


Project Management Institute Washington, DC Chapter



Earned Value Management Systems (EVMS)

Basic Concepts



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“It must be remembered that there is nothing more difficult to plan, more doubtful of success, more dangerous to manage, than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of the old institutions and merely lukewarm defenders in those who would gain by the new ones.

— Niccolo Machiavelli



EVMS Objectives

- ⊕ Plan all work prior to beginning it;
- ⊕ Measure performance based on an objective set of technical criteria;
- ⊕ Analyze schedule status and projections using a time phased CPM network;
- ⊕ Analyze the expenditure of funds in light of the work accomplished (not work scheduled);

EVMS Objectives [continued]

- ⊕ Isolate problems:
 - ⊕ Quantify technical problems within the context of cost and schedule parameters;
 - ⊕ Not aimed at replacing or changing the process for technical problem detection;
- ⊕ Forecast completion date and final cost;
- ⊕ Take corrective action;
- ⊕ Maintain disciplined control of the performance measurement baseline.

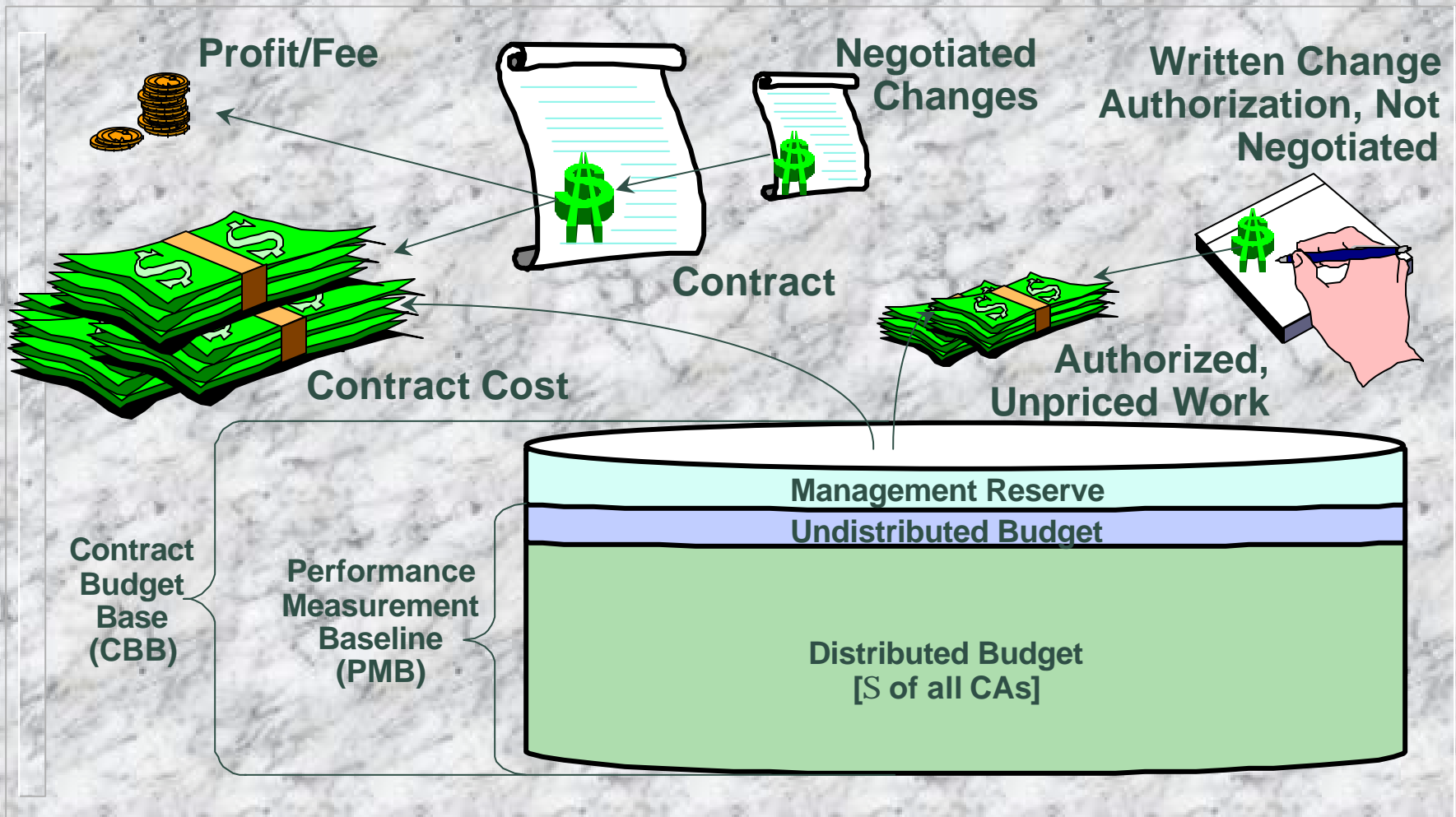
Earned Value Management: How Did It Come About?

- ✦ 1959 PERT and PERT/Cost
 - Milestone Charts And Rate-of Expenditure Curves
 - Dollars Spent Vs Estimates Of Percent Complete (DD 1097)
- ✦ 1963 Earned Value Concept (MINUTEMAN)
- ✦ 1964 Cost Accomplishment-Concept (TITAN III)
- ✦ 1966 AF—Cost/schedule Planning And Control Specification (C/SPCS)
- ✦ 1967 DOD—Cost/Schedule Control Systems Criteria (C/SCSC) (DODI 7000.2)
- ✦ 1972 DOD—Revised DODI 7000.2 and Issued the Joint Implementation Guide (JIG)
- ✦ 1972 NASA Marshall Space Flight Center—C/SPC
- ✦ 1975 DOE—Performance Measurement System (PMS)
- ✦ 1976 DOD—Revised the C/SCSC JIG
- ✦ 1980 DOD—Revised the C/SCSC JIG
- ✦ 1982 National Security Agency—Earned Value
- ✦ 1983 NASA—Goddard Space Flight Center—PMS
- ✦ 1984 FAA & NASA Lewis Research Center—PMS
- ✦ 1985 NASA Johnson Space Flight Center—PMS
- ✦ 1987 DOD—Revised DOD C/SCSC JIG
- ✦ 1988 NASA Marshall SFC—Revised PMS (MMI 8020.7C, 44 Criteria)
- ✦ 1989 Australian DOD—DODI 7000.2
- ✦ 1990 Canadian DOD—PMS
- ✦ 1991 DODI 5000.2 replaces DODI 7000.2
- ✦ 1992 National Oceanic And Atmospheric Administration (NOAA)—PMS
- ✦ 1993 Swedish FMV—C/SCSC
- ✦ 1994 Internal Revenue Service (IRS)—C/SCSC
- ✦ 1994 Federal Bureau Of Investigation (FBI)—C/SCSC
- ✦ 1996 DODR 5000.2-R replaces DODI 5000.2 C/SCSC revised from 35 to 32 criteria
- ✦ 1996 Revised JIG—Renamed Earned Value Management Implementation Guide (EVMIG)
- ✦ 1997 EVMIG Revised
- ✦ 1998 MIL-STD 881B replaced by MIL HDBK 881

The Eight Subsystems of EVMS

- ⊕ Organization
- ⊕ Scheduling
- ⊕ Budgeting
- ⊕ Work Authorization
- ⊕ Data Accumulation and Reporting
- ⊕ Variance Analysis
- ⊕ Estimate At Completion
- ⊕ Baseline Maintenance and Control

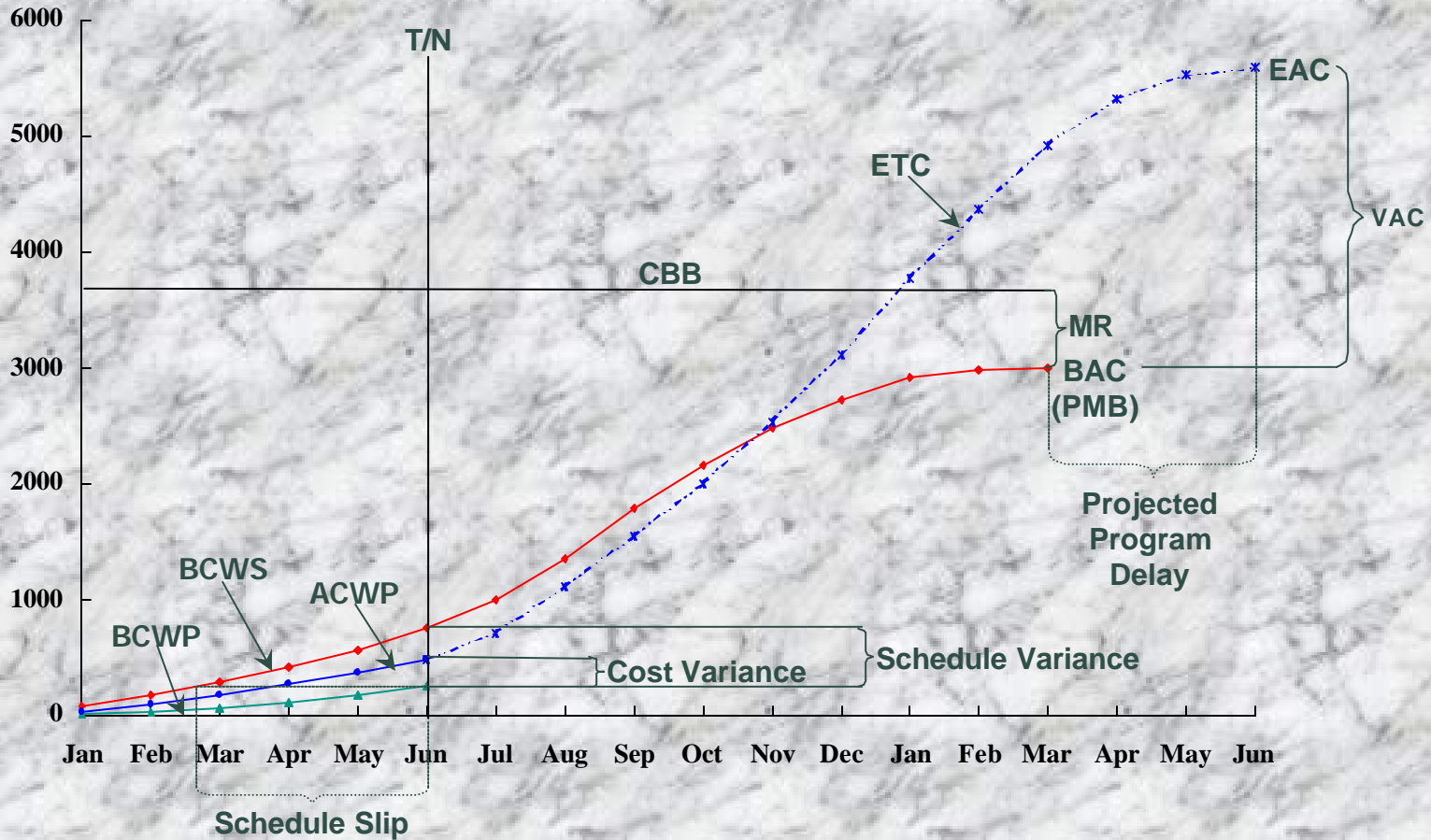
Budget Structure



Earned Value Terminology

<i>Data Element</i>	<i>Term</i>	<i>Acronym</i>
Scheduled Work	Budgeted Cost for Work Scheduled	BCWS
Earned Value	Budgeted Cost for Work Performed	BCWP
Actuals	Actual Cost of Work Performed	ACWP
Authorized Work	Budget At Completion	BAC
Forecasted Cost	Estimate At Completion	EAC
Work Variance	Schedule Variance	SV
Cost Variance	Cost Variance	CV
Completion Variance	Variance At Completion	VAC

Earned Value Data Elements



Where Are We Going?

*"Cheshire-Puss," she began, rather timidly,
"Would you tell me, please, which way I ought
to go from here?"*

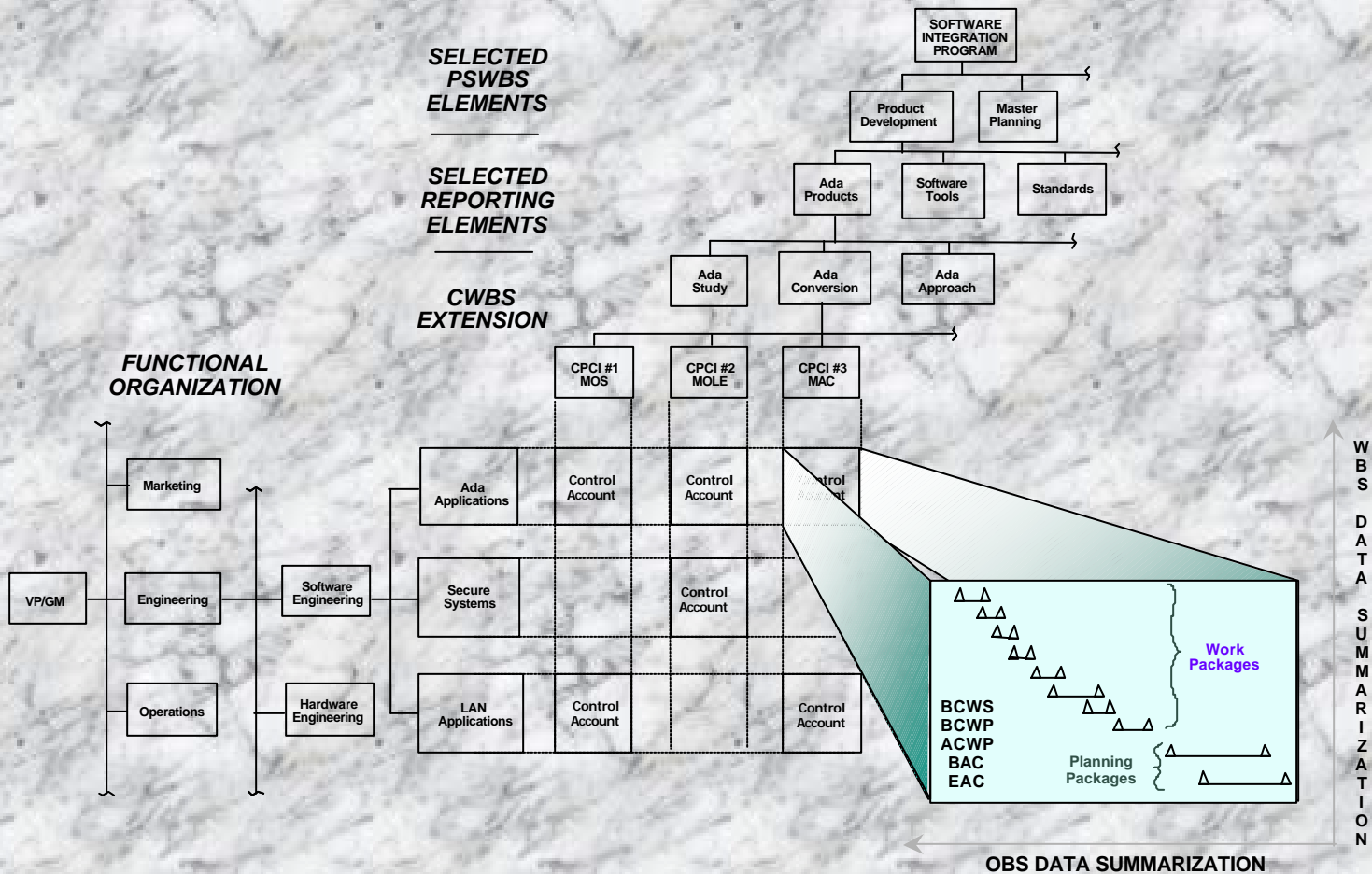
*"That depends a great deal on where you want
to get to," said the cat.*

"I don't much care where -," said Alice.

*"Then it doesn't matter which way you go,"
said the cat.*

**- Lewis Carroll
Alice in Wonderland**

CWBS/OBS Integration



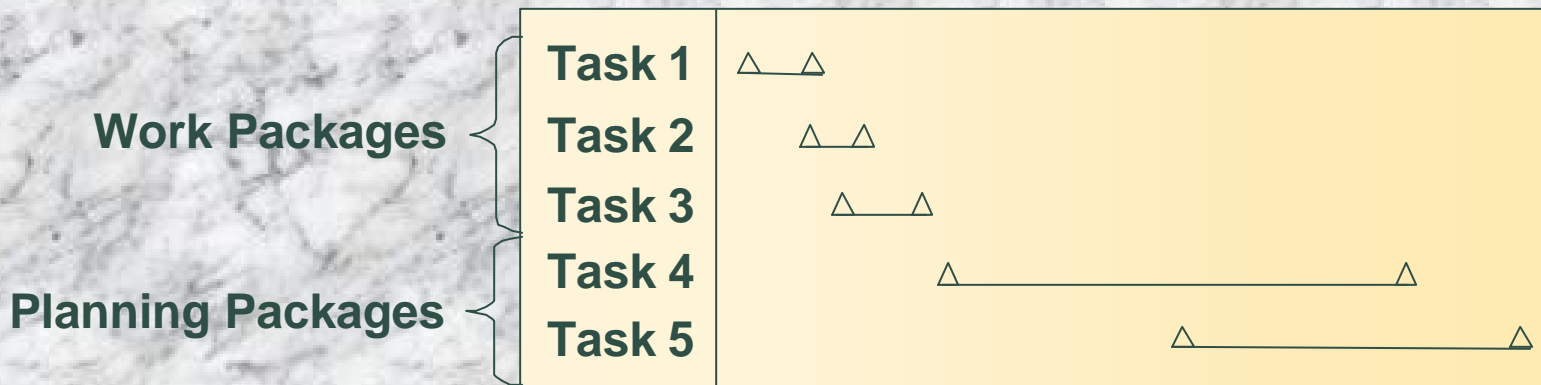
Control Account Elements

Work Packages

Detailed, short-span tasks, or material items, required to accomplish the CA objectives, typically in the near term

Planning Packages

Future work that has not been detail planned as work packages. They are always scheduled to occur in the future.



Earned Value Techniques

A ***predetermined*** amount of *value*, i.e., budget, that is claimed, or *earned*, when the corresponding work is accomplished. The budget value is earned in one of the following ways:

- ☑ 0/100
- ☑ X/Y Percent
 - ⊕ 25/75
 - ⊕ 40/60
 - ⊕ 50/50
- ☑ Milestone Weights
- ☑ Milestone Weights with Percent Complete
- ☑ % Complete
 - ⊕ Subjective Estimate
 - ⊕ Objective Indicators
- ☑ Apportioned Effort
- ☑ Level of Effort



Budgets v. Funds



BCWS v. ETC

⊕ Budgeted Cost for Work Scheduled (BCWS)

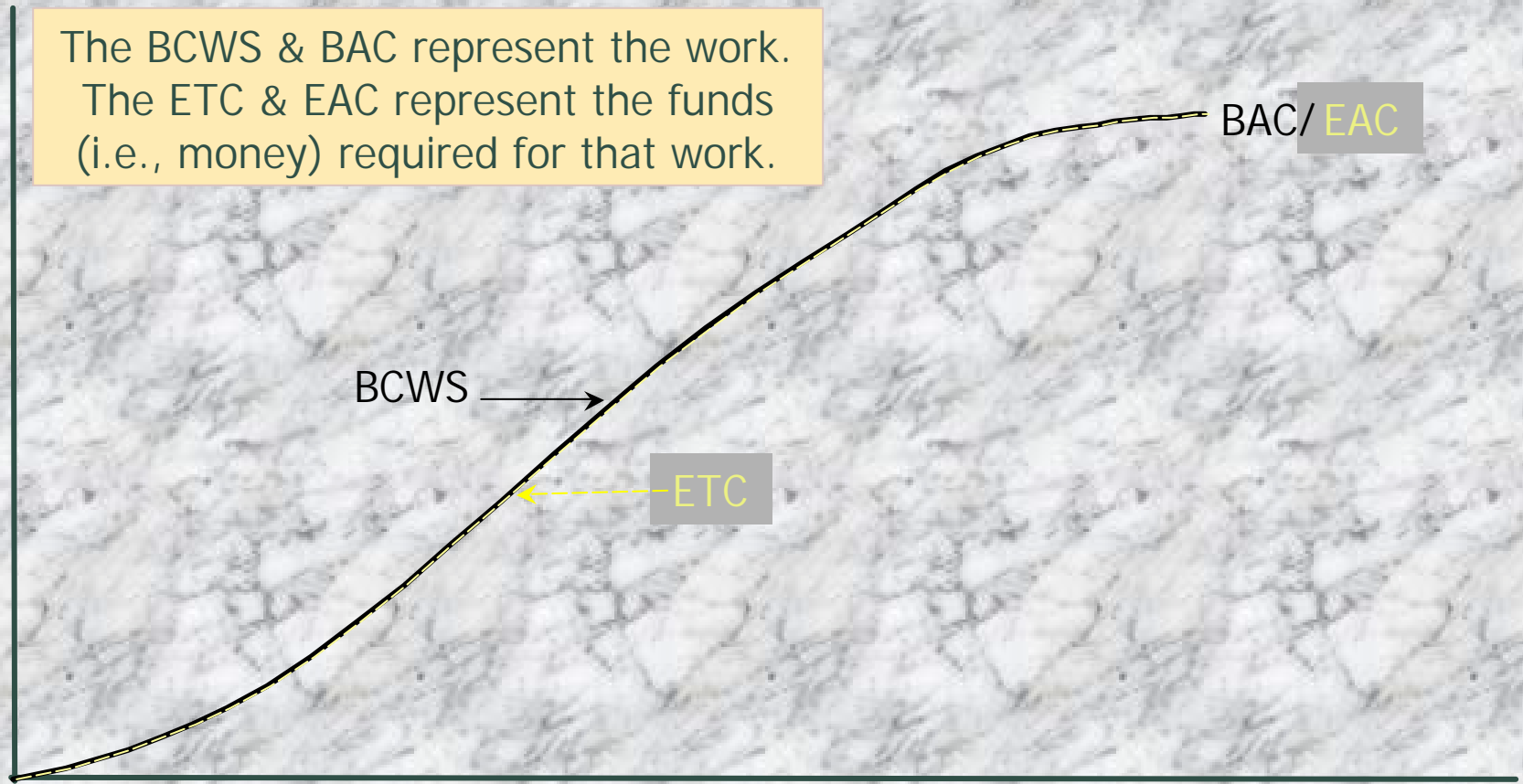
- ⊕ Time phased budget spread of required resources for the entire task.
- ⊕ Forms the Performance Measurement Baseline (PMB).

⊕ Estimate To Complete (ETC)

- ⊕ Funding required to complete remaining work.
- ⊕ When added to ACWP, it results in the EAC.

The Plan (BCWS) and the ETC

The BCWS & BAC represent the work.
The ETC & EAC represent the funds
(i.e., money) required for that work.



BAC v. EAC

⊕ Budget At Completion (BAC)

- ⊕ Budgetary number representing ALL authorized work (i.e., the SOW).
- ⊕ **Cannot** change without a change to the SOW, or appropriate approval.

⊕ Estimate At Completion (EAC)

- ⊕ Funding number representing ALL the money that will be spent.
- ⊕ **Can** change without a commensurate change to the SOW.

Budget v. Funds

Budget	Funds
<ul style="list-style-type: none">✓ A number written on a piece of paper✓ Cannot be spent✓ BCWS✓ BCWP✓ BAC	<ul style="list-style-type: none">✓ Actuals✓ Expenditures & estimates of future spending✓ ETC✓ ACWP✓ EAC

Data Analysis Relationships

Term	Symbol	Formula	Checklist Actions
Percent Complete	% Done	$\frac{BCWP}{BAC}$	Ratio of work accomplished in terms of the total amount of work to do.
Cost Performance Index or Performance Factor	CPI or PF	$\frac{BCWP}{ACWP}$	Ratio of work accomplished against money spent (an efficiency rating: Work Done for Resources Expended)
To Complete Performance Index or Verification Factor	TCPI or VF	$\frac{BAC - BCWP}{EAC - ACWP}$	Ratio of work remaining against money remaining (Efficiency which must be achieved to complete the remaining work with the expected remaining money)
Schedule Performance Index	SPI	$\frac{BCWP}{BCWS}$	Ratio of work accomplished against what should have been done (Efficiency Rating: Work done as compared to what should have been done)
Schedule Correlation	SC or S/C	$\frac{\bar{P}_{CUM}}{SV}$	Ratio of Schedule Variance (SV) in terms of average amount of work accomplished (in weeks or months). It indicates a correlation to program true schedule condition
Independent Estimate At Completion	IEAC	1) $\frac{BAC}{PF}$ 2) $ACWP + \frac{BAC - BCWP}{.8CPI + .2SPI}$	Calculation of a projected Estimate At Completion to compare with the CAM's Estimate At Completion: 1) Ration of total work to be done against experienced cost efficiency 2) Sunk costs added to a ratio of remaining work against weighted cost and schedule efficiencies
Average Performance	\bar{P}_{CUM}	$\frac{BCWP_{cum}}{\text{Duration (wks or mos) Since ACWP Began}}$	Average rate at which work has been accomplished since work began
Average Expected Performance To Finish	$\bar{P}_{TO GO}$	$\frac{BCWP_{cum}}{\text{Duration (wks or mos) From Time Now to Manager's Stated Completion Date}}$	Average rate at which work must be accomplished in the future to finish on the date the CAM has forecasted for completion of the work.

Benefits of EVMS

- ⊕ Clear definition of work prior to beginning that work
 - ⊕ Helps the line manager credibly request appropriate resources
 - ⊕ Provides the basis for a realistic plan against which to measure performance

Benefits of EVMS [continued]

⊕ Objective measurement of work accomplishment

- ⊕ Helps the line manager develop plans that are rooted in reality
 - ✧ If the task can be done within scope, schedule, budget; confidence in a successful outcome is increased
 - ✧ If the task cannot be done within scope, schedule, budget; that problem can be defined and resolved at a time when the resolution will be reasonably inexpensive

Benefits of EVMS [continued]

⊕ Objective measurement of work accomplishment [continued]

- ⊕ Assists the line manager to request needed help
- ⊕ Assists program and functional management to identify areas requiring additional management attention

⊕ Provides true cost condition

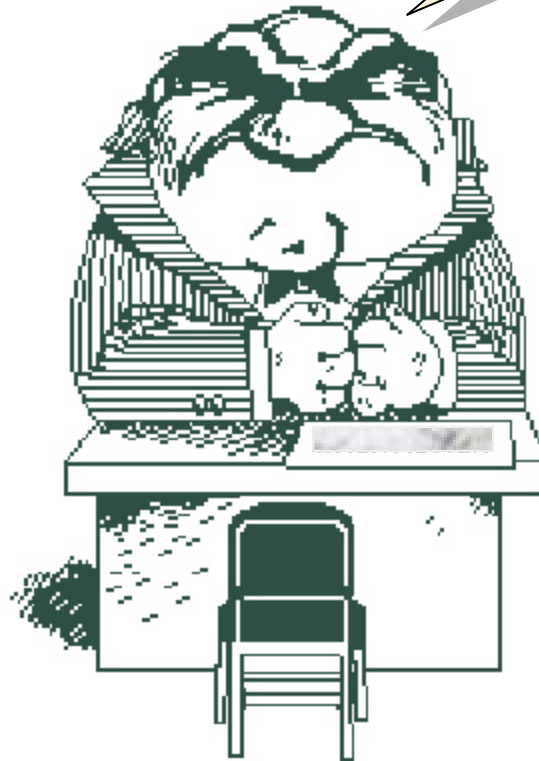
- ⊕ Side-steps false cost variances
- ⊕ Encourages realistic projections of final cost
- ⊕ Enhances accuracy of funding forecasts

Benefits of EVMS [continued]

- ⊕ Reduces propensity of customer/boss to add work without adding budget
 - ⊕ Ties budget directly to work
 - ⊕ Requires all work transfers to include associated budget
 - ⊕ Requires all budget transfers to include associated work
- ⊕ Fosters management decisions within a framework of reality, rather than latent unease

Summary/Wrap-up

Any Questions?



EVMS Resources

⊕ Books

- ☑ *Earned Value*
Quentin W. Fleming & Joel M. Koppleman
- ☑ *Cost/Schedule Control Systems Criteria*
Quentin W. Fleming
- ☑ *Project Performance Measurement*
Robert R. Kemps
- ☑ *Visualizing Project Management*
Kevin Forsberg, Ph.D., Hal Mooz and Howard Cotterman

⊕ Software

- ☑ *Artemis Views*
Artemis Management Systems
Contact: Patrick Perugini (303) 581-3102
Web: <http://www.artemisp.com>
- ☑ *Cobra*
Welcom Software
Contact: Diana Melton (281) 558-0514
Web: <http://www.wst.com>

⊕ Software [continued]

- ☑ *Dekker TRAKKER*
Dekker Ltd.
Contact: Ron Barry (909) 384-9000
Web: <http://www.dtrakker.com>
- ☑ *MicroFrame Project Manager (MPM)*
MicroFrame Technologies, Inc.
Contact: Carl Amacker (415) 616-4000
Web: <http://www.microframe.com>

⊕ Internet

- ☑ Project Management Institute
<http://www.pmi.org>
- ☑ US DoD Earned Value
<http://www.acq.osd.mil/pm>
- ☑ Earned Value Bibliography
<http://www.uwf.edu/~dchriste/ev-bib.html>
- ☑ Amazon.com
<http://www.amazon.com>

