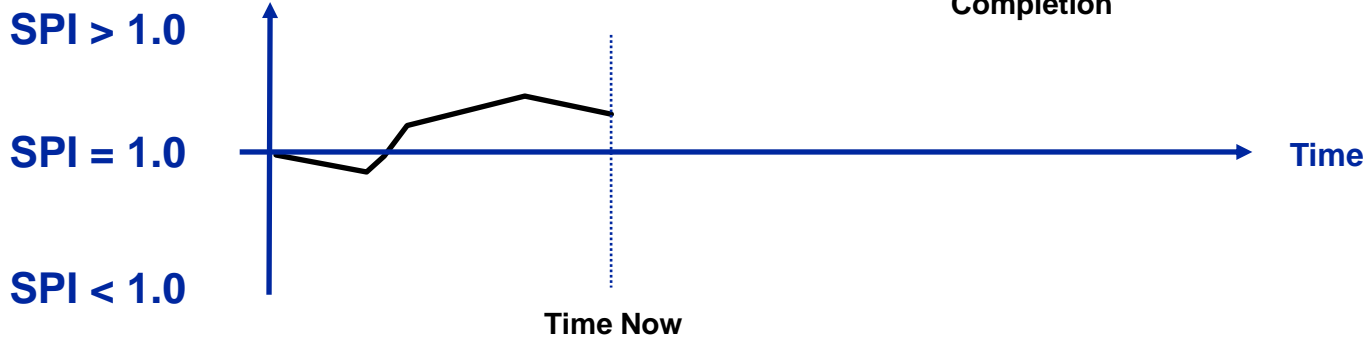
This task is being performed sooner than planned by about 33%

Schedule Performance Index - SPI



In this example, we started with a schedule performance less than plan and then performed work well ahead of plan. The trend looks slightly negative, but we clearly have a schedule productivity higher than planned.

What is your assessment of future program schedule performance.



Basic Earned Value (EV) Metrics

Cost Variance ($CV = EV - \text{Actual Costs}$)

Difference between work completed and costs expended

Schedule Variance ($SV = EV - \text{Spend Plan}$)

Difference between work completed and work planned

Cost Performance Index ($CPI = EV/\text{Actual Costs}$)

Ratio of work completed to costs expended

Schedule Performance Index ($SPI = EV/\text{Spend Plan}$)

Ratio of work completed to work planned

Basic EV Metrics

CV Cost Variance	SV Schedule Variance
CPI Cost Performance Index	SPI Schedule Performance Index

IEAC - Independent EACs

(calculated EACs)

- ▶ IEAC - Low Schedule Sensitivity - Optimistic

$$\text{EAC} = \text{Actuals} + (\text{work remaining} / \text{CPI})$$

- ▶ IEAC - Modest Schedule Sensitivity

$$\text{EAC} = \text{Actuals} + (\text{work remaining} / [0.8 \text{ CPI} + 0.2 \text{ SPI}])$$

- ▶ IEAC - High Schedule Sensitivity - Pessimistic

$$\text{EAC} = \text{Actuals} + (\text{work remaining} / [\text{CPI} * \text{SPI}])$$

Integrated Cost/Schedule Example

Activity Name	ID	EV %	BCWS	BCWP	SV	BL Cost	BL Start	BL Finish	2004	2005	2006
1.10.4 ECS SDD Phase II		74.23%	\$20,672,406.70	\$20,031,742.93	(\$640,663.77)	\$26,987,698.02	11-Mar-04	28-Feb-06			
1.10.4.0 Major Milestones		0%	\$0.00	\$0.00	\$0.00	\$0.00	11-Mar-04	28-Feb-06			
1.10.4.1 Program Management (CLIN2501)		62.66%	\$5,298,770.48	\$5,250,176.32	(\$48,594.16)	\$8,379,073.02	11-Mar-04	31-Dec-05			
1.10.4.1.1 Northrop Grumman Program Management		74.08%	\$2,357,572.57	\$2,316,808.80	(\$40,763.77)	\$3,127,405.48	11-Mar-04	31-Dec-05			
1.10.4.1.2 EASI Program Management		61.49%	\$1,874,121.16	\$1,874,121.15	(\$0.01)	\$3,047,672.60	16-Mar-04	31-Dec-05			
1.10.4.1.3 Boeing Program Management		48.06%	\$1,067,076.75	\$1,059,246.36	(\$7,830.39)	\$2,203,994.94	11-Mar-04	31-Dec-05			
1.10.4.2 System Level Reviews and Audits		0%	\$0.00	\$0.00	\$0.00	\$0.00	16-Mar-04	15-Dec-05			
1.10.4.3 System Engineering & Integration		77.25%	\$6,923,059.29	\$6,650,381.52	(\$272,677.78)	\$8,609,026.45	11-Mar-04	31-Dec-05			
1.10.4.3.1 Northrop Grumman System Engineering Int...		77.48%	\$457,453.53	\$457,453.53	\$0.00	\$590,428.89	11-Mar-04	23-Dec-05			
1.10.4.3.2 Weapon System Data		70.05%	\$2,587,550.99	\$2,459,561.58	(\$127,989.41)	\$3,511,173.79	11-Mar-04	31-Dec-05			
1.10.4.3.3 System Engineering		87.48%	\$1,130,033.86	\$1,105,250.24	(\$24,783.62)	\$1,263,399.02	11-Mar-04	23-Dec-05			
1.10.4.3.4 Test and Evaluation		85.26%	\$651,638.31	\$620,562.76	(\$31,075.54)	\$727,811.93	11-Mar-04	23-Dec-05			
1.10.4.3.5 Production Planning		90.12%	\$113,465.81	\$109,897.25	(\$3,568.56)	\$121,952.04	11-Mar-04	23-Dec-05			
1.10.4.3.6 Deployment Planning		79.38%	\$1,975,219.28	\$1,889,958.65	(\$85,260.63)	\$2,380,929.57	17-Mar-04	23-Dec-05			
1.10.4.3.7 EASI Interim Contractor Support (ST&E to ...		57.74%	\$7,697.51	\$7,697.51	\$0.00	\$13,331.20	17-Jan-05	22-Dec-05			
1.10.4.4 Detailed Design		87.42%	\$2,781,442.25	\$2,647,912.68	(\$133,529.57)	\$3,028,912.70	11-Mar-04	23-Dec-05			
1.10.4.4.1 Northrop Grumman Detailed Design Integra...		100%	\$325,779.80	\$325,779.80	\$0.00	\$325,779.80	11-Mar-04	06-May-05			
1.10.4.4.2 LF Equipment Detailed Design & Hardware...		82.08%	\$1,140,492.77	\$1,053,397.62	(\$87,095.15)	\$1,283,356.08	16-Mar-04	23-Dec-05			
1.10.4.4.3 MAF Equipment Detailed Design & Hardwa...		86.45%	\$1,009,887.67	\$963,453.26	(\$46,434.42)	\$1,114,494.83	15-Mar-04	23-Dec-05			
1.10.4.4.4 TX Technology		100%	\$305,282.00	\$305,282.00	\$0.00	\$305,282.00	19-Apr-04	12-Apr-05			
1.10.4.5 Integration Test Units (ITUs)		100%	\$2,292,104.62	\$2,292,104.62	\$0.00	\$2,292,104.62	11-Mar-04	02-May-05			
1.10.4.6 ECS Equipment DT&E and ST&E Testing		95.04%	\$1,555,990.42	\$1,535,541.89	(\$20,448.53)	\$1,615,694.48	12-Oct-04	30-Sep-05			
1.10.4.6.1 Northrop Grumman DT&E and ST&E Integr...		85.86%	\$323,779.66	\$323,779.66	\$0.00	\$377,088.72	03-Jan-05	02-Sep-05			
1.10.4.6.2 LF Equipment DT&E		99.46%	\$325,584.20	\$330,200.18	\$4,615.98	\$331,979.20	03-Jan-05	30-Sep-05			
1.10.4.6.3 MAF Equipment DT&E		99.8%	\$406,073.08	\$405,275.52	(\$797.56)	\$406,073.08	12-Oct-04	29-Jul-05			
1.10.4.6.4 LF System Test		99.73%	\$132,122.15	\$131,763.82	(\$358.33)	\$132,122.15	17-Mar-05	22-Jun-05			
1.10.4.6.5 MAF System Test		82.54%	\$136,950.58	\$113,041.95	(\$23,908.63)	\$136,950.58	28-Feb-05	11-Jul-05			
1.10.4.6.7 EASI DT&E Test Support		100%	\$181,363.20	\$181,363.20	\$0.00	\$181,363.20	01-Nov-04	28-Apr-05			
1.10.4.6.8 Damper Actuators for LCC/LER		100%	\$25,449.71	\$25,449.71	\$0.00	\$25,449.71	17-Nov-04	18-Mar-05			
1.10.4.6.9 SVIC ERMS Testing		100%	\$24,667.83	\$24,667.83	\$0.00	\$24,667.83	11-Apr-05	25-May-05			
1.10.4.7 Support Equipment		86.97%	\$29,851.80	\$29,897.03	\$45.23	\$34,374.80	01-Jun-04	28-Oct-05			

**COST PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE**

DOLLARS IN Thousands

1. CONTRACTOR		2. CONTRACT		3. PROGRAM		4. REPORT PERIOD	
a. NAME xyz		a. NAME EMD_ALL		a. NAME abc Ground Segment		a. FROM (YYYYMMDD) 980530	
b. LOCATION (Address and ZIP Code) 6304 Spine Road Anywhere, USA 80301		b. NUMBER HS55E4300N				b. TO (YYYYMMDD) 980626	
		c. TYPE CPAF	d. SHARE RATIO 100/0 100/0	b. PHASE (X one) <input checked="" type="checkbox"/> RDT&E <input type="checkbox"/> PRODUCTION			

5. CONTRACT DATA							
a. QUANTITY 1/0/1	b. NEGOTIATED COST \$444,426	c. EST. COST AUTHORIZED UNPRICED WORK \$0	d. TARGET PROFIT/FEE	e. TARGET PRICE \$499,622	f. ESTIMATED PRICE \$499,622	g. CONTRACT CEILING	h. ESTIMATED CONTRACT CEILING

6. ESTIMATED COST AT COMPLETION				7. AUTHORIZED CONTRACTOR REPRESENTATIVE			
	MANAGEMENT ESTIMATE AT COMPLETION (1)	CONTRACT BUDGET BASE (2)	VARIANCE (3)	a. NAME (Last, First, Middle Initial)		b. TITLE	
a. BEST CASE	\$444,426			c. SIGNATURE		d. DATE SIGNED (YYYYMMDD)	
b. WORST CASE	\$444,426						
c. MOST LIKELY	\$444,426	\$444,426	\$0				

8. PERFORMANCE DATA																
ITEM (1)	CURRENT PERIOD						CUMULATIVE TO DATE					REPROGRAMMING ADJUSTMENTS		AT COMPLETION		
	BUDGETED COST		ACTUAL COST WORK PERFORMED (4)	VARIANCE		BUDGETED COST		ACTUAL COST WORK PERFORMED (9)	VARIANCE		COST VARIANCE (12)	BUDGET (13)	BUDGETED (14)	ESTIMATED (15)	VARIANCE (16)	
	WORK SCHEDULED (2)	WORK PERFORMED (3)		SCHEDULE (5)	COST (6)	WORK SCHEDULED (7)	WORK PERFORMED (8)		SCHEDULE (10)	COST (11)						
a. WORK BREAKDOWN STRUCTURE ELEMENT																
3000 - GRD MSN EQUIP	2	9,263	7,544	7,648	-1,719	-104	128,195	125,357	129,885	-2,838	-4,528		318,858	324,819	-5,961	
3100 - IAT&C	3	1,912	1,777	1,889	-135	-112	28,277	28,062	29,914	-215	-1,852		71,590	75,440	-3,853	
3200 - MCS	3	2,963	2,938	2,892	-30	41	64,625	63,400	66,291	-1,225	-2,891		127,029	129,158	-2,129	
3300 - MCS-B	3	1,956	34	34	-1,932	0	3,093	2,060	1,864	-1,033	196		14,634	14,490	144	
3400 - SURV BACKUP	3	9	9	28	0	-19	1,933	1,929	1,725	-4	204		11,623	11,352	271	
3500 - RGS	3	2,397	2,775	2,772	378	3	29,865	29,504	29,791	-361	-287		90,077	90,621	-544	
Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ		Σ	Σ	Σ	
b. COST OF MONEY		41	34	36	-7	-2	552	540	554	-12	-14		1,534	1,534	0	
c. GENERAL & ADMINISTRATIVE		510	427	447	-83	-20	7,100	6,949	7,129	-151	-180		20,245	21,173	-928	
d. UNDISTRIBUTED BUDGET													924	924	0	
e. SUBTOTAL (Performance Measurement Baseline)		9,871	8,155	8,260	-1,716	-105	146,360	143,253	146,663	-3,107	-3,410		432,424	437,148	-4,724	
f. MANAGEMENT RESERVE													12,002	7,278	4,724	
g. TOTAL		9,871	8,155	8,260	-1,716	-105	146,360	143,253	146,663	-3,107	-3,410		444,426	444,426	0	

9. RECONCILIATION TO CONTRACT BUDGET BASE																
a. VARIANCE ADJUSTMENT																
b. TOTAL CONTRACT VARIANCE																
														444,426	444,426	0

Sample Variance Analysis Report (VAR)

Prgm	CA	BCWS	BCWP	ACWP	CVInd	CV	CV%	CPI	SVInd	SV	SV%	SPI	TPhsd Bdgt	%Spent	%Comp
63641	HCBA006	37,721	37,344	359,790	Red	-322,446	-863.4	0.1	Green	-377	-1	0.99	37,721	953.8	99
63641	HCCT221	172,854	19,203	29,315	Red	-10,112	-52.7	0.66	Red	-153,651	-88.9	0.11	192,018	15.3	10

Variance Analysis Report (VAR)

Program 63641 Cost Account HCBA006 Variance CV -322,446 CAM John B. Good Month End May-01

Variance explanation (Root cause):

Explain the cause of the cost and/or schedule variance. This explanation needs to be more than "the work was more than anticipated" or the "budget was insufficient for the tasks".

A better explanation would be something similar to "the skill expertise available (or needed) to accomplish the task was much higher/more expensive than anticipated when bidding/budgeting" or the "schedule delay is due to late receipt of part number xxx (or drawing xxx for yyyy)"

Impact of problem to task/program:

The schedule will be recovered in approximately two weeks (see corrective action). There is/will be no impact to other tasks or the completions of XXXXXX.

Corrective Action (Recover plan & when):

The schedule variance will be recovered by adding an additional individual for two weeks. There is/will be no impact to other tasks or the completions of XXXXXX.

The additional individual will increase costs by approximately \$4000, but since we are currently underrunning, it is still anticipated that the budget will be met.

Estimate at completion impact:

If a cost variance cannot be recovered, or a schedule variance will have a cost impact, the impact to the EAC should be quantified.

Approvals:

Cost Account Manager:

John B. Good

Date:

20-May-01 Program Office Review by:

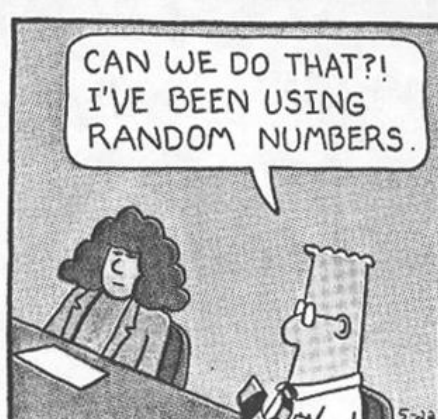
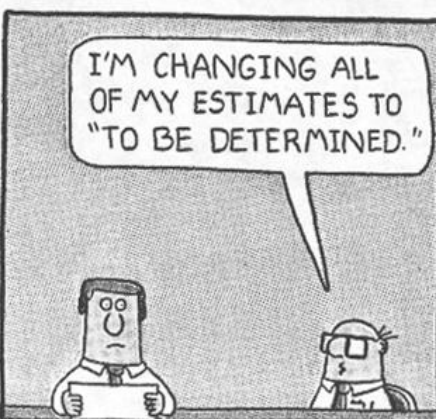
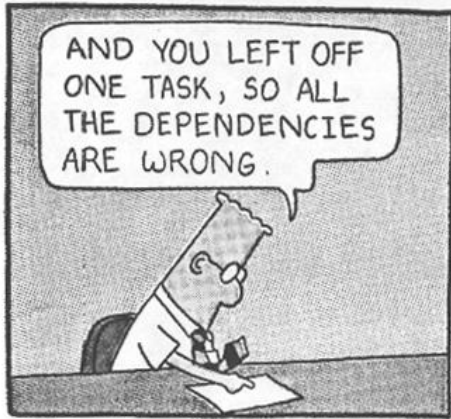
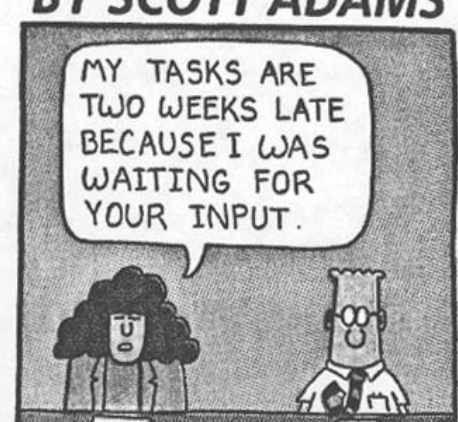
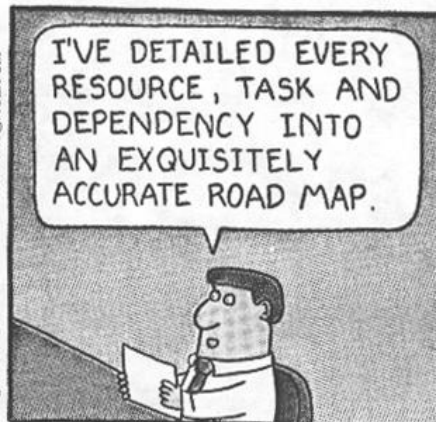
Suzy R. Concerned

Date:

21-May-01

DILBERT

BY SCOTT ADAMS



S. Adams
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5-22

The Cost Performance Trend (CPT)

- ▶ The Cost Performance Trend metric is a simple formula for quickly seeing changes in the cumulative CPI:

$$\text{CPT} = \frac{\text{CPI (now)} + \text{CPI (last month)} + \text{CPI (2 months ago)}}{3} - \frac{\text{CPI (last month)} + \text{CPI (2 months ago)} + \text{CPI (3 months ago)}}{3}$$

- The resulting Metric indicates the change in performance efficiency over the past 4 months of the program
- Looking at changes in the 3 month moving average smoothes out spikes in the data and focuses on true trending

Data Example with the CPT Metric:

- ▶ Adding the CPT to the earlier example gives us this:

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Earned Value (BCWP)	\$1,000	\$1,150	\$1,300	\$1,450	\$1,600	\$1,700
Actual Costs (ACWP)	\$901	\$1,045	\$1,204	\$1,394	\$1,584	\$1,735
CPI (BCWP / ACWP)	1.11	1.10	1.08	1.04	1.01	0.98
CPT (3-Month Average Comparison)				-0.02	-0.03	-0.03

- ▶ The CPI became an indicator of a problem in month 6, while the CPT revealed a trend issue in month 4.

IPIC Implementation of the CPT

- ▶ Both the CPI and the CPT will be used to determine a program's cost status for internal reviews
- ▶ Display CPI and CPT for program bottom line summary information
 - ▶ PMs may elect to use CPI/CPT information for individual WBS elements or major summary WBSs at their discretion
- ▶ Both metrics will use a color coding system to communicate status:

CPI Colors	
≥ 1.00	BLUE
< 1.00 and ≥ 0.95	GREEN
< 0.95 and ≥ 0.90	YELLOW
< 0.90	RED

CPT Colors	
$> +.005$	BLUE
$\leq +.005$ and $\geq -.005$	GREEN
$< -.005$ and $\geq -.015$	YELLOW
$< -.015$	RED

We use consistent color-coding metrics for internal reporting

IPIC Implementation Examples

November 04 Add-On CLINs	Cumulative to Date								At Completion				Cost Metrics	
	BCWS	BCWP	ACWP	SV	%	CV	%	% Compl	Budget	LRE	VAC	%	CPI	CPT
A Lower risk - Category A programs														
7281 ALCS E6B Blk 1 Mod Spt FY05 (Opt 1)	7	7	7	0	0%	0	0%	11%	64	64	0	0%	1.00	0.001
Subtotal A Category CLINs	7	7	7	0	0%	0	0%	11%	64	64	0	0%	1.00	0.002
B Higher risk - Category B programs														
7069 ISMP SDD B-Plug & RVA)	13,459	13,477	12,500	18	0%	977	7%	62%	22,113	22,113	0	0%	1.08	0.003
2450 SPP Motor Gen/ Voltage Regulator SDD	479	447	381	-33	-7%	66	15%	28%	1,653	1,653	0	0%	1.17	0.002
2451 SPP Capacitor Qual & Del. FY04/FY05	372	322	195	-49	-13%	127	39%	20%	1,654	1,654	0	0%	1.65	0.006
7258 PT APU Replacement Design & Dev.	1,090	1,123	758	33	3%	365	33%	97%	1,292	992	300	23%	1.48	0.007
7262 AN/GSM 315 Prod (GMATS)	2,885	2,877	2,870	-8	0%	7	0%	95%	3,121	3,121	0	0%	1.00	(0.004)
7263 AN/GSM-315 ATS (GMATS) FY04	1,150	1,156	782	6	1%	374	32%	45%	2,790	2,790	0	0%	1.48	0.006
7298 Fit Ctrl Power Supply TPS Dev/Prod	96	46	33	-50	-52%	13	29%	21%	230	230	0	0%	1.40	0.009
Subtotal B Category CLINs	19,530	19,448	17,519	-82	0%	1,930	10%	59%	32,853	32,553	300	1%	1.11	0.006
N/A Not CPAF - No Award Fee														
2502 ECS Parts Replacement Study	38	38	21	0	0%	17	44%	11%	347	347	0	0%	1.78	0.010
7299 PT APU PRODUCTION	809	756	756	-53	-6%	0	0%	25%	3,081	3,081	0	0%	1.00	0.005
Subtotal N/A CLINs	847	794	777	-53	-6%	17	2%	24%	3,428	3,428	0	0%	1.02	0.011
GS CLINs Total	20,383	20,249	18,303	-134	-1%	1,946	10%	57%	36,345	36,045	300	1%	1.11	0.007

Internal PMR Reporting Example

Internal PMR Reporting Example

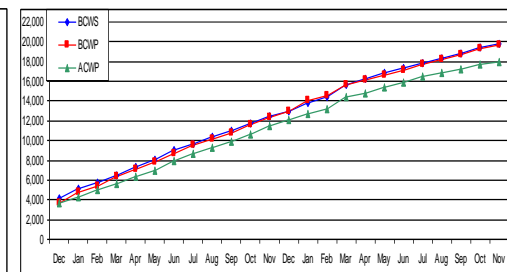
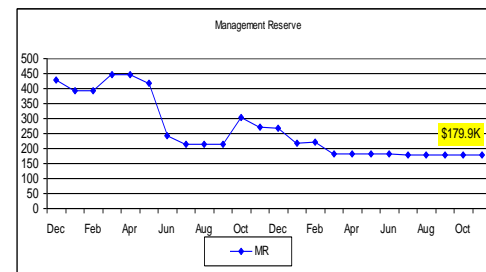
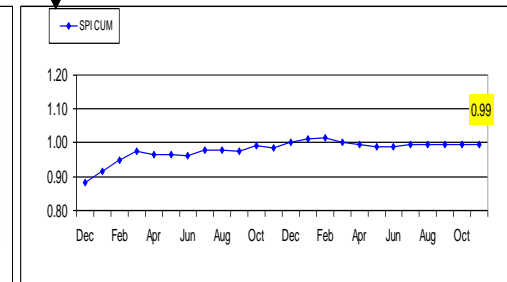
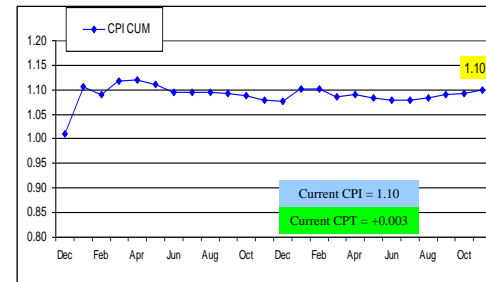
CLIN Performance is Excellent
 CLIN Performance is Satisfactory
 CLIN Performance is of Concern
 CLIN Performance is Unsatisfactory

Award Fee Categories
 Cat. A - Low Risk
 Cat. B - Moderate to High Risk
 N/A - Not Applicable

CPI = Cost Performance Index
 (Current Performance / Current Costs)
 CPT = Cost Performance Trend
 (Change In CPI Trend)

Cost History Example
 For Major Programs
 (In Backup)

Program XYZ	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04
CPI	1.14	1.11	1.11	1.11	1.12	1.11
CPT	0.006	0.005	0.003	-0.010	0.003	0.000



BCWS CUM	BCWP CUM	ACWP CUM	TAB	BAC	EAC
\$19.8M	\$19.7M	\$17.9M	\$22.2M	\$26.1M	\$25.0M
MR	NG	Boeing	Raytheon	Total	
	\$ 179.9	\$ 1,243.0	\$ 93.2	\$ 1,516.1	

Case Study

- ▶ Let's look at real data from an IPIC program to see how the CPT provides valuable data upon which PMs can act...

<i>SERV Test Equipment</i>	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04
Monthly BCWP	158,713	258,305	360,278	288,142	326,389	248,034	285,803	343,204	269,113	358,738	322,494	346,530	466,924	408,188	566,880	657,018	551,587	560,447	594,061	548,288	615,168	627,298	970,318	901,987	942,414	891,079	758,449	802,416	1,071,177	894,260	723,900	561,994
Monthly ACWP	130,430	119,926	262,481	228,806	180,881	218,693	200,953	169,729	228,001	314,415	309,698	453,128	417,921	435,074	580,355	419,462	627,026	578,651	592,530	703,709	461,746	535,580	1,140,351	997,433	1,216,680	1,564,382	1,251,319	1,318,644	1,904,636	1,690,801	2,075,784	1,389,897
Cumulative BCWP	158,713	417,018	777,296	1,065,438	1,391,827	1,639,861	1,925,664	2,298,868	2,537,981	2,896,719	3,219,213	3,565,743	4,032,667	4,440,855	5,007,735	5,664,753	6,216,340	6,776,787	7,370,848	7,919,136	8,534,304	9,161,602	10,131,920	11,033,907	11,976,321	12,867,400	13,625,849	14,428,285	15,499,442	16,393,702	17,117,602	17,679,596
Cumulative ACWP	130,430	250,356	512,837	741,643	922,524	1,141,217	1,342,170	1,511,899	1,739,900	2,054,315	2,364,013	2,817,141	3,235,062	3,670,136	4,250,491	4,669,953	5,296,979	5,875,630	6,468,160	7,171,869	7,633,615	8,169,195	9,309,546	10,306,979	11,523,659	13,088,041	14,339,360	15,659,004	17,562,640	19,253,441	21,329,225	22,719,122
Cumulative CPI	1.22	1.67	1.52	1.44	1.51	1.44	1.43	1.50	1.46	1.41	1.36	1.27	1.25	1.21	1.18	1.21	1.17	1.15	1.14	1.10	1.12	1.12	1.09	1.07	1.04	0.98	0.98	0.92	0.88	0.85	0.80	0.76
3-Mnth Avg CPI			1.47	1.54	1.49	1.46	1.46	1.46	1.46	1.46	1.41	1.35	1.29	1.24	1.21	1.20	1.19	1.18	1.16	1.13	1.12	1.11	1.11	1.09	1.07	1.03	0.99	0.95	0.92	0.89	0.85	0.81
CPT				0.073	-0.052	-0.026	-0.001	-0.006	0.007	-0.008	-0.046	-0.064	-0.051	-0.029	-0.011	-0.012	-0.008	-0.024	-0.023	-0.012	-0.004	-0.006	-0.016	-0.027	-0.036	-0.040	-0.039	-0.034	-0.033	-0.040	-0.036	

<i>TOTAL SERV</i>	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	
Monthly BCWP	1,703,603	2,011,908	2,625,249	2,625,249	3,096,150	3,222,654	3,187,640	3,295,791	2,611,636	3,057,407	2,927,591	3,249,846	3,211,799	3,280,894	3,159,047	3,936,064	3,543,168	3,314,675	3,780,904	4,167,568	4,533,366	3,304,632	3,057,576	4,562,586	4,017,691	4,040,050	4,757,562	3,159,047	3,595,982	5,088,059	3,553,454	3,327,212	3,307,671
Monthly ACWP	1,317,932	1,619,179	2,188,294	2,311,172	2,622,730	2,883,077	2,883,887	2,872,306	2,517,311	2,853,791	2,909,064	3,161,875	3,133,240	3,202,496	3,709,563	3,665,234	3,570,317	3,193,597	3,527,815	4,533,366	2,270,995	3,143,738	4,497,124	4,018,785	4,117,217	5,695,288	3,831,880	4,217,824	5,022,706	4,968,679	4,900,363	4,466,256	
Cumulative BCWP	1,703,603	3,715,511	6,340,760	8,966,009	12,062,159	15,284,813	18,472,453	21,768,244	24,379,880	27,437,287	30,364,878	33,614,724	36,826,523	40,107,417	43,266,464	47,202,528	50,745,696	54,060,371	57,841,275	62,008,843	65,313,475	68,371,051	72,933,637	76,951,328	80,991,378	85,748,940	88,907,987	92,503,969	97,592,028	101,145,482	104,472,694	107,780,365	
Cumulative ACWP	1,317,932	2,937,111	5,125,405	7,436,577	10,059,307	12,942,384	15,826,271	18,698,577	21,215,888	24,069,679	26,978,743	30,140,618	33,273,858	36,476,354	40,185,917	43,851,151	47,421,468	50,615,065	54,142,880	58,676,246	60,947,241	64,080,979	68,588,103	72,606,889	76,724,105	82,419,393	86,251,273	90,469,097	95,491,803	100,460,482	105,360,845	109,827,101	
Cumulative CPI	1.29	1.27	1.24	1.21	1.20	1.18	1.17	1.16	1.15	1.14	1.13	1.12	1.11	1.10	1.08	1.08	1.07	1.07	1.07	1.06	1.07	1.07	1.06	1.06	1.06	1.04	1.03	1.02	1.02	1.01	0.99	0.98	
3-Mnth Avg CPI			1.26	1.24	1.21	1.20	1.18	1.17	1.16	1.15	1.14	1.13	1.12	1.11	1.11	1.09	1.08	1.07	1.07	1.07	1.06	1.07	1.07	1.06	1.06	1.05	1.04	1.03	1.03	1.02	1.01	0.99	
CPT				-0.029	-0.022	-0.019	-0.013	-0.012	-0.011	-0.009	-0.013	-0.011	-0.011	-0.009	-0.013	-0.010	-0.010	-0.003	-0.003	-0.004	0.001	-0.001	0.002	-0.004	-0.004	-0.008	-0.010	-0.011	-0.006	-0.008	-0.010	-0.014	



Recommended 1st Stops for EVM Info:

1. PMI Earned Value Management Community of Practice
<http://www.pmi-cpm.org>
2. Department of Defense Earned Value Management Website
<http://www.acq.osd.mil/pm/>
3. Dr. David Christensen's (SUU!!!) Earned Value Bibliography
<http://www.suu.edu/faculty/ChristensenD/EV-bib.html>
4. AACE Web Site
<http://www.aacei.org>

EVP – Earned Value Professional

▶ **EVP Exam Structure**

The EVP examination consists of four parts (1 hour 45 min each).

- ▶ *Part I is Planning. It consists of multiple-choice questions concerning general earned value concepts, organization, planning, scheduling and budgeting.*
- ▶ *Part II is an Earned Value Professional Communications Memorandum. It requires the candidate to write the equivalent of a one-page typewritten memorandum, to a project manager, on a given project situation. The memorandum must explain the issues and propose a solution regarding a given problem on a project.*
- ▶ *Part III is applied Earned Value Applied. This part entails answering a series of complex applications.*
- ▶ *Part IV is Monitoring and Control. It consists of multiple-choice questions involving accounting, analysis and reporting.*

▶ **Recommended Text to Study for EVP Certification:**

Most recommended texts, available in AACE [Online Store](#):

Earned Value Professional Certification Study Guide

- ▶ *Skills and Knowledge of Cost Engineering*, 5th edition (4th if you already have it)
- ▶ **Additional Reference Material, The ANSI 748-B Standard:** [ANSI Website](#)
- ▶ [NDIA Website](#)
- ▶ DOD Earned Value Management Website
Sponsored by the Office of the Under Secretary of Defense (Acquisition, Technology & Logistics)
 - ▶ [Main Web site](#)
 - ▶ [List of formulas and terms](#)

EVM included in Ch9 of TCM Framework

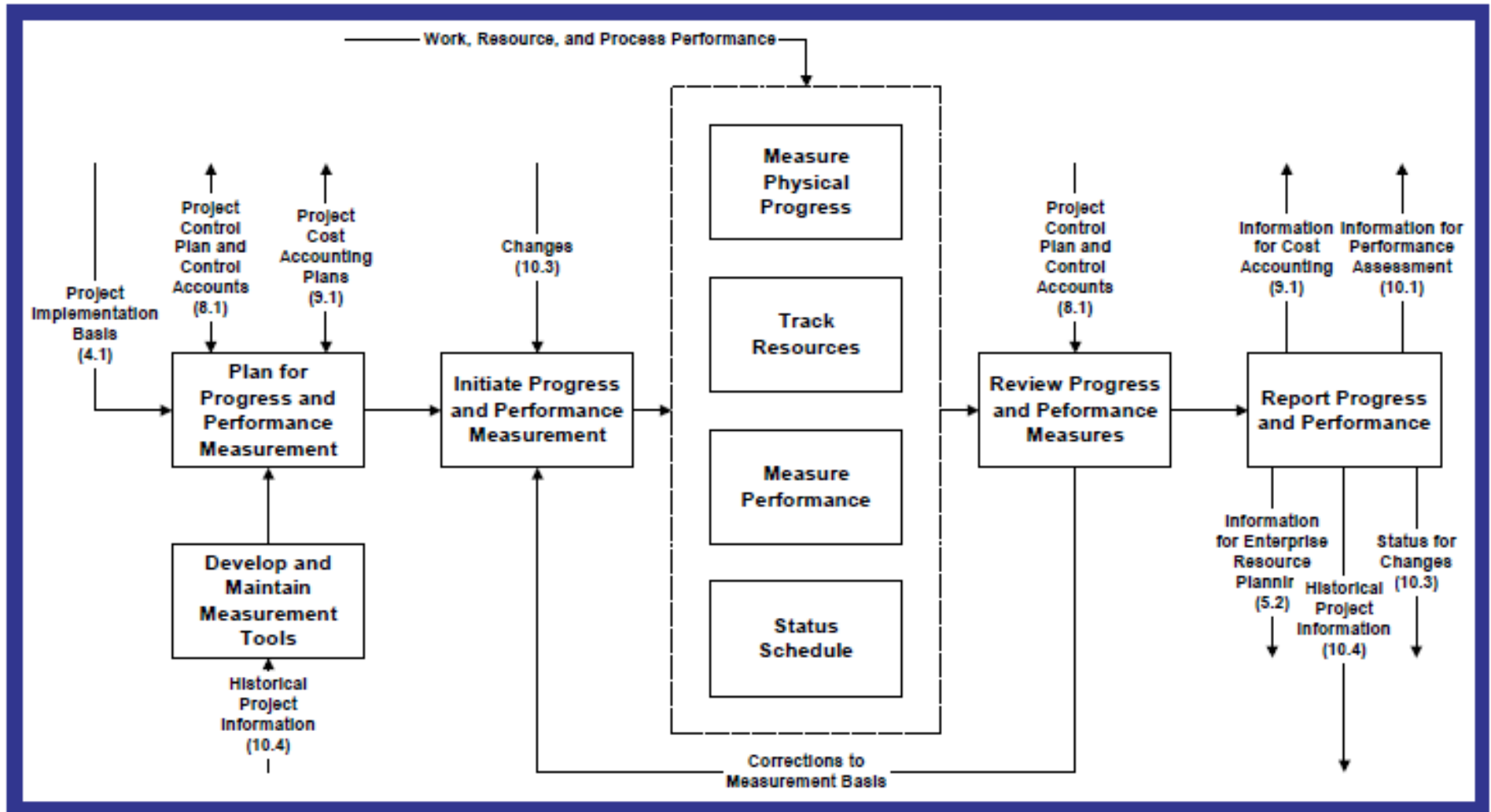


Figure 2—The TCM Process Map for Project Performance Measurement