Earned Value Management

Presentation Courtesy of: US Dept of Defense, KM Systems Group, BAE Systems, Inc., and Abba Consulting, Inc.

EARNED VALUE

- Earned Value Background and History
- Earned Value Management Systems
- Earned Value Analysis

EARNED VALUE MANAGEMENT SYSTEM

IS NOT:

A software product,
or
Something you can buy.

IS:

A collection of management practices.
A structured method to:

- **Establish a Performance Measurement Baseline**
- **Measure and analyze performance**

Scalable to all sizes of projects.

Earned Value Management: Origins

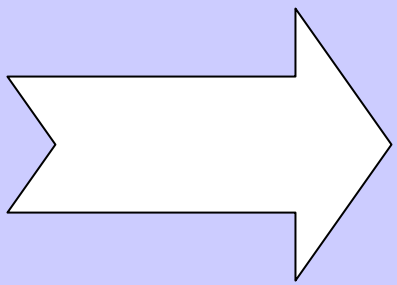
1960s

- Complex Defense Programs
- Multiple Customers
- Need for Improved Management

- Solution – PERT and PERT COST
- 10 versions by 1964
- Industry "How to Manage"

Industry Best Practices

Government Requirements



1967: DoD Instruction 7000.2

Cost/Schedule Control Systems Criteria (C/SCSC)

Criterion-based Management

- Brief Statements of Attributes
- Not "How-To"
- Not a System
- Minimum Acceptable Standard

1997: DoD Regulation 5000.2-R

Earned Value Management Systems (EVMS)

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EVM History

- In mid-1990s, OMB search for best practices in US Government led to The Pentagon
  - Department of Defense cooperative relationship with industry
  - Integrated Product Teams
  - Integrated Baseline Reviews
  - Reporting processes
- Worked with OSD to write guidance for all federal agencies in OMB Circular A-11 Part 3 and Capital Programming Guide

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EVM Evolution

- Key events in transformation from C/S to EVM
  - 1991 – Termination of Navy A-12 Avenger II
  - 1993-94 – OSD Acq. Reform Office; C&L/TASC study
  - 1994 – Integrated Baseline Review Policy issued
  - 1996 – OMB adopts EVM “or similar” for all agencies
  - 1997 – General Accounting Office issues positive report
  - 1998 – ANSI/EIA 748-98 issued; DoD adopts in 1999
  - 2003 – ANSI standard reaffirmed; OMB adopts

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EARNED VALUE MANAGEMENT SYSTEM

Project Management Practices Addressing 32 Criteria:

- **Organization (of the project)**
  5 criteria
- **Planning, Scheduling, & Budgeting**
  10 criteria
- **Accounting Considerations**
  6 criteria
- **Analysis and Management Reports**
  6 criteria
- **Revisions and Data Maintenance**
  5 criteria

EARNED VALUE MANAGEMENT SYSTEM

➢Organization (of the project)

- ✓ Define the authorized work elements.
- ✓ Provide for integration of organization's PPBES structure
- ✓ Provide for integration of WBS and organizational structure.

Note: The information listed here is only a sampling of the criteria listed in the ANSI-EIA 748A. For complete listing of the criteria, refer to the NDIA ANSI-EIA 748A Intent Guide.

EARNED VALUE MANAGEMENT SYSTEM

➢Planning, Scheduling, and Budgeting

- ✓ Identify sequencing and interdependencies of tasks.
- ✓ Describe work in discrete work packages (WBS).
  - ❖Budget
  - ❖Schedule
  - ❖Deliverables
- ✓ Ensure work packages flow up to over-all budget

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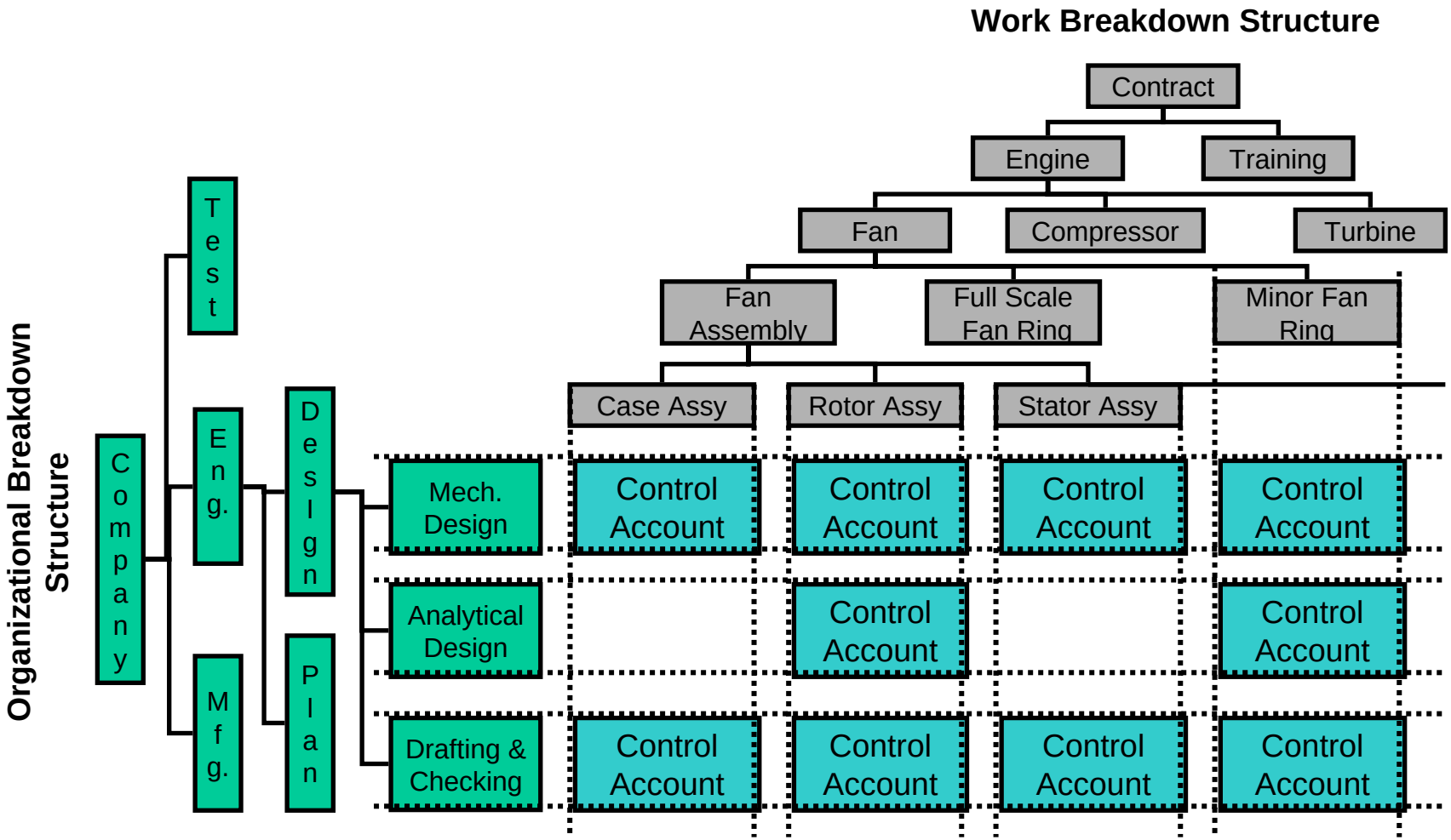
RESPONSIBILITY ASSIGNMENT MATRIX



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EARNED VALUE MANAGEMENT SYSTEM

➢ Accounting Considerations

- ✓ Cost performance measurement at a suitable time
- ✓ Recognized, acceptable costing techniques
  - ? Obligation
  - ? Accrual
  - ? Invoice
- ✓ Rational identification and accountability of all costs

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EARNED VALUE MANAGEMENT SYSTEM

➢ Analysis & Management Reports

- ✓ Generate reports at least monthly
  - ❖ Schedule Variance
  - ❖ Cost Variance
- ✓ Implement managerial actions as appropriate
- ✓ Develop revised estimates

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EARNED VALUE MANAGEMENT SYSTEM

➢ Revisions and Data Maintenance

- ✓ Reconcile budget changes to authorized scope changes
- ✓ Incorporate authorized changes in a timely fashion
- ✓ Control retroactive changes

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EARNED VALUE ANALYSIS

☹ **Provides an integrated performance report.**

☹ **Relates Directly to the WBS**

- **Planned WBS $ = Planned Value**
- **No WBS = No planning = No Planned Value**
- **Applicable to projects of any size.**

☹ **Relies on three key data points:**

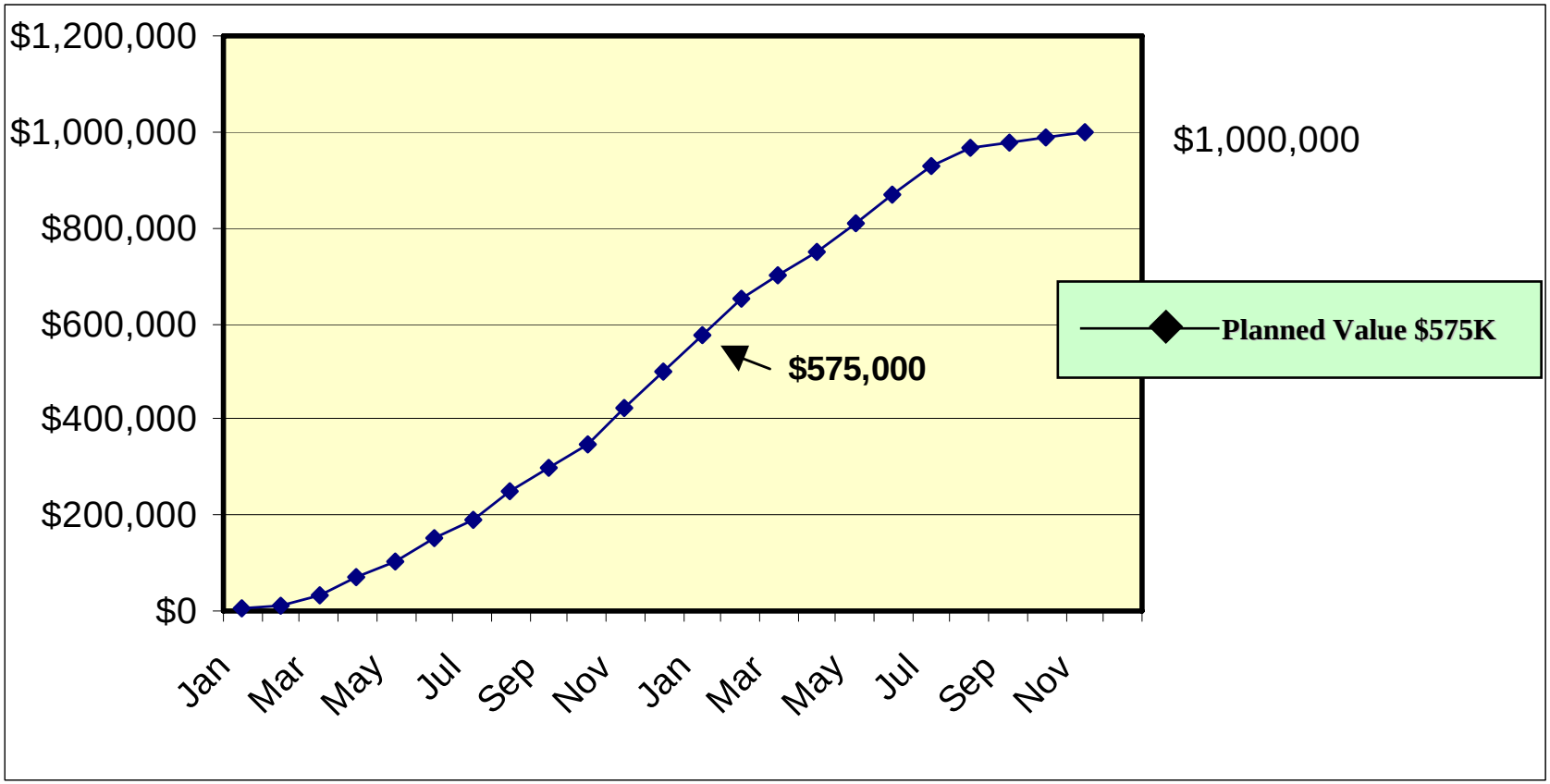
- **Planned Value**
- **Actual Cost**
- **Earned Value**

PLANNED VALUE

- **How much do you expect to have done at completion ?**
  Budget at Completion (BAC)

- **How much should you have done at point X ?**
  (PV) or Budgeted Cost of Work Scheduled (BCWS)

PLANNED VALUE

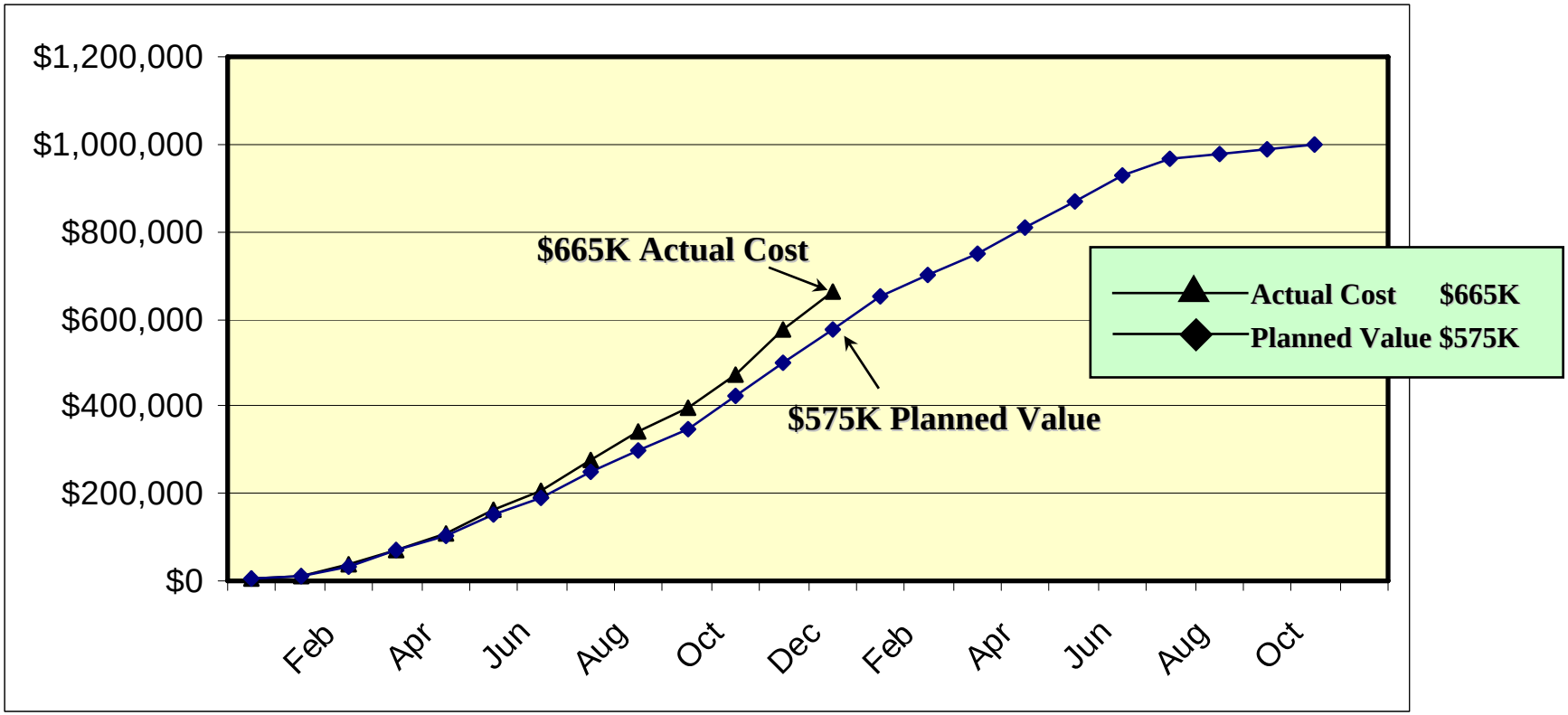


ACTUAL COST

- **The dollar amount actually spent to date.**
  (AC) or Actual Cost of Work Performed (ACWP)

- **Has no relationship to work accomplished.**

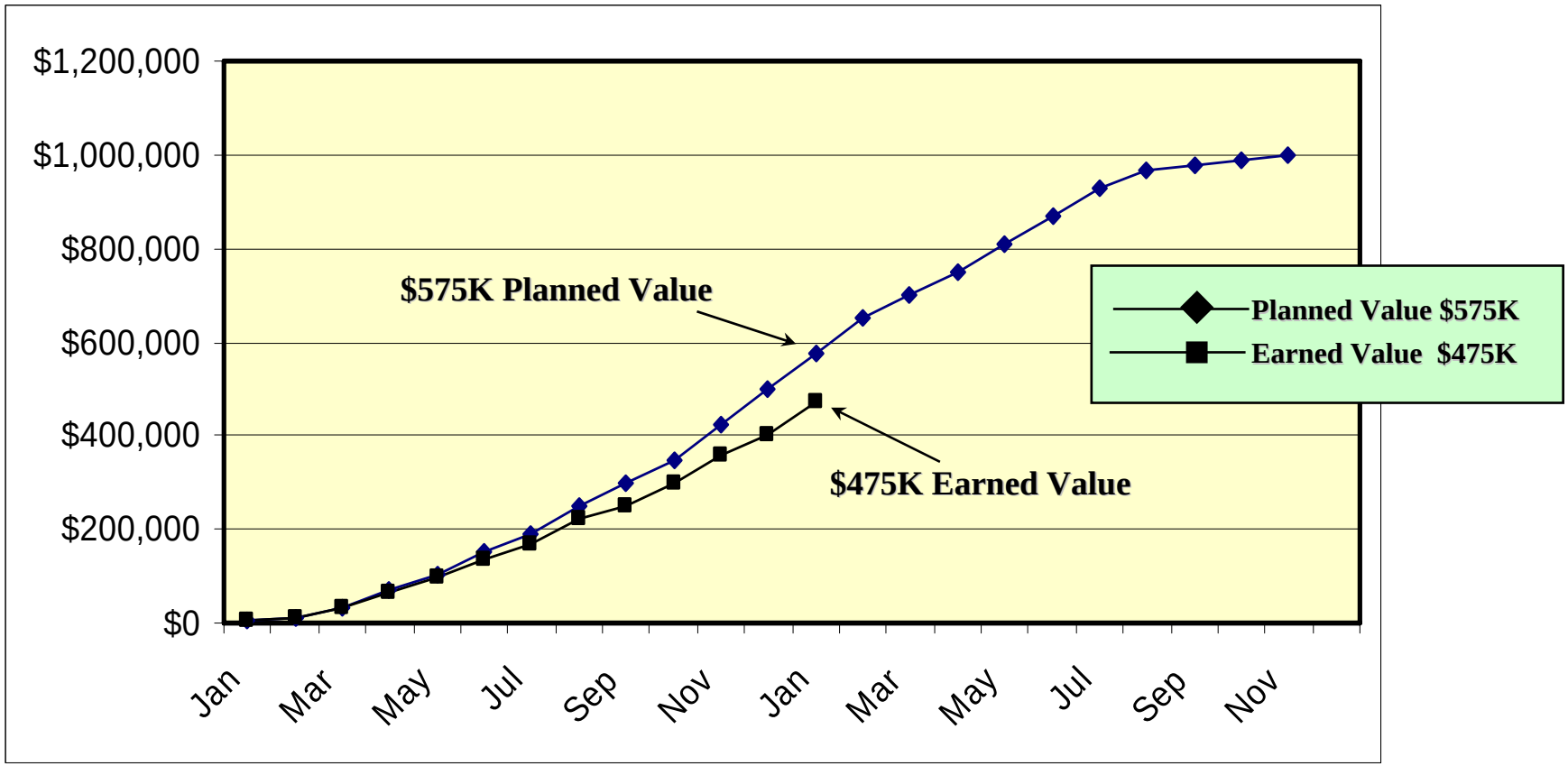
ACTUAL COST


$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
Feb
Apr
Jun
Aug
Oct
Dec
Feb
Apr
Jun
Aug
Oct
$665K Actual Cost
$575K Planned Value
Actual Cost $665K
Planned Value $575K

EARNED VALUE

- **How much have you actually gotten done as of <u>Today</u> ?**
  (EV) or Budgeted Cost of Work Performed (BCWP)
- **Work accomplished, not money spent.**
- **EV is the basis for Variances and Performance Indices**
  - ✓ **Cost Variance & CPI**
  - ✓ **Schedule Variance & SPI**
- **Everything starts with EV (or BCWP)**

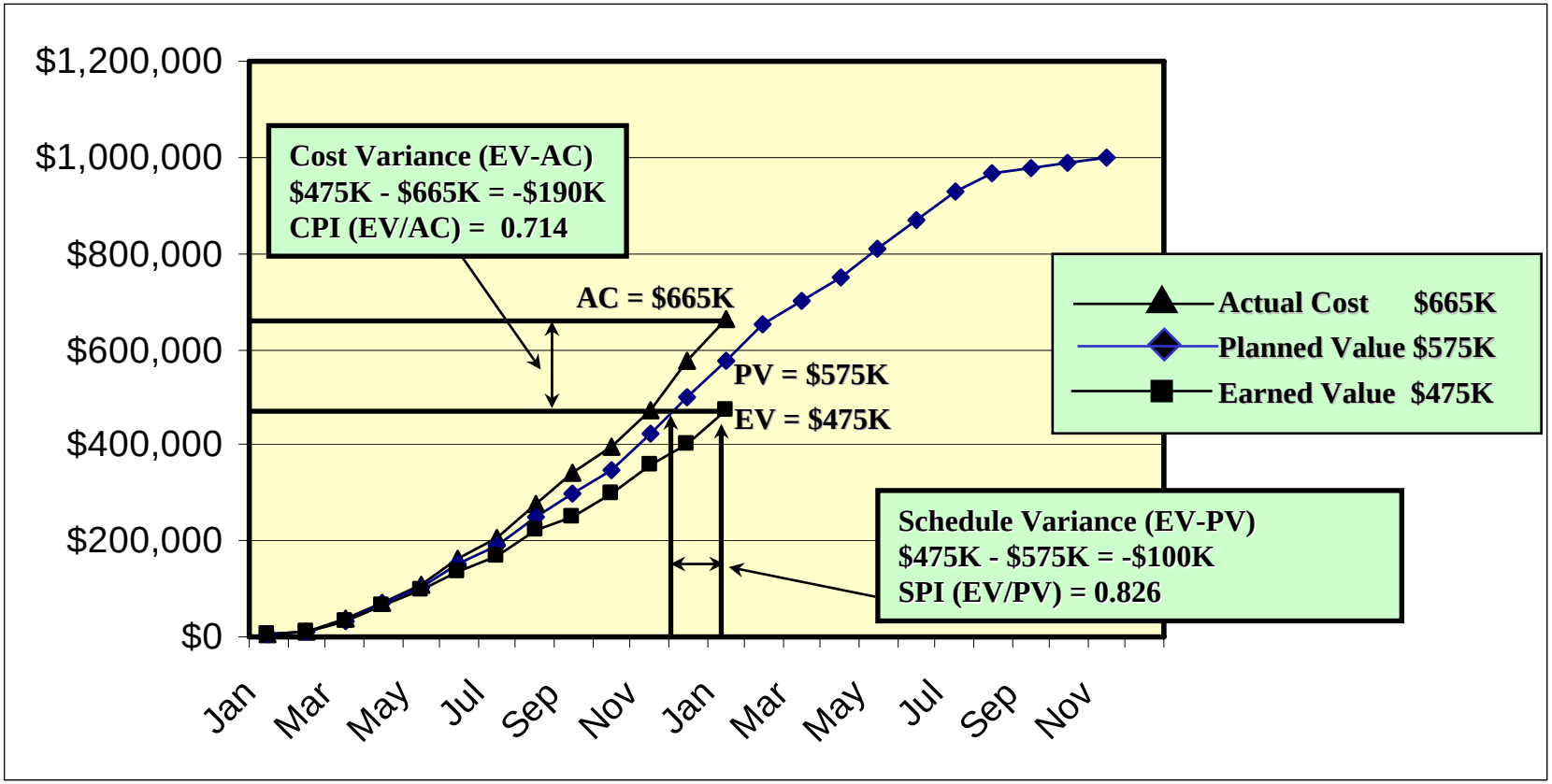
EARNED VALUE



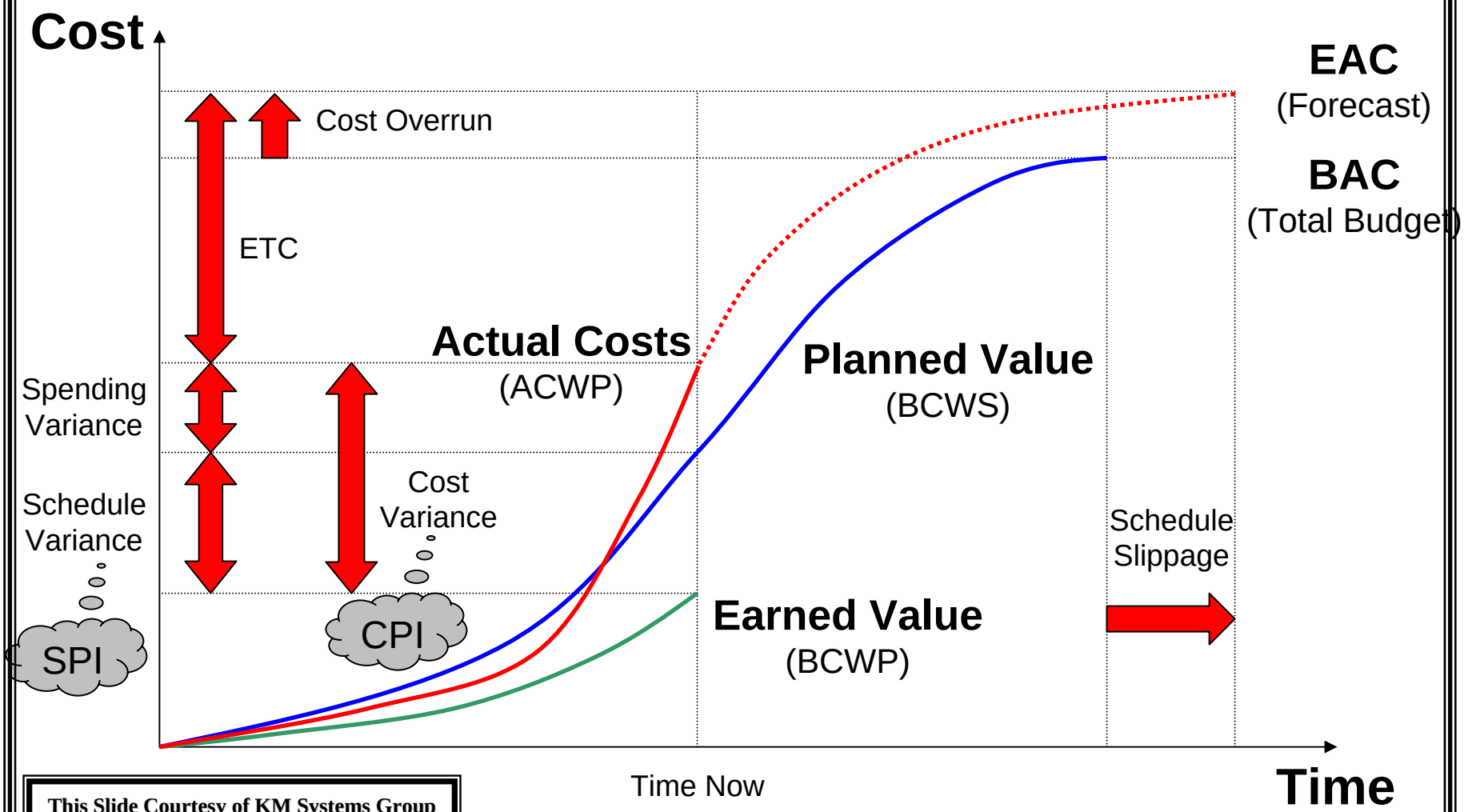
EARNED VALUE

- **Several ways to "Earn" value:**
  - ✓ **% Complete**
  - ✓ **50/50 Rule**
  - ✓ **20/80 Rule**
  - ✓ **0/100 Rule**

CALCULATING VARIANCES



EVMS RESULTS



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CALCULATIONS

Cost Variance: $CV = EV - AC$

Cost Performance Index: $CPI = EV / AC$

Schedule Variance: $SV = EV - PV$

Schedule Performance Index: $SPI = EV / PV$

Estimate to Complete: $ETC = BAC - EV$

Estimate at Completion: $$EAC = AC + \frac{BAC - EV}{CPI}$$

PERFORANCE METRICS

- Cost Performance
  - Cost Variance (CV)
    - Difference between earned value and actual cost
    - CV = BCWP – ACWP (+ favorable; - unfavorable)
  - Cost Variance Percent (CV%)
    - The ratio of the cost variance to the earned value
    - CV% = 100 x CV / BCWP
  - Cost Performance Index (CPI)
    - Cost efficiency index
    - CPI = BCWP ÷ ACWP
      - Favorable if >1.0
      - Unfavorable if <1.0

PERFORANCE METRICS

- Schedule Performance
  - SV - Schedule Variance
    - Difference between earned value and planned value
    - SV = BCWP – BCWS (+ favorable; - unfavorable)
  - SV% - Schedule Variance Percent
    - Ratio of schedule variance to planned value
    - SV% = 100 x SV / BCWS
  - SPI - Schedule Performance Index
    - Schedule efficiency index
    - SPI = BCWP ÷ BCWS
      - Favorable If >1.0
      - Unfavorable If <1.0

PERFORANCE METRICS

- VAC - Variance At Completion
  - Difference between the budget at completion and the estimate at completion
  - VAC = BAC – EAC (+ favorable; - unfavorable)
- TCPI - To Complete Performance Index
  - Cost efficiency required to finish within the EAC
  - $$\text{TCPI} = \frac{\text{Work Remaining}}{\text{Cost Remaining}} = \frac{\text{BAC - BCWP (cum)}}{\text{EAC - ACWP (cum)}}$$

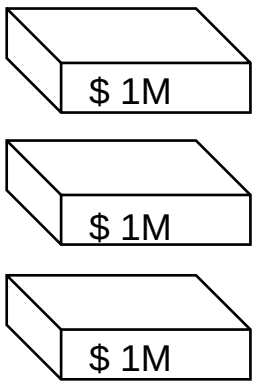
ESTIMATE AT COMPETION

- Independent Estimate at Completion (IEAC)
  = ACWP + (Remaining Budget ÷ *Performance Factor*)
  - $IEAC_1$ = ACWP + ((BAC – BCWP) / ***CPI***)
    - Cumulative performance to date
    - Provides reliable minimum EAC early in performance
  - $IEAC_2$ = ACWP + ((BAC – BCWP) / (***CPI x SPI***))
    - Cost and schedule
    - Early warning when behind schedule
  - $IEAC_3$ = ACWP + ((BAC – BCWP) / ($\Sigma BCWP_3$ / $\Sigma ACWP_3$))
    - Recent performance
    - Reliable in mid-contract phase
- Based on research performed by Air Force Institute of Technology on hundreds of completed DoD contracts

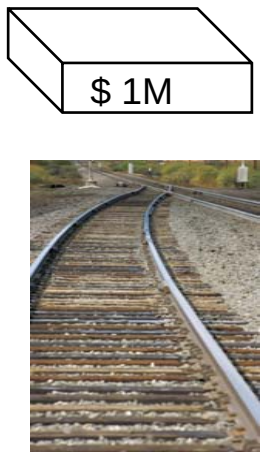
EARNED VALUE EXAMPLE

Contract: 4 miles of railroad track in 4 months for $4 million.
Status: After 3 months, only 1 mile completed and $2 million has been spent.
Question: How are you doing (and how do you know)?

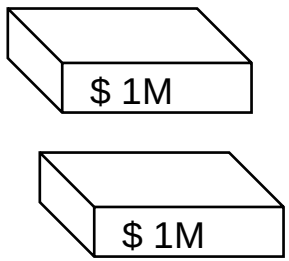
PLANNED WORK $ 3M



EARNED VALUE $ 1M



COST OF WORK $ 2M



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Source: May 1997 GAO Report

EARNED VALUE EXAMPLE

CV = [EV] BCWP – [AC] ACWP (+ favorable; - unfavorable)

-1M = 1M - 2M

CV% = 100 x CV / BCWP

-100% = 100 x -1M / 1M

SV = [EV] BCWP – [PV] BCWS (+ favorable; - unfavorable)

-2M = 1M - 3M

SV% = 100 x SV / BCWS

-66% = 100 x -1M / 3M

EARNED VALUE EXAMPLE

CPI = BCWP ÷ ACWP

.5 = 1M / 2M

EAC = BAC/CPI

$8M

SPI = BCWP ÷ BCWS

.33 = 1M / 3M

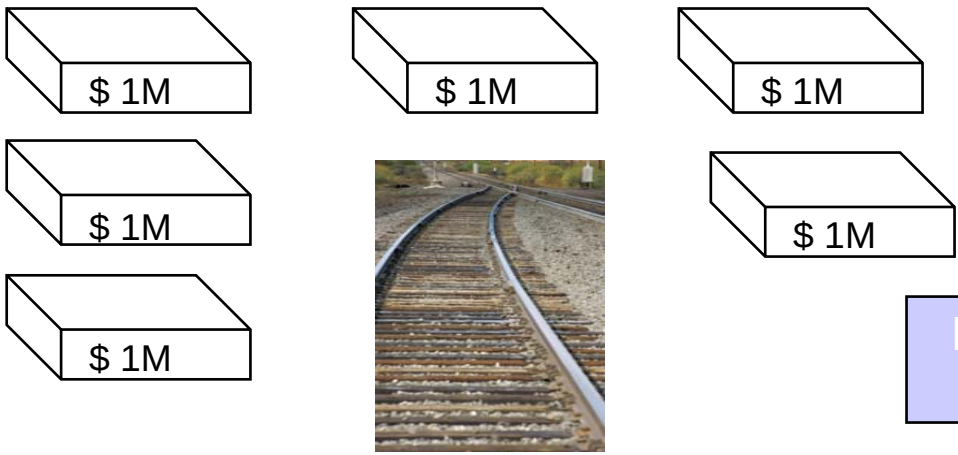
Schedule Months = Schedule/SPI

12.12 Month = 4 Months /.33

EARNED VALUE EXAMPLE

Contract: 4 miles of railroad track in 4 months for $4 million.
Status: After 3 months, only 1 mile completed and $2 million has been spent.
Question: How are you doing (and how do you know)?

PLANNED WORK	EARNED VALUE	COST OF WORK	SCHEDULE VARIANCE	COST VARIANCE
$ 3M	$ 1M	$ 2M	$1M - $3M = ($2M) (66% behind)	$1M - $2M = ($1M) (100% overrun)



Estimate at Completion: $8M and 8 months late

Source: May 1997 GAO Report

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