

Earned Value - Evolution and Practice

Project Management Institute OVOC

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Abstract

Earned Value looks simple: project managers can understand the basic calculations in about fifteen minutes.

Anyone who has tried to incorporate Earned Value into a project management system, though, has uncovered a change management project that can take six to twelve months, or even longer.

And customers have found that a successful implementation requires personnel and partners with years of experience and previous EV successes.

Agenda

- Earned Value Concepts
- History of Earned Value Management
- EVMS / ANSI 748
- Implementing EV Management Systems
- Conclusion
- Acronyms and Definitions
- More Information

Earned Value Concepts

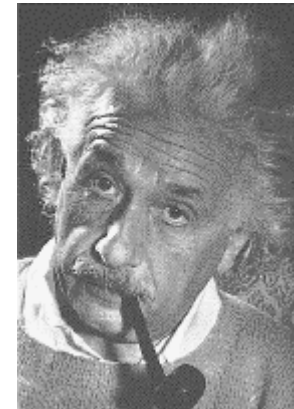
Basis for Project Control Systems

➤ The Goal

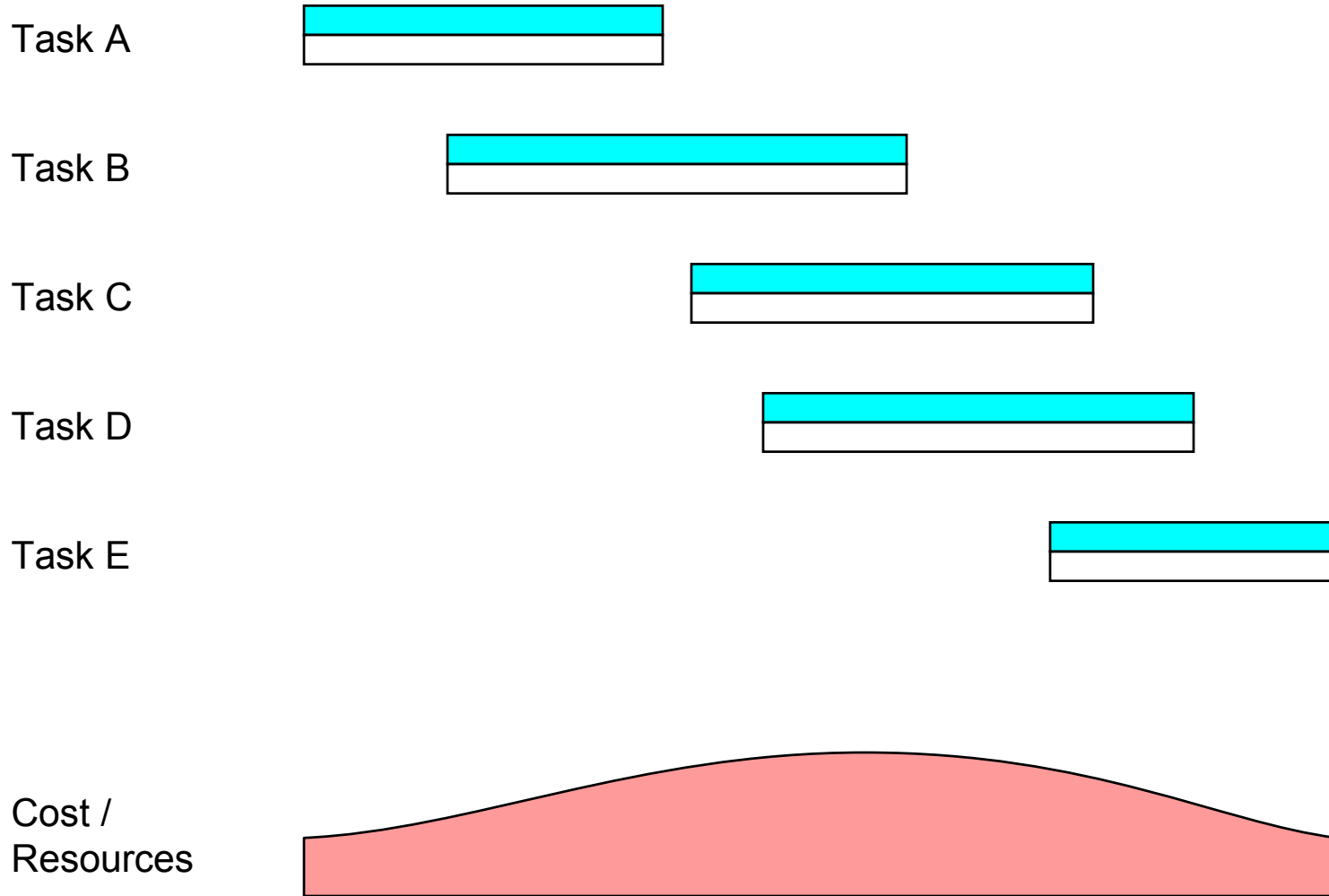
- Get the project done
- Low Cost
- Short Schedule
- Predictable Cost
- Predictable Schedule
- Minimize overhead costs

➤ The Usual Approach

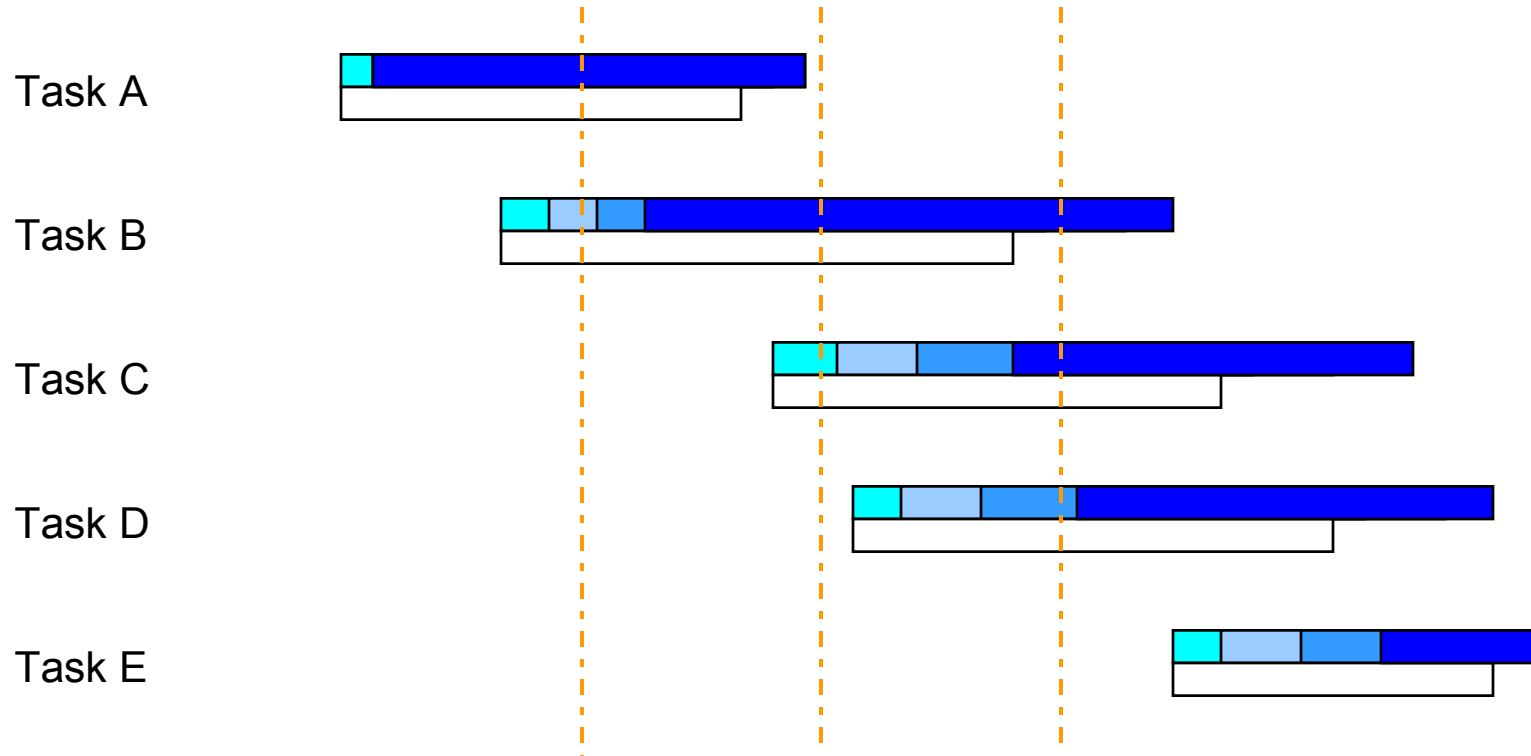
- Build a Schedule
- Maybe we resource it ...
- ... maybe we don't
- Manage Milestones
- Try the same old approach
- Hope for a different result



Initial Project Schedule



Typical Schedule Slip Over Time



What Happened?

➤ Cause

- Work takes longer than expected (hoped?)
- Results cost more than expected (hoped?)
- Resources aren't as productive as claimed
- Subcontractors are later than planned
- And there are reasonable explanations for everything

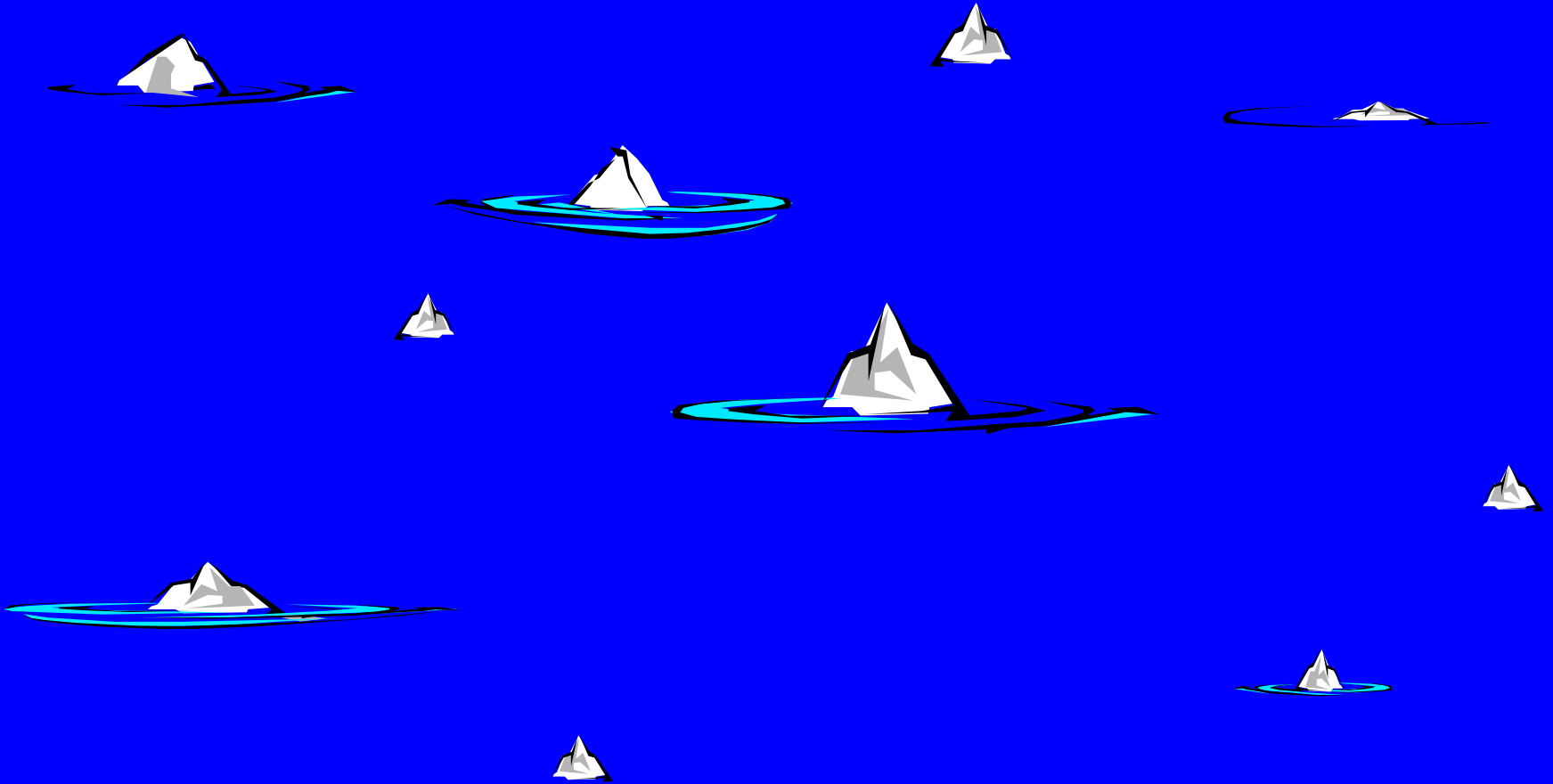
➤ We still *want* to meet our targets

➤ Result

- Problem is masked when looking only at schedules
- Resources and costs are deferred - pushed ahead like a bow wave
- Resource capacity (already a problem?) is exceeded
- Extra resources on project exacerbate the confusion
- Reluctance to admit mistakes delays resolution
- Delays cause overheads to be carried longer

➤ Cost *and* Schedule suffer

Without Earned Value - Counting Milestones

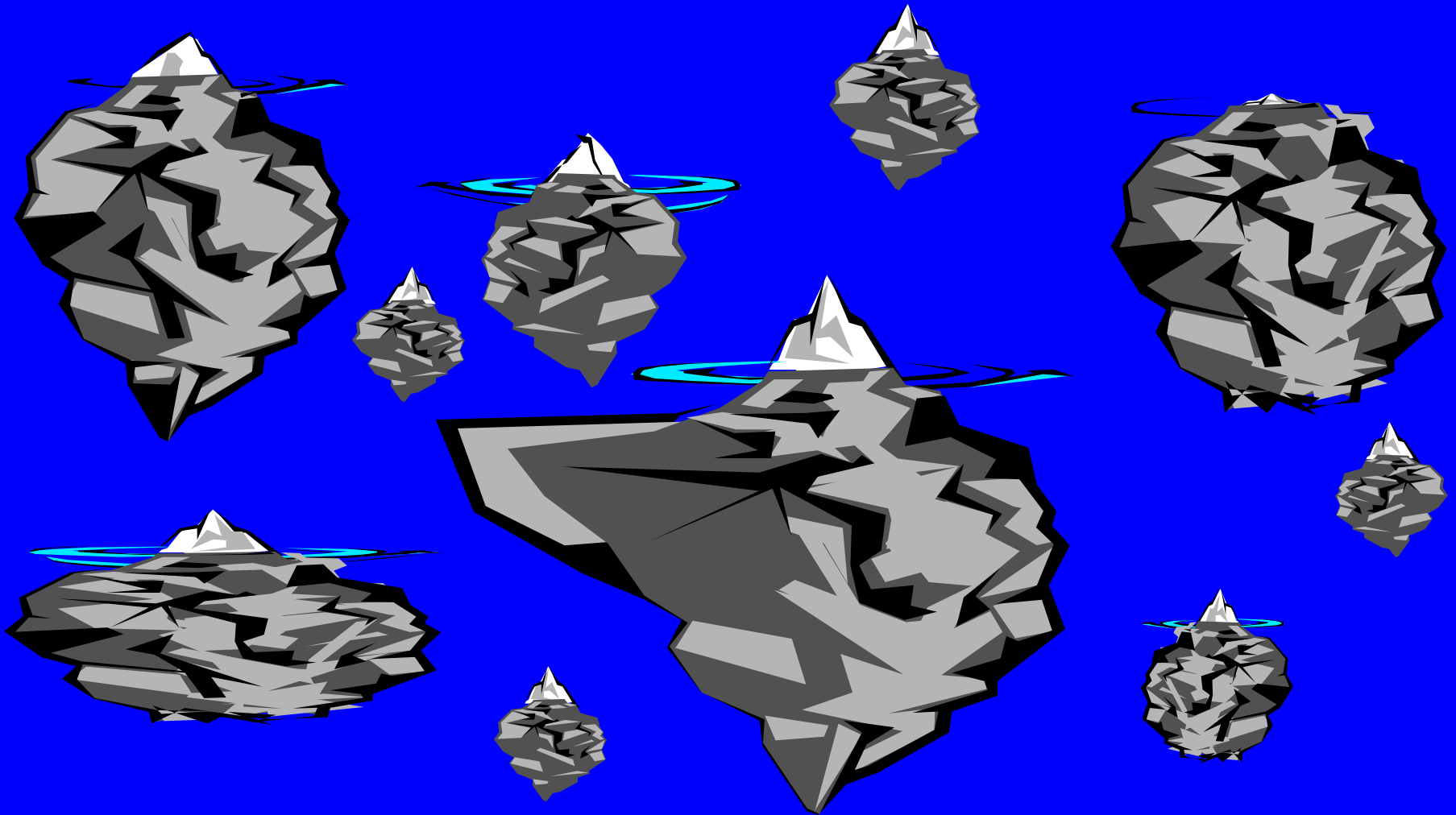


If We Accounted for Costs and Earned Value

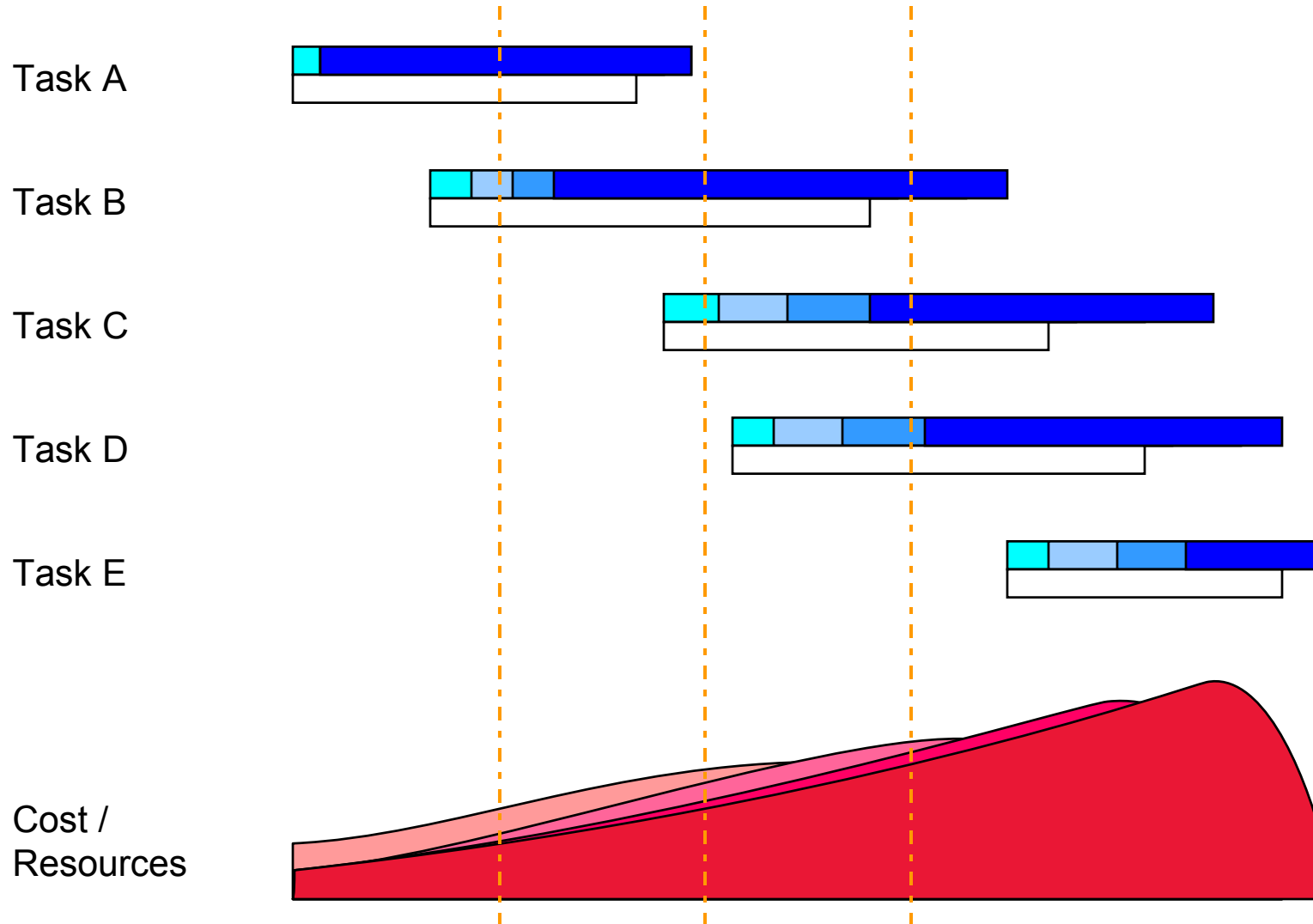
➤ We would have

- Developed a schedule for each work package
- Simultaneously developed a time-phased budget for each work package
- Identified results-based deliverables
- Tracked the actual resources and costs at each status point
- Tracked the earned value at each status point
- Re-estimated the effort and cost to complete the work, when status was taken
- Done analysis and made our management decisions along the way, based on these measurements

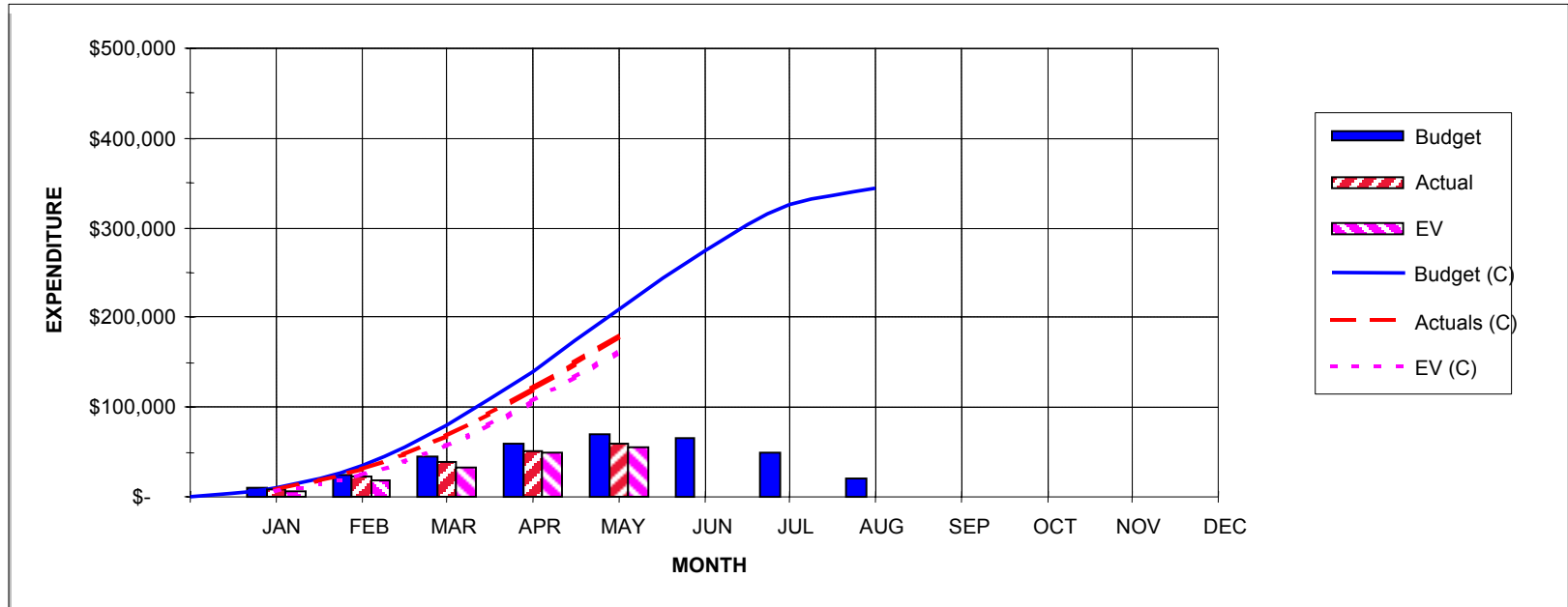
An EVMS Accounts for Cost and Effort



Impact of Schedule Slip on Project Cost



Comparing Budget, Actual, & Earned Value



➤ Capture of Budget

- Comprehensive
- By Deliverable
- By Org Group
- Detailed Over Time

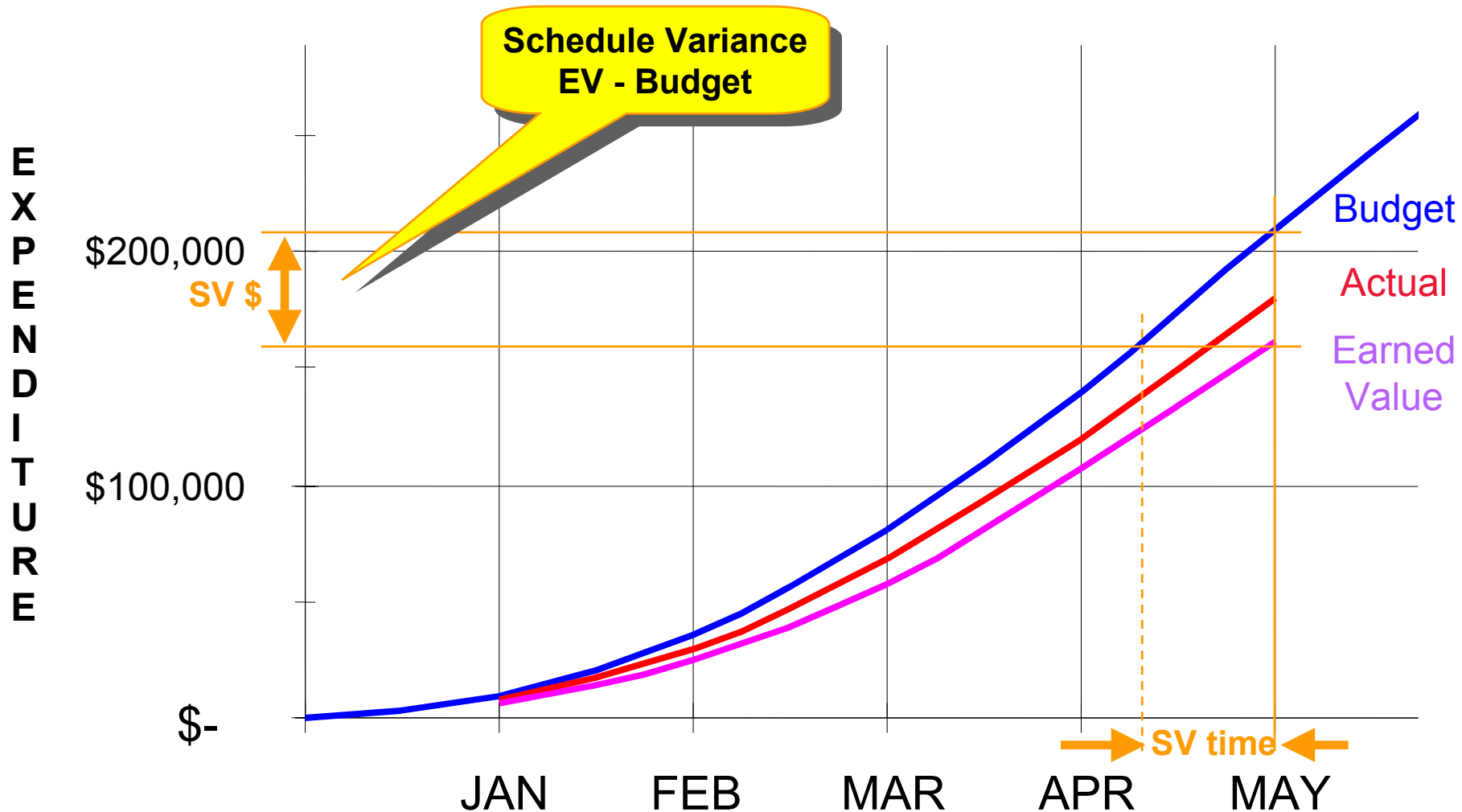
➤ Capture of Actuals

- Dollars & Hours
- Consistent with Budget
- Aligned with Project

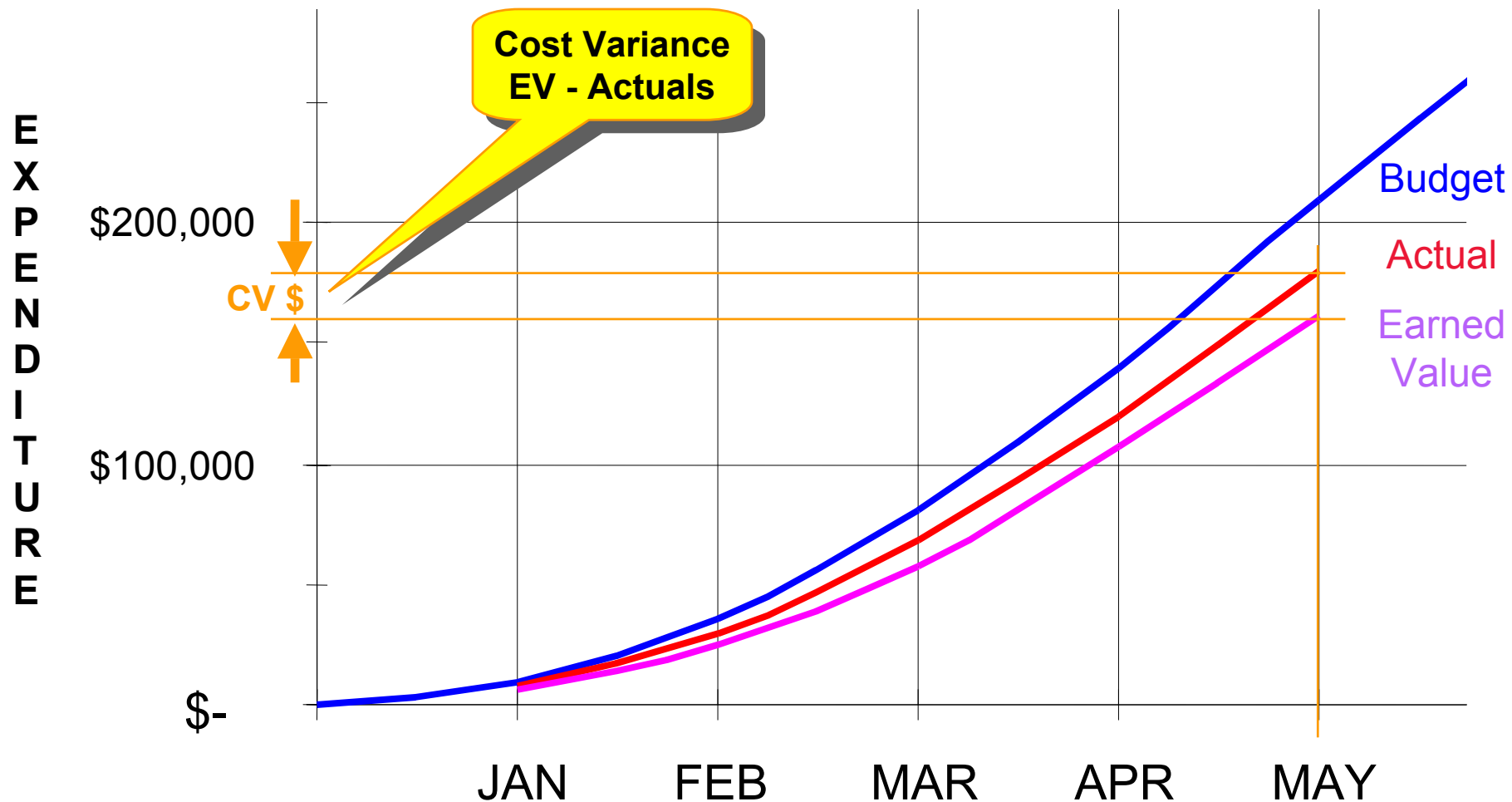
➤ Assessment of Work Earned

- Performed by Manager
- Pre-determined Criteria
- Budgeted Value
- Every Status Period

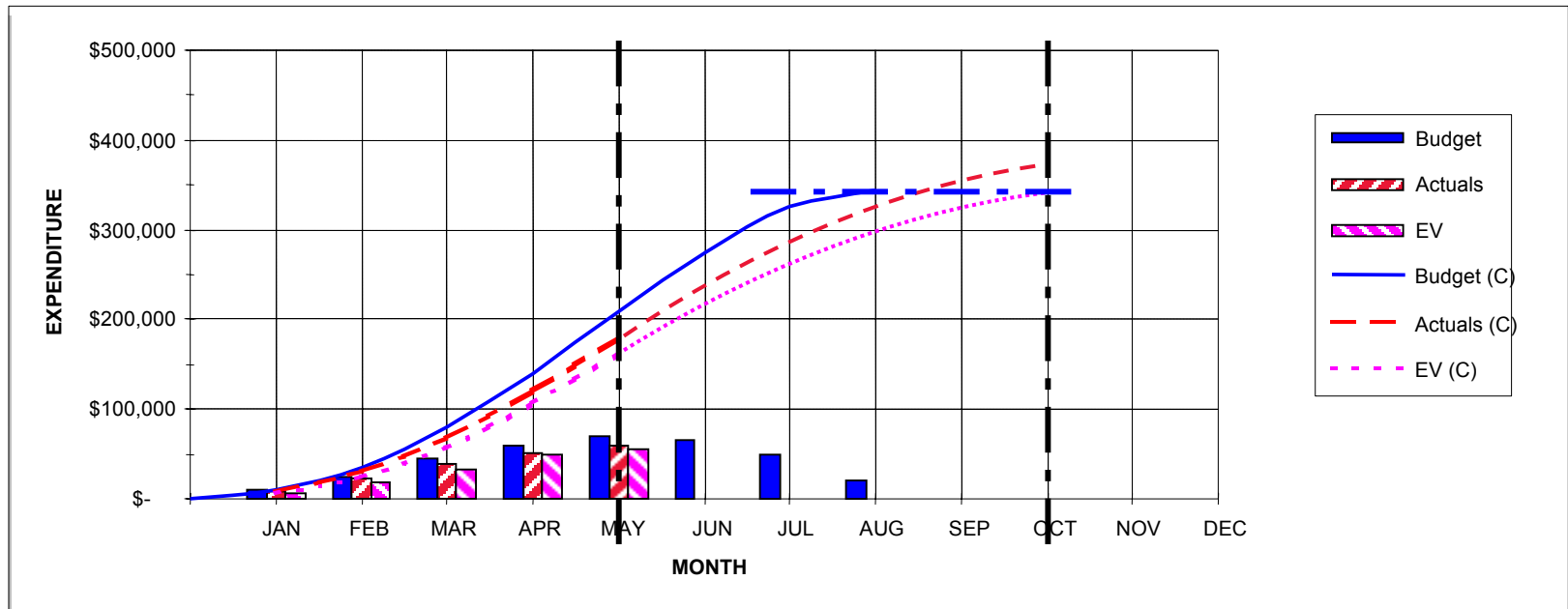
Schedule Variance (Cumulative)



Cost Variance (Cumulative)



Forecasting with an EVMS

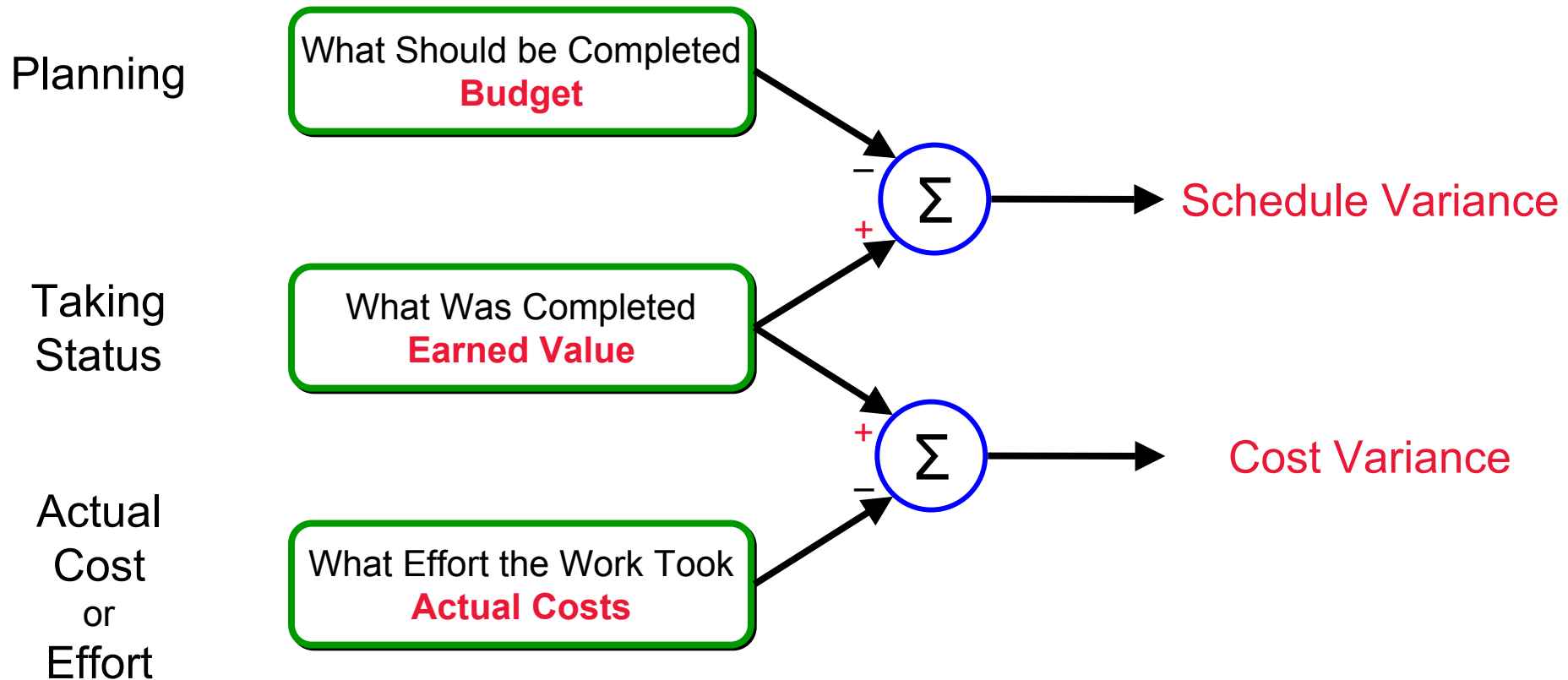


- Forecast New End Date
 - Use Schedule Performance to date

- Forecast New Earned Value Curve
 - Maximum at BCWP
 - Interpolate Points

- Forecast New Cost Curve
 - Scale EV by Cost Performance to date

Three Elements in Earned Value Analysis



What EVMS Brings - PM Science

- Without an Earned Value System
 - We can only see
 - Total Variance =
Budget minus Actuals
 - We can only watch the burn rate
 - Costs have weak or no association with the work done
 - Non-program costs can slip in with program costs
 - Games can be played with costs and charge accounts
- With an Earned Value System
 - We can clearly see
 - Schedule Variance
 - Cost Variance
 - Clear matching of costs to work
 - Non-program costs clearly identified
 - Managers responsible are motivated to watch costs
 - Can perform this analysis
 - by WBS item
 - by cost type
 - by labor group
 - by manager ...

What EVMS Brings - Practically

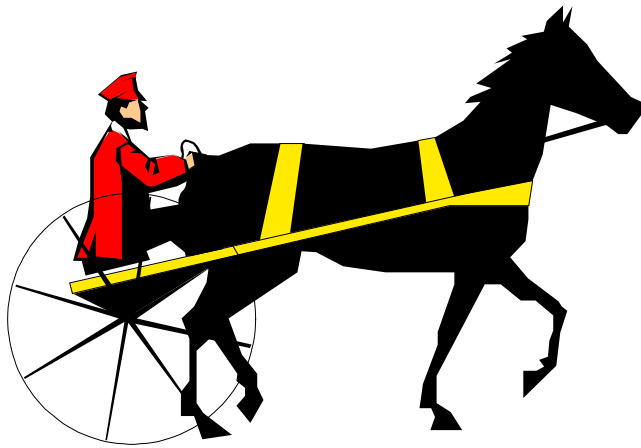
- Because it is possible to have more than
 - Insufficient executive insight into project status
 - Difficult to see real costs
 - Poor insight into root causes of problems
 - Inconsistent planning
 - Large, on-going, variances
 - Difficulty in reconciling departmental charges with the program
 - Seat of the pants methods
 - “Trust me”
- EV is the only method of getting a real picture in real time for a Program
 - What was planned
 - What was accomplished
 - What it has cost
 - Where the overruns are
 - What the real schedule status is
 - Where the problems are
 - Whose responsibility it is
 - What interventions are working
 - Where the program is going

An EVMS Requires More Than Earned Value

- Schedule and Cost
 - Structured Definition of Work
 - Account for impact of deferred effort
- Integrated Plan
 - Single reference file
 - Enables analysis of dependencies between teams
 - Documentation control ensures data integrity
- Defined Deliverables (Milestones)
 - Straightforward planning
 - Unambiguous status
- Assignment of Responsibility
 - Tiered Delegation of Authority for Decision-Making
- Capture Actuals
 - Time Sheets
 - Financial Costs
- Straightforward Reporting
 - Predefined Completion Criteria
 - Standard reports Controlling the Baseline
 - Changes to scope are managed
 - Can distinguish performance issues from scope changes
- Standard Methods
 - Work Definition
 - Performance Measurement
 - Variance Analysis
 - Reporting

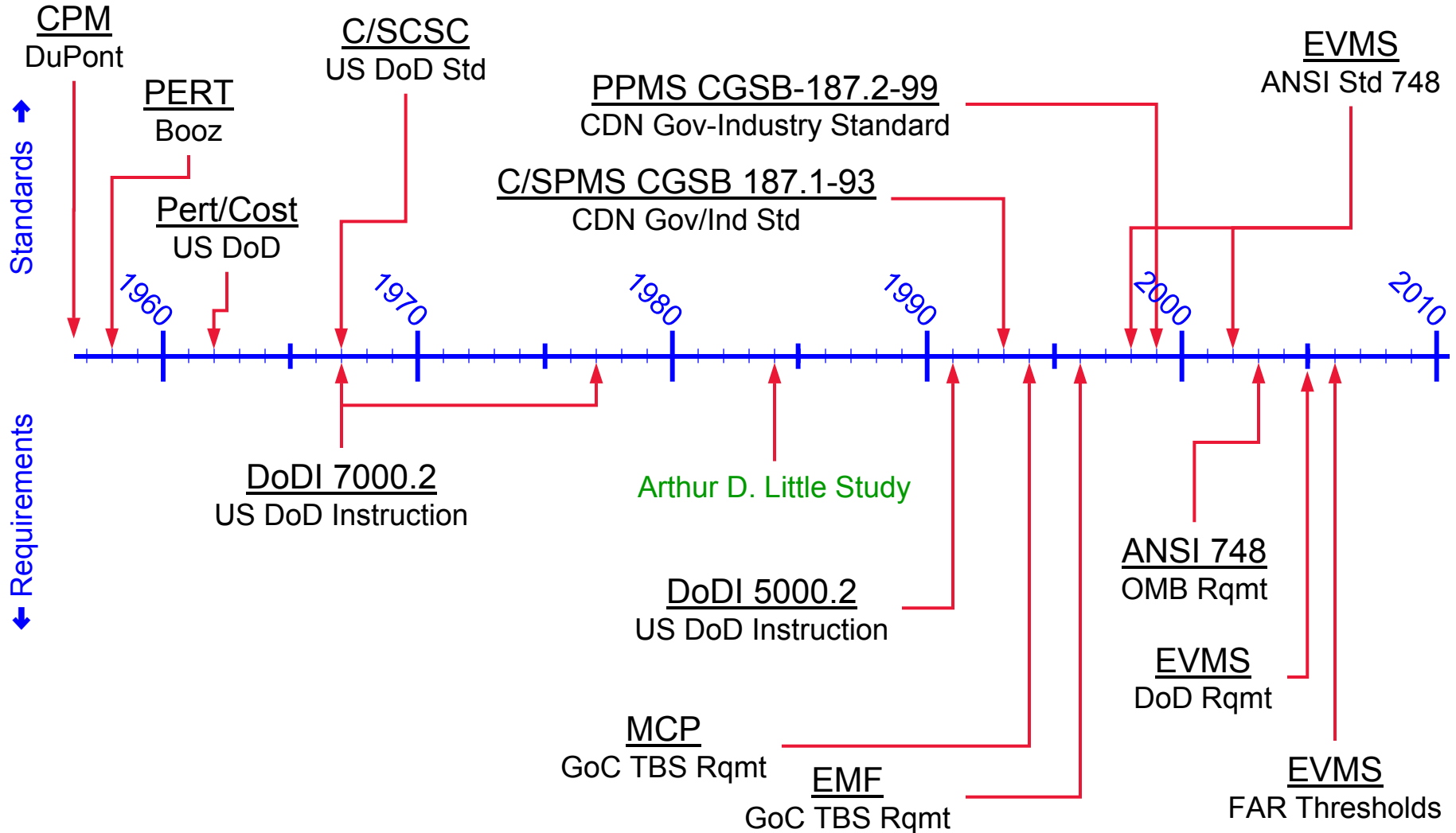
History of Earned Value Management

Historical Context



- Originally systems were merely for reporting
- Imposed by managers or customers
- Marginally adequate
- Information
 - Not timely
 - Not indicative of actual status
 - Not derived from systems used to manage
- Inconsistent between groups

Evolution of Earned Value Standards



C/SCSC

- Cost/Schedule Control Systems Criteria
- Also Known As...
 - CS-Squared
 - C-Spec
- Established in 1967 by US Department of Defense
- To provide visibility
- To standardize requirements for contractor reporting
- Cost and schedule performance
- Subsequently adopted by
 - US Department of Energy
 - US Department of Transportation
- Improvement over “budget versus actuals”
- Requires
 - Quantification of work progress
 - Using objective indicators of work performed
- Careful Planning
- Baseline Establishment
- Reporting Discipline
- Variance Analysis
- Corrective Action
- Measurement of accomplishment at multiple levels

C/SPMS and PPMS



- Cost / Schedule Performance Management Standard
 - CGSB Standard 187.1-93
 - Upgrade of U.S. C/SCSC
 - Developed by joint Government - Industry group
 - Required by TBS on Major Crown Projects

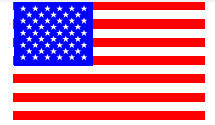
- Project Performance Management Standard
 - CGSB Standard 187.2-99
 - EV-Lite
 - More performance-based, less cost-based
 - Developed by joint Government - Industry group
 - Quickly overtaken by EVMS

Treasury Board Requirement - 1996

- Enhanced Management Framework for Information Technology Projects

- “The Earned Value Method of planning and reporting progress on deliverables, which is being used for Major Crown Projects, will be adapted for use in information technology projects.”
 - http://www.tbs-sct.gc.ca/emf-cag/about/ppw-slp/ppw-slp04_e.asp

US Government Thresholds for EVM



Federal agency	EVM threshold	EVMS requirement
DoD, NASA	\$20-50 Million	EVMS required
DoD, NASA	> \$50 Million	EVMS implementation & process must be validated
GSA	> \$20 Million	EVMS required; implementation & process must be validated
DoE	> \$20 Million	EVMS required
EPA	> \$5 Million	EVM required
FAA	> \$10 Million	EVM required
Medicare & Medicaid	Variable	Based on Contracting Officer's approval
HHS	> \$10 Million	EVMS and certification required

ANSI 748

The Current Industry Standard

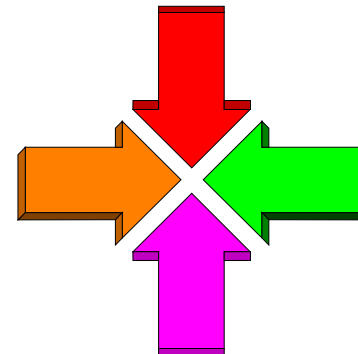
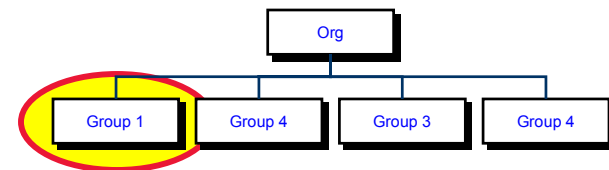
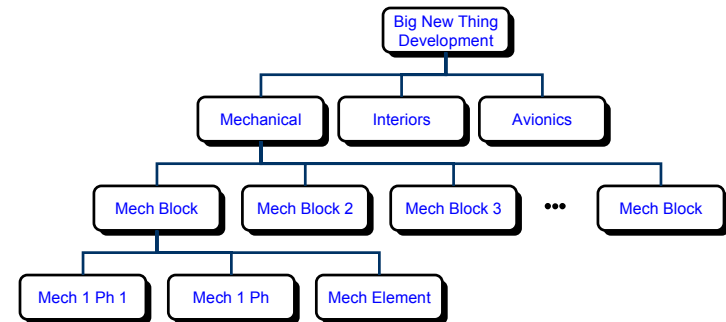
EVMS Guidelines

- 32 Guidelines in 5 categories
- Recommendations for management systems and processes
- Management System can be reviewed for compliance
- Or, organizations can tailor the application of guidelines for their needs



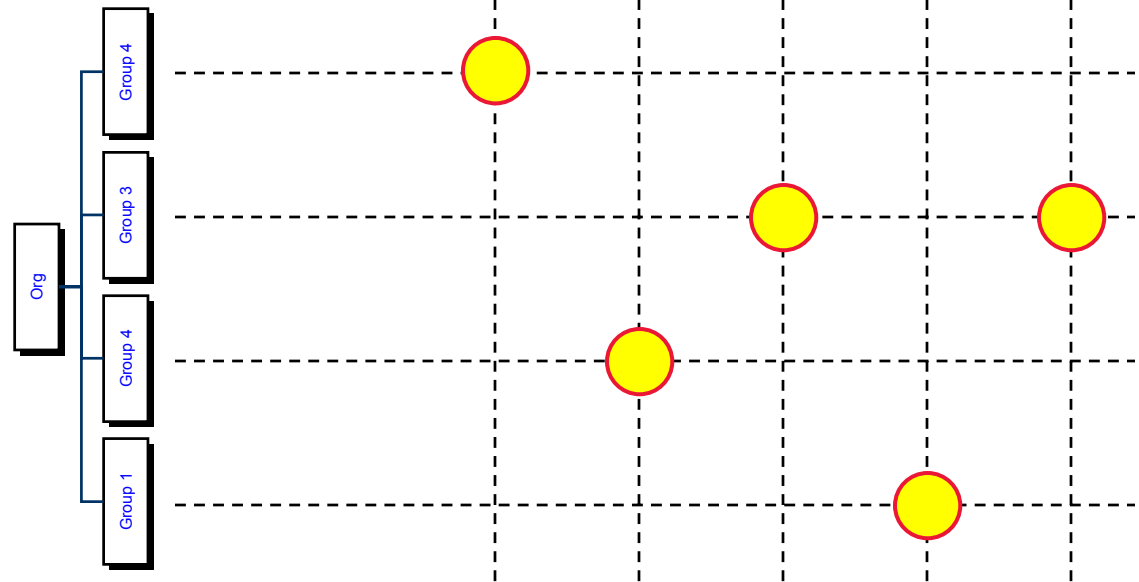
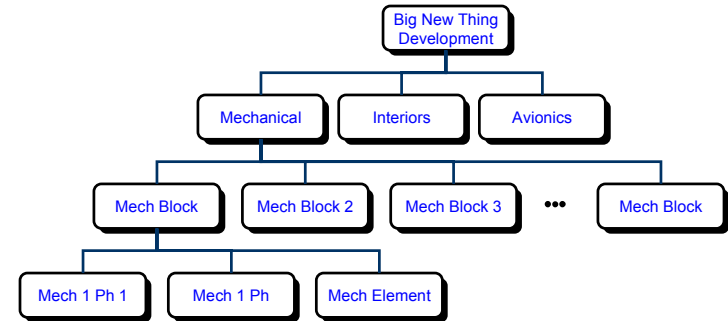
748 (a): Organization

- Define work in a work breakdown structure (WBS)
- Identify organizational structure and control points for planning, controlling, and accomplishing the work
- Ensure the integration of systems for
 - Planning
 - Scheduling
 - Budgeting
 - Work Authorization
 - Cost Accumulation
 - Program WBS
 - Program OBS



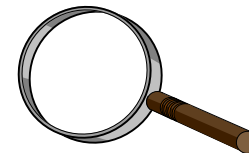
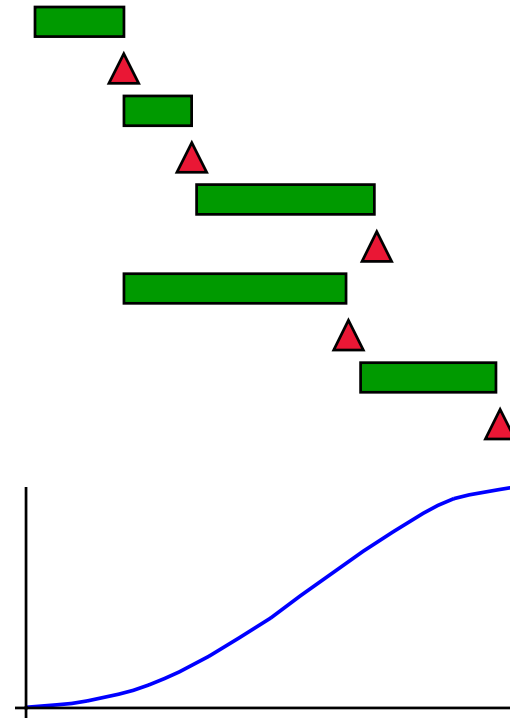
748 (a): Organization (cont'd)

- Identify OBS element responsible for indirect costs
- Integrate the program WBS and OBS to allow performance measurement by either structure



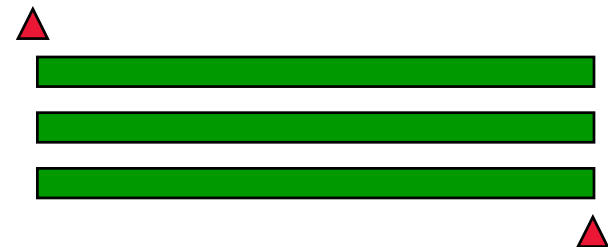
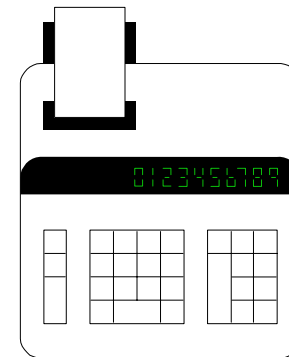
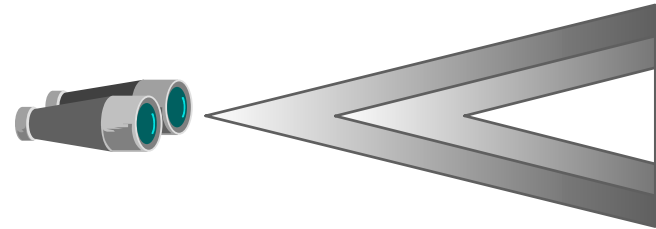
748 (b): Planning, Scheduling, and Budgeting

- Schedule the work accounting for all dependencies
- Identify unambiguous indicators to measure progress
- Establish and maintain a time-phased budget baseline, at the control account level, for measurement of performance
- Ensure that budgets provide sufficient visibility for management of internal resources and subcontractors



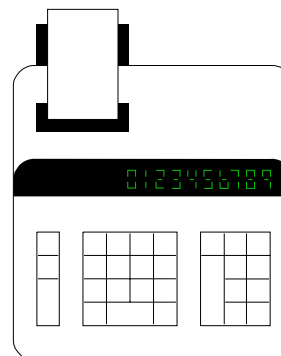
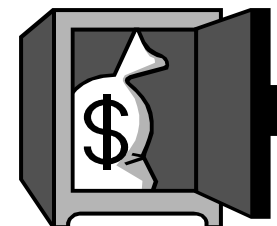
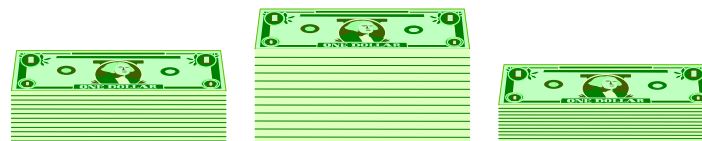
748 (b): Planning, Scheduling, and Budgeting

- Break down authorized work for the near term into discrete work packages with budgets, and into larger planning packages for the far term
- Ensure that the sum of all work- and planning-package budgets sums to the control account budget
- Establish time-phased budgets for work that is not practically measurable (level-of-effort activity)



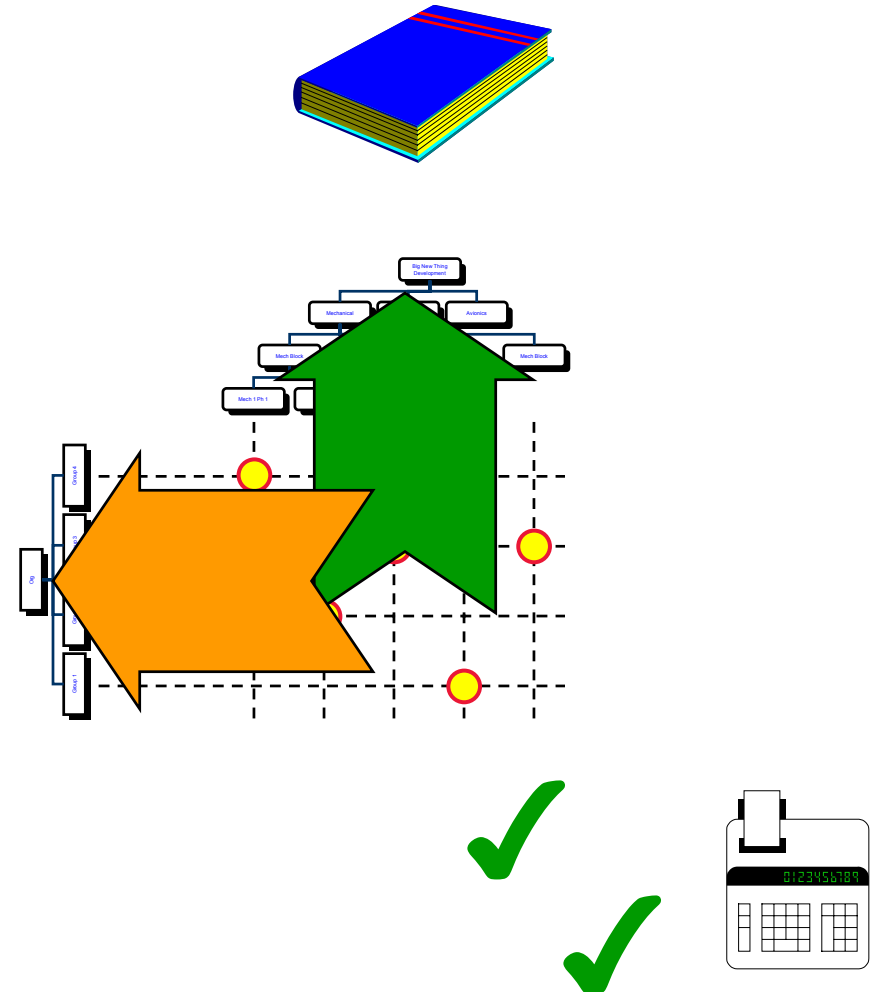
748 (b): Planning, Scheduling, and Budgeting

- Establish budgets for organizational overheads and allocate to the program (as appropriate) as indirect costs
- Identify management reserves and undistributed budget
- Reconcile the program budget with the sum of all internal program budgets and management reserves



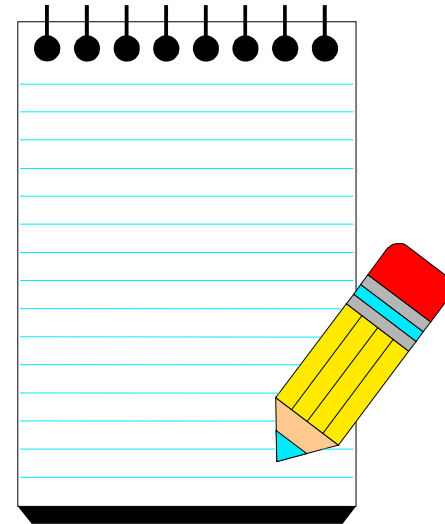
748 (c): Accounting Considerations

- Formally record direct costs in the same way as budgets were established, and under control of the accounting system
- Summarize direct costs from control accounts into the WBS by allocating each control account to one WBS element
- Summarize direct costs from control accounts into the OBS by allocating each control account to one OBS element
- Record all indirect costs as allocated
- Identify unit and lot costs when needed



748 (c): Accounting Considerations (cont'd)

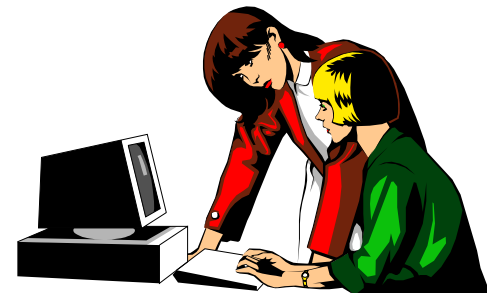
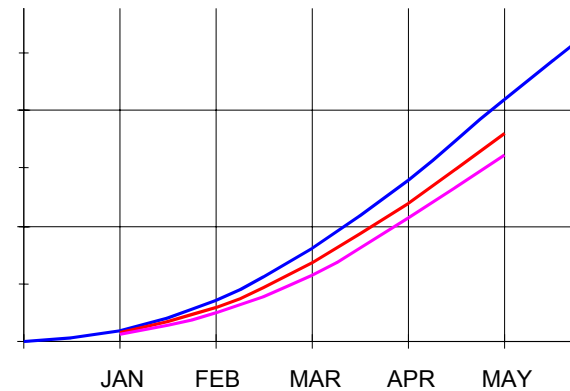
- For material:
 - Ensure cost tracking is accurate, appropriate, and consistent with the budgets
 - Measure performance at a suitable time, no earlier than the time of progress payments or actual receipt of material
 - Account for all material purchased for the program, including residual



748 (d): Analysis and Management Reports

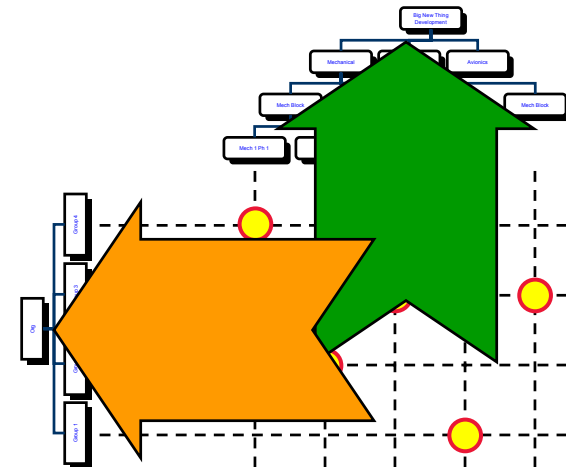
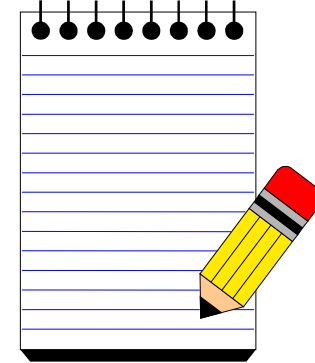
- At least monthly, for each control account, collect from the accounting system and calculate:
 - $\text{Schedule Variance} = \text{Earned Value} - \text{Planned Budget}$
 - $\text{Cost Variance} = \text{Earned Value} - \text{Actual Cost}$

- At least monthly, identify significant schedule and cost variances, and provide the reasons



748 (d): Analysis and Management Reports

- Identify budgeted and actual indirect costs and provide the reasons for any significant variances
- Summarize the data elements and associated variances through the OBS and the WBS

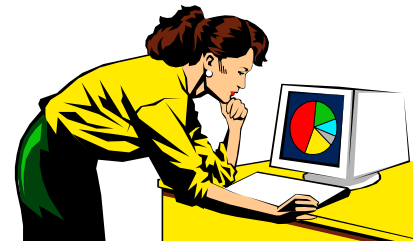


748 (d): Analysis and Management Reports

- Implement managerial actions based on information reported

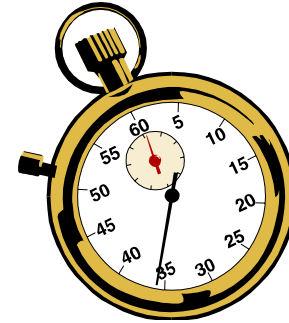


- Revise the estimates at completion (EAC) based on performance to date and estimates of future conditions, and compare this new EAC with the PM baseline, for action by management



748 (e): Revisions and Data Maintenance

- Incorporate authorized changes to budgets and schedules in a timely manner
- Maintain an audit trail of changes to the budget baseline



748 (e): Revisions and Data Maintenance

- Prevent changes to previously reported amounts
- Prevent revisions to the program budget except for authorized program changes
- Document changes to the performance measurement baseline

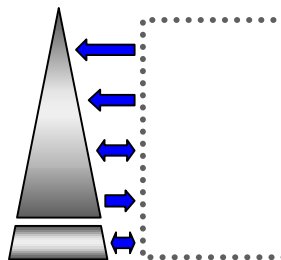


Implementing EV Management Systems

Three Elements of EVMS

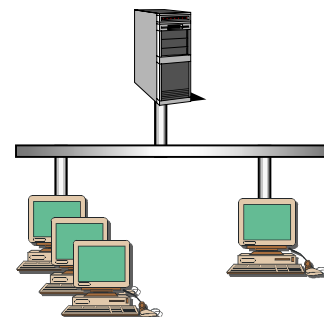
► People and Organization

- The distributed managers who use the system
- The group to operate it and produce reports (PCO)



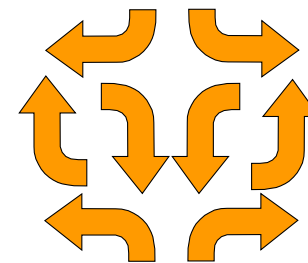
► Computer Tools and Systems

- Storage
- Analysis
- Reporting
- Managing the data



► Processes and Standards

- Management actions
- Analytical processes
- Reporting cycles
- Functions performed by the PCO



People & Organization



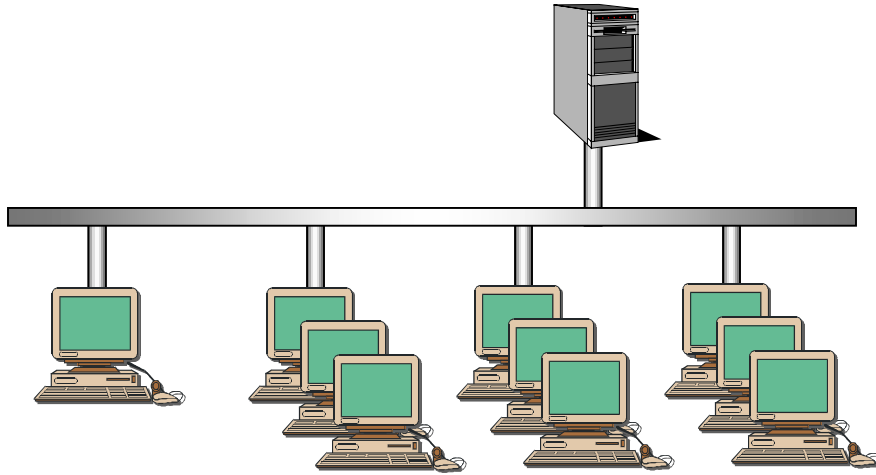
► Challenges

- Inertia
- Understanding
- Habit
- Vested interests
- Fear

► Organizational Change Tools

- Training
- Coaching
- Listening
- Analysis
- Authority

Computer Tools and Systems

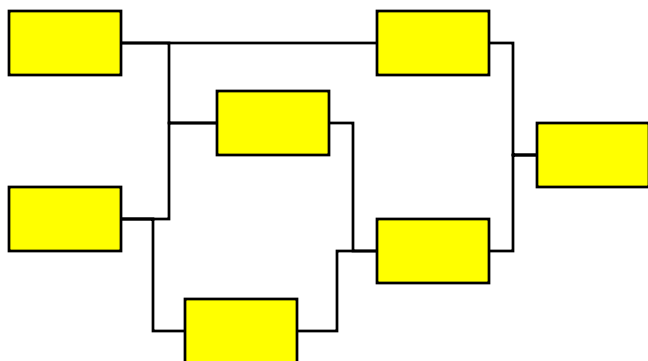


- The easiest part
- Tools are robust
- Installation and connection are straightforward

- Ensure that the tool suite you select actually meets the requirements

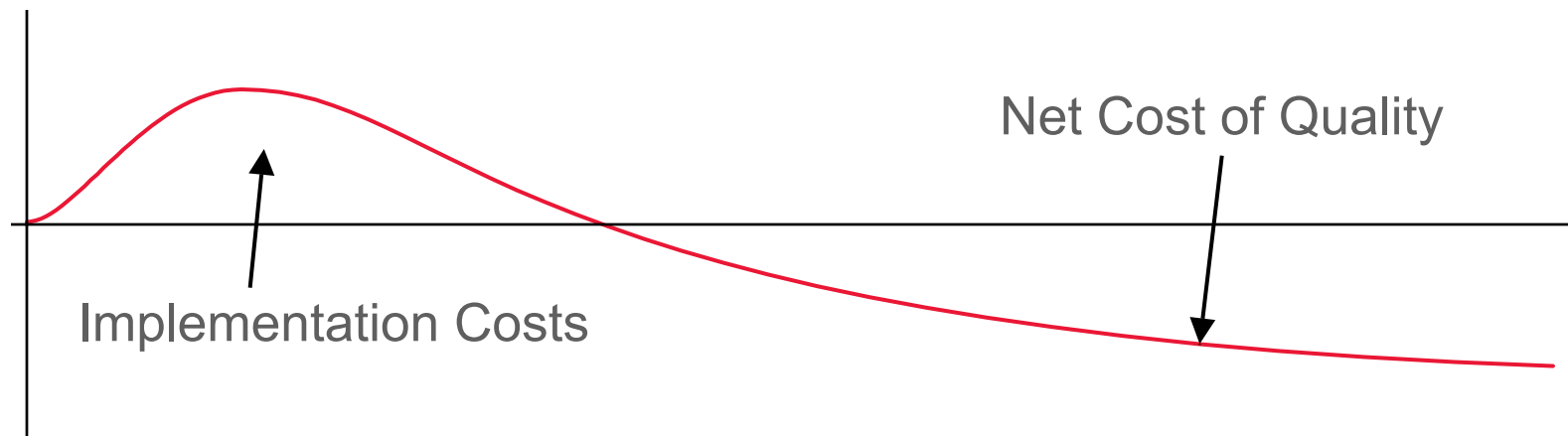
Processes and Standards

- The boring part
 - Re-engineering management processes
 - Understanding what needs to be done
 - Incorporating best practices
 - Adapting the standards
- The deceptively difficult part
 - EVMS is more than EV
 - EV-Lite is different than Accredited C/SCSC
 - Every customer has different needs
 - Every individual has their favourite tools
 - Some can cut it
 - Some can't
 - Experience doesn't come from the PMBOK
 - Everyone has a copy of the PMBOK under their arm



Planning Your First Program Under EVMS

- Where the rubber hits the road
- Short-cuts will come back to haunt you
- The real heel-draggers will become apparent
- It will be very tempting to blame
 - The tools
 - The methodology
 - The consultants
- The first program will encounter the implementation costs



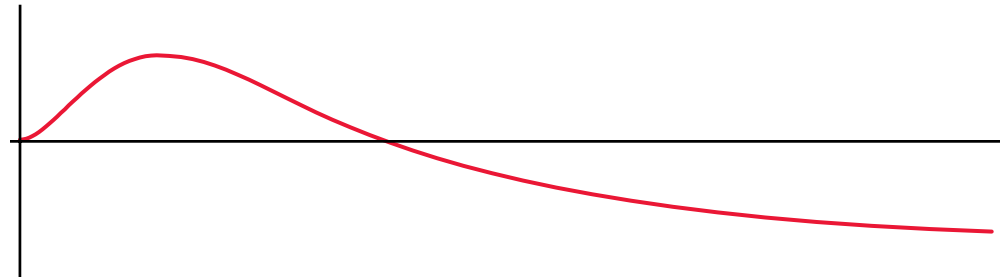
Conclusions

Application

- EV is amazingly powerful
 - Should be applied - at some level - on most projects
 - Every management decision has a cost impact
- One size does not fit all
- On small projects and in small organizations
 - Use the back of a Napkin, MS Project, and Excel
- Large Aerospace & Defence organizations
 - Will do it because they are contractually bound to
- Organizations and projects in between
 - Will need more assistance than they will get from the PMBOK guide
 - Typically start from accredited systems (C/SPMS, C/SCSC, or EVMS) and strip out requirements and functionality
 - ... rather than starting with MS Project and the Napkin and building up

Plan and Manage the Implementation

- This is a process re-engineering project, remember?
 - It isn't just a duel between vendors
 - Understand the organization's
 - Goals
 - Requirements
 - Expect challenges
 - Inertia
 - Understanding
 - Habit
 - Vested interests
 - Fear
- Plan the implementation project
 - Manage it
 - Start climbing the learning curve
 - Get the start-up costs behind you



- Start benefiting from Earned Value

Implementation Partner

- Find a management consulting organization with the experience to help you through
 - Implementation
 - Adaptation
 - Organizational Change Process
 - Process Development
 - Training
 - Mentoring
- SOMOS
 - Senior PMs and systems people
 - 17 years' experience with these tools
- PM company that represents Deltek EPM tools
 - Not a software company with incidental PM experience

SOMOS
PROJECT MANAGEMENT

Component Tool Suite

- Select the best tool components for the system
 - Robust
 - Proven
 - Scalable

 - Scheduling tool sufficient for the programs
 - EV Engine
 - (No, this does not exist within any scheduler)
 - Time Sheet System
 - Accounting Systems
 - Reporting Suite

- Deltek
 - Best-of-Breed Tool Suite
 - Enterprise-Quality Systems
 - Global Scale Vendor (\$240M Sales)
 - Hundreds of implementations in government and industry
 - Corporate focus on Project-Based organizations



Acronyms & Definitions

Definitions from EIA-748-A

- Budget or Resource Plan (BC)
 - The time-phased budget, which is the schedule for the planned expenditure of program resources for accomplishment of program work scope.
- Actual Cost (AC)
 - The costs actually incurred and recorded in accomplishing work performed.
- Earned Value (EV)
 - The value of completed work expressed in terms of the budget assigned to that work.
- Cost Variance (CV)
 - A metric for the cost performance on a program. It is the algebraic difference between earned value and actual cost (Cost Variance = Earned Value - Actual Cost.) A positive value indicates a favorable position and a negative value indicates an unfavorable condition.
- Schedule Variance (SV)
 - A metric for the schedule performance on a program. It is the algebraic difference between earned value and the budget (Schedule Variance = Earned Value - Budget). A positive value is a favorable condition while a negative value is unfavorable.

Definitions from EIA-748-A

- Budget At Completion (BAC)
 - The total authorized budget for accomplishing the program scope of work. It is equal to the sum of all allocated budgets plus any undistributed budget. (Management Reserve is not included.) The Budget At Completion will form the Performance Measurement Baseline as it is allocated and time-phased in accordance with program schedule requirements.
- Estimate At Completion (EAC)
 - The current estimated total cost for program authorized work. It equals actual cost to a point in time plus the estimated costs to completion (Estimate To Complete).
- Estimate To Complete (ETC)
 - Estimate of costs to complete all work from a point in time to the end of the program.

Definitions from EIA-748-A

- Control Account (CA)
 - A management control point at which budgets (resource plans) and actual costs are accumulated and compared to earned value for management control purposes. A control account is a natural management point for planning and control since it represents the work assigned to one responsible organizational element on one program work breakdown structure element.
- Work Package (WP)
 - A task or set of tasks performed within a control account.
- Performance Measurement Baseline (PMB)
 - The total time-phased budget plan against which program performance is measured. It is the schedule for expenditure of the resources allocated to accomplish program scope and schedule objectives, and is formed by the budgets assigned to control accounts and applicable indirect budgets. The PMB also includes budget for future effort assigned to higher Work Breakdown Structure levels (summary level planning packages) plus any undistributed budget. Management Reserve is not included in the baseline as it is not yet designated for specific work scope.

More Information

References

- Fleming, Quentin W. and Koppelman, Joel M. Earned Value Project Management, Second Edition. Project Management Institute, 2000, ISBN: 1-880410-27-3.
- Fleming, Quentin W. Cost/Schedule Control Systems Criteria, The Management Guide to C/SCSC. Probus Publishing 1988, ISBN: 1-55738-011-2.
- American National Standards Institute (ANSI), Earned Value Management Systems, EIA-748A. Government Electronics and Information Technology Association (GEIA), 1998, <http://www.geia.org>.

Links

- SOMOS Site with Earned Value References
 - <http://www.SOMOS.com>
- Deltek Cobra for Earned Value Management
 - <http://www.SOMOS.com/epmsystems/cobra>
- Earned Value Management Website
 - <http://www.acq.osd.mil/pm>
- PMI College of Performance Management
 - <http://www.pmi-cpm.org/pages/home/index.html>
- Earned Value Bibliography
 - <http://www.suu.edu/faculty/christensend/ev-bib.html>
- To Download EIA-748-A
 - <http://www.geia.org>

End of Presentation

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