



Evolution of EVM and the Future

NSF Large Facilities Workshop
Baton Rouge, LA
May 1, 2017

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President, CPM

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Agenda

- College of Performance Management (CPM)
- Earned Value Management (EVM) – the Foundation of Integrated Program Management (IPM)
- Evolution of IPM
 - Past (Cost/Schedule Control Systems Criteria)
 - Present (Earned Value Management)
 - Future (Integrated Program Management)
- War Story – A Tale of Two Aircraft
- Summary and Q&A

THE COLLEGE OF PERFORMANCE MANAGEMENT (CPM) WWW.MYCPM.ORG/

About CPM

- The College of Performance Management (CPM) is a global, non-profit, professional organization dedicated to developing and disseminating the principles and practices of earned value management and other project performance management techniques.
- We assist the project control professional and project manager in professional growth and promote the application of earned value management. We are a growing body of professionals dedicated to managing projects on time and on budget.

2017 CPM Events

- EVM World 2017
 - May 31 – June 2, 2017
 - New Orleans, Louisiana
 - Hyatt Regency New Orleans
 - Science & PM Track
- IPM Workshop
 - Oct 30 – Nov 1, 2017
 - Bethesda, Maryland
 - Bethesda North Marriott Hotel & Conference Center



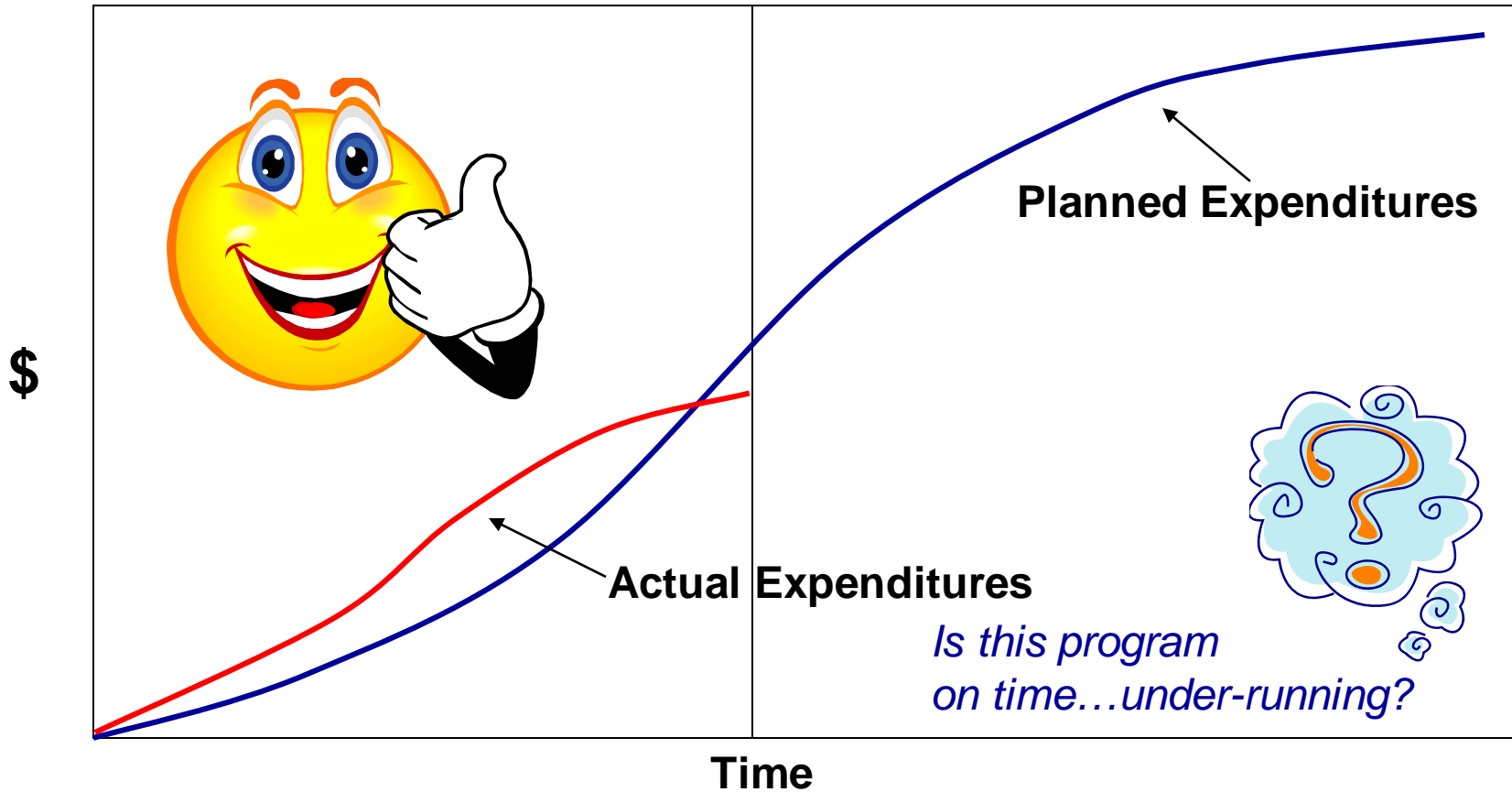
www.mycpm.org/news-events/events/

EARNED VALUE MANAGEMENT (EVM)

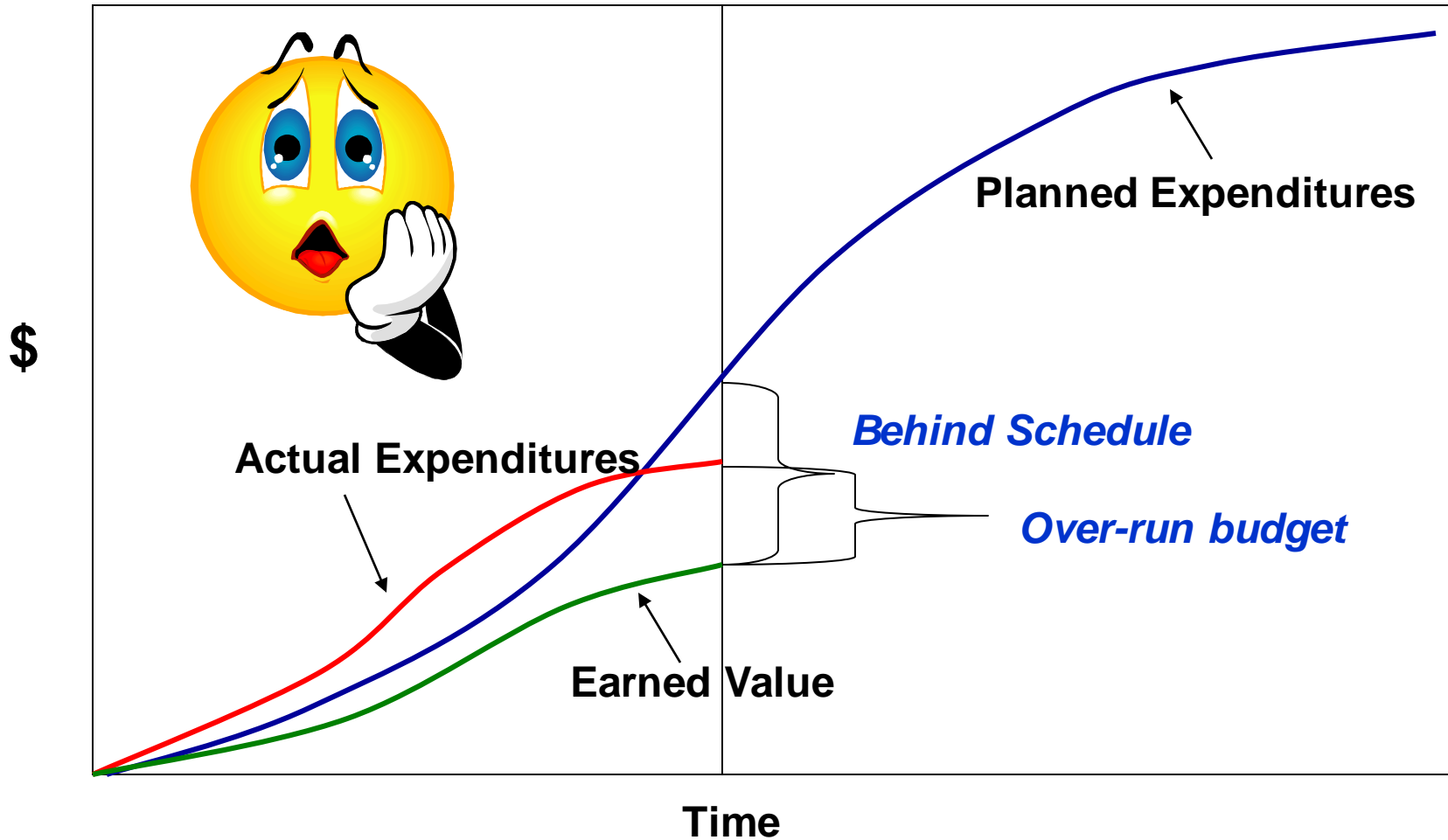
What is EVM?

- Earned Value Management (EVM) is a project management technique for measuring project performance and progress. In a single integrated system, Earned Value Management (EVM) is able to provide accurate forecasts of project performance problems, which is an important contribution for good project performance. It is therefore considered a Performance Management approach.

Without Earned Value



With Earned Value



EVM System Definition

- An EVMS for program management will effectively **integrate** the **work scope** of a project with the **schedule and cost** elements for optimum program planning and control. The primary purpose of the system is to support program management. The system is owned by the organization and is governed by the organization's policies and procedures.

*EIA 748-98B
Earned Value
Management Systems*

Using EVM Effectively

- Keys to success:
 - Emphasis on Program Planning
 - Integration of disciplines and processes
 - Systems Engineering
 - Scheduling
 - Cost Estimating
 - Procurement
 - Project Management
- Address management needs
 - Reporting as “by-product”

THE EVOLUTION OF IPM

PAST

PRESENT

FUTURE

EVM Origins

1960s

- Complex Defense Programs
- Multiple Customers
- Need for Improved Management
- Solution – PERT and PERT COST
- 10 versions by 1964
- Industry “How to Manage”

1967: DoD Instruction 7000.2

Cost/Schedule Control Systems Criteria (C/SCSC)

Criterion-based Management

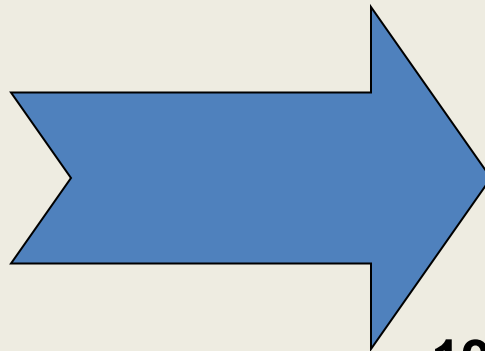
- Brief Statements of Attributes
- Not “How-To”
- Not a System
- Minimum Acceptable Standard

1997: DoD Regulation 5000.2-R

Earned Value Management Systems (EVMS)

Industry Best Practices

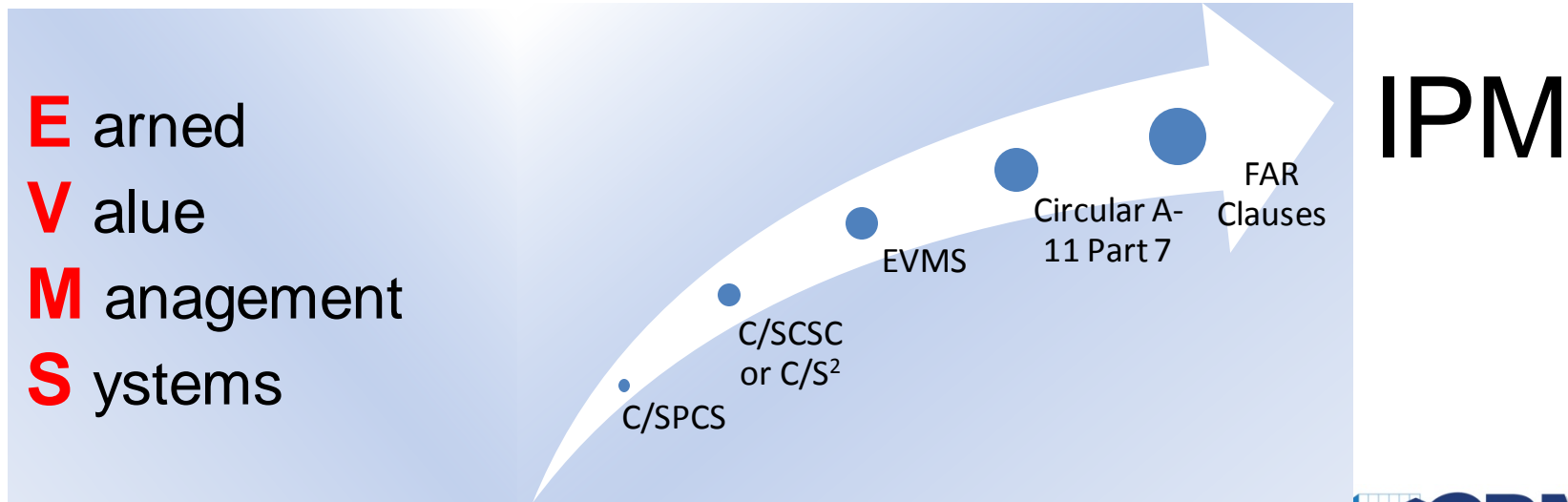
Government Requirements





US Government EVM Policy

- 1966 – Air Force Cost/Schedule Performance Control Specification
- **1967** – DoD Cost/Schedule Control Systems Criteria
- 1996 – OMB adopts C/SCSC in Circular A-11, Part 3
- 1997 – DoD adopts EVMS; OMB follows suit in A-11 Part 3 (now Part 7)
- 1998 – EIA Standard 748-98
- 2006 – Federal Acquisition Regulation Clauses issued



Performance Management Laws

- Government Performance and Results Act of 1993
- Federal Acquisition Streamlining Act of 1994, Title V
- Information Technology Management Reform Act of 1996 (Clinger-Cohen)
- **Program Management Improvement and Accountability Act of 2015**
- Implemented by Executive Office of the President, Office of Management and Budget (OMB)
 - ... cost, schedule, and performance goals are to be controlled and monitored by using an earned value management system; and if progress toward these goals is not met, there is a formal review process to evaluate whether the acquisition should continue or be terminated. (Circular A-11, 2016)
- Audited by Government Accountability Office (GAO)

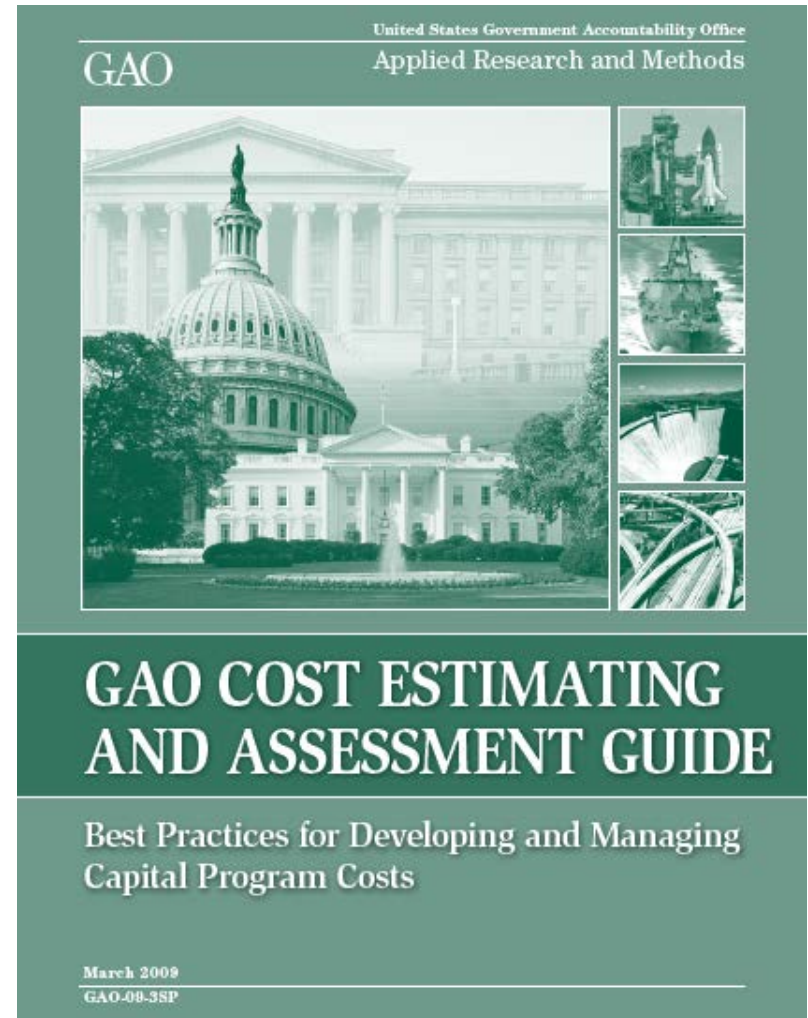


PMIAA

- Signed December 2016
- Reform Program Management in 4 ways by:
 1. Creating a formal job series and career path for program managers in the federal government.
 2. Developing a standards-based program management policy across the federal government.
 3. Recognizing the essential role of executive sponsorship and engagement by designating a senior executive in federal agencies to be responsible for program management policy and strategy. Sharing knowledge of successful approaches to program management. [Have Chief Financial Officer? Name Program Management Improvement Officer]
 4. through an interagency council on program management.

GAO Cost Guide

- Issued March 2009
 - 3 years in development
 - www.gao.gov
 - GAO-09-3SP
- Comprehensive
 - 20 chapters
 - 17 – Cost Estimating
 - 3 – EVM
 - 14 Appendices
 - 56 Tables
 - 42 Figures
 - 48 Case studies
 - 17 Checklists
- > 1,000's downloads
- Used by NSF LFO



Why GAO?

- New name reflects expanded role
 - Old - General Accounting Office
 - Financial audits \approx 15% of workload
 - New - Government Accountability Office
 - Program evaluations
 - Policy analyses and legal opinions
 - Advocate for truth and transparency in government
 - Not just “what is wrong” but best practices
 - Cost guide intended for auditors and as a resource for agencies that lack capabilities of major agencies
- Schedule, Agile, Technology Readiness Levels, Analysis of Alternatives

Using the GAO Cost Guide

- Program Audits
 - F-35 Lightning II (March 2008)
 - Office of Personnel Management Retirement System Modernization (March 2008)
- Agency Audits
 - Federal Aviation Administration (FAA) (July 2008)
- Government-wide Audit (October 2009)
 - GAO 10-2, Agencies Need to Improve the Implementation and Use of Earned Value Techniques to Help Manage Major System Acquisitions

EVM at the Federal Aviation Administration

- OMB budget reduction 2004
- GAO “High Risk List”
- Began major transformation 2005
 - Policy
 - Guidance
 - Training
 - Program assessments
- EVM at Program Level
 - Prime, sub and support contractors
 - Government employees
- Working teams
 - Systems Engineering, Risk Management, Cost Estimating, Contracting, Finance, Operations
 - EVM Council





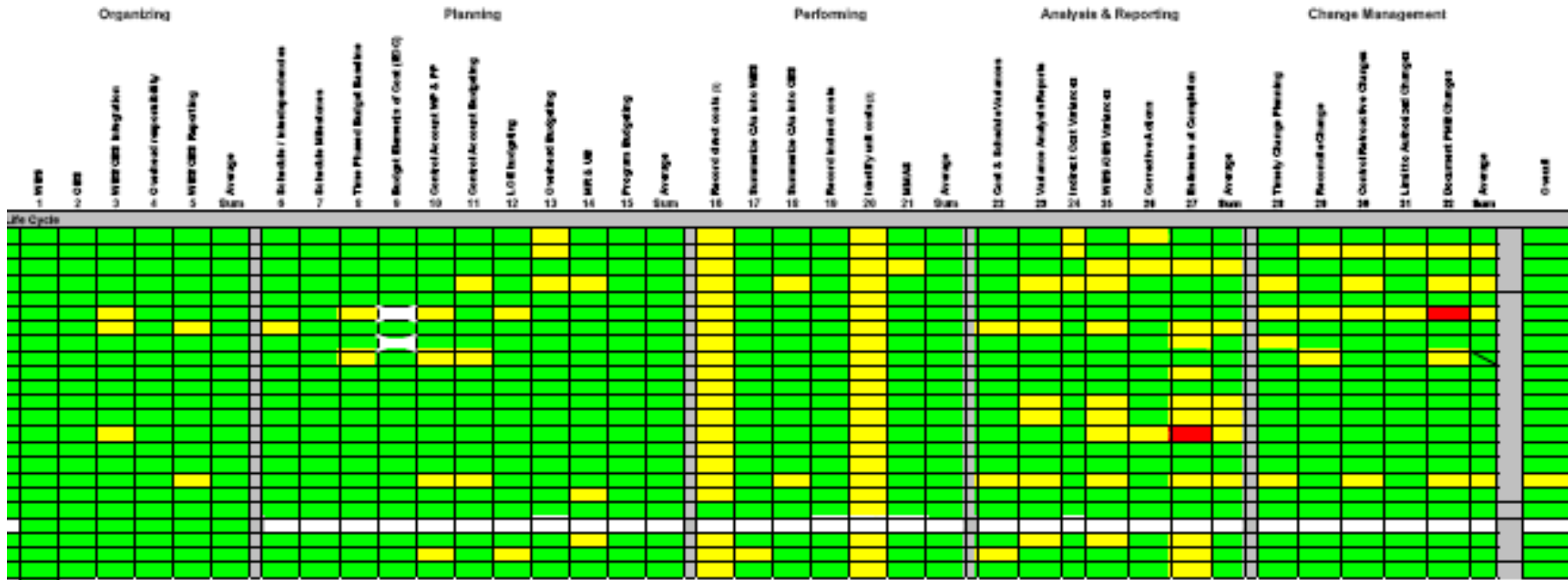
FAA EVM Assessment Summary (Baseline 2005)

| Guideline | Organizing | | | | | Planning | | | | | | | | | | Performing & Accounting | | | | | | | | | | Analysis & Reporting | | | | | Change Management | | | | | | | | |
|-------------|--|--------|---------------------|-------------------|---------|------------------------------|---------------------|-----------------------------|-------------------------------|-------------------------|---------------------------|---------------|---------|-------------------|---------|-------------------------|--------------------|---------------------|------------------------|------------------------|-----------------------|---------------------|--------|-------------------------|---------|---------------------------|---------------------------|-------------------|--------------------|-------------------------|-------------------|------------------------|------------------|-----------------------------|-----------------------------|----------------------|---------|-----|--|
| | WBS | OBS | WBS/OBS Integration | WBS/OBS Reporting | Average | Schedule / interdependencies | Schedule Milestones | Time Phased Budget Baseline | Budget Elements of Cost (EOC) | Control Account WP & PP | Control Account budgeting | LOE budgeting | MR & UB | Program budgeting | Average | Overhead responsibility | Overhead budgeting | Record direct costs | Summarize CAs into WBS | Summarize CAs into OBS | Record indirect costs | Identify unit costs | MMAS | Indirect Cost Variances | Average | Cost & Schedule Variances | Variance Analysis Reports | WBS/OBS Variances | Corrective Actions | Estimates at Completion | Average | Timely Change Planning | Reconcile Change | Control Retroactive Changes | Limit to Authorized Changes | Document PMB Changes | Average | | |
| | 1 | 2 | 3 | 5 | Sum | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 15 | Sum | 4 | 13 | 16 | 17 | 18 | 19 | 20 | 21 | 24 | Sum | 22 | 23 | 25 | 26 | 27 | Sum | 28 | 29 | 30 | 31 | 32 | Sum | | |
| Prog 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prog 2 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 3 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 4 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 5 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 6 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 7 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 8 | | | | | 0.0 | | | | | | | | | | 0.0 | | | | | | | | | | | | | | | | | | | | | | | 0.0 | |
| Prog 9 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | Yellow | Green | Yellow | Yellow | Yellow | | | |
| Prog 10 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 11 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 12 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 13 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 14 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 15 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prog 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prog 18 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prog 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prog 21 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 22 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 23 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 24 | Green | Green | Green | Green | Green | Green | Red | White | Red | Red | White | Green | Yellow | Yellow | Blue | Green | Red | Blue | White | White | Blue | Red | Red | Red | Red | Red | Yellow | Red | Yellow | Yellow | Red | White | Yellow | Green | Yellow | Yellow | Yellow | | |
| Prog 25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prog 26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FAA Average | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Blue | Yellow | Yellow | Blue | Green | Blue | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | | |
| | Agency-Level Guideline not assessed at the Program Level | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Based on Unique Aspects of the Program this Guideline was Not Applicable | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Program Completely in Either the Planning or O&M Phase of the Life Cycle (Guidelines Not Assessed- Transition Plan Provided) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | This Pattern Indicates that the Program is Between a Green and Yellow Assessment Rating | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assessment has NOT been completed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



FAA EVM Assessment Summary (October 2008)

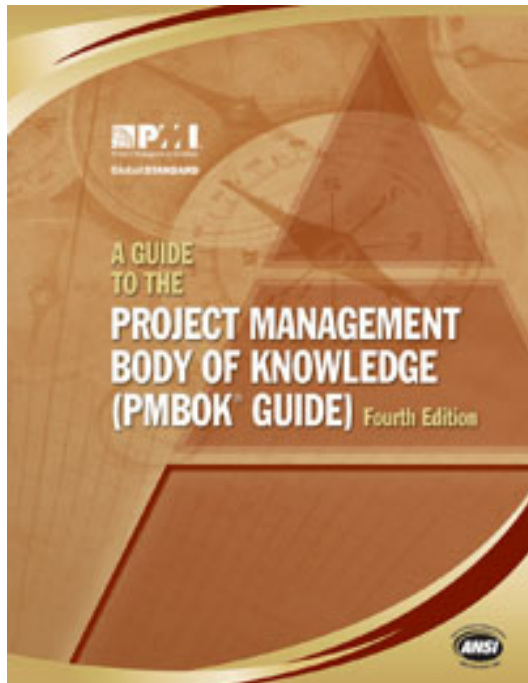
FAA Major Programs - EVM Assessment Summary
(October 2008- Final)



Major Milestone for the FAA

- January 2009 – after 14 years, GAO removed Air Traffic Control Modernization program from its list of high risk programs and operations
 - Significant progress
 - Fewer overruns and schedule delays
 - Going forward – place high emphasis on effective and efficient management
- The only program removed from the list
- EVM played a significant role

EVM Content in the PMBOK®



A Guide to the Project Management
Body of Knowledge (PMBOK® Guide)
- 4th Edition

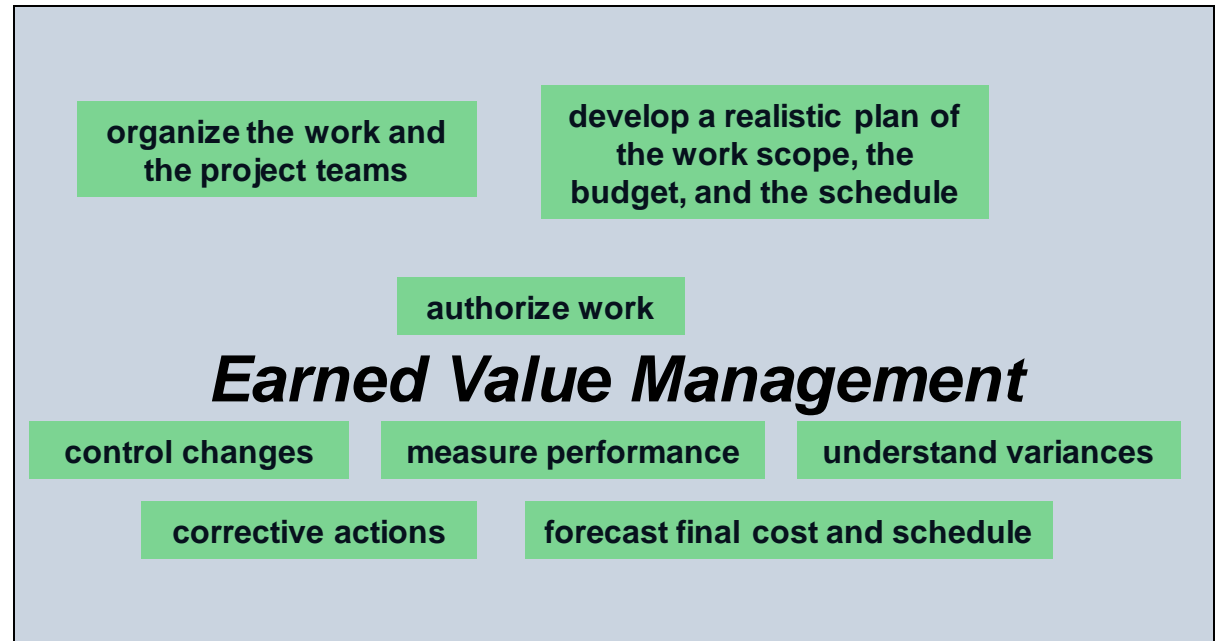
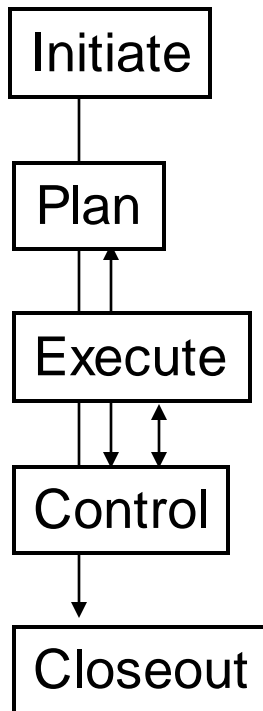
A promotional banner for PMI Marketplace. It features a stack of books on the left, a large red '@' symbol in the center, and the text 'PMI Marketplace' and 'Where project knowledge is always in stock.™' on the right. The background is a gradient of orange and red.

PMI Marketplace *Where project knowledge is always in stock.™*

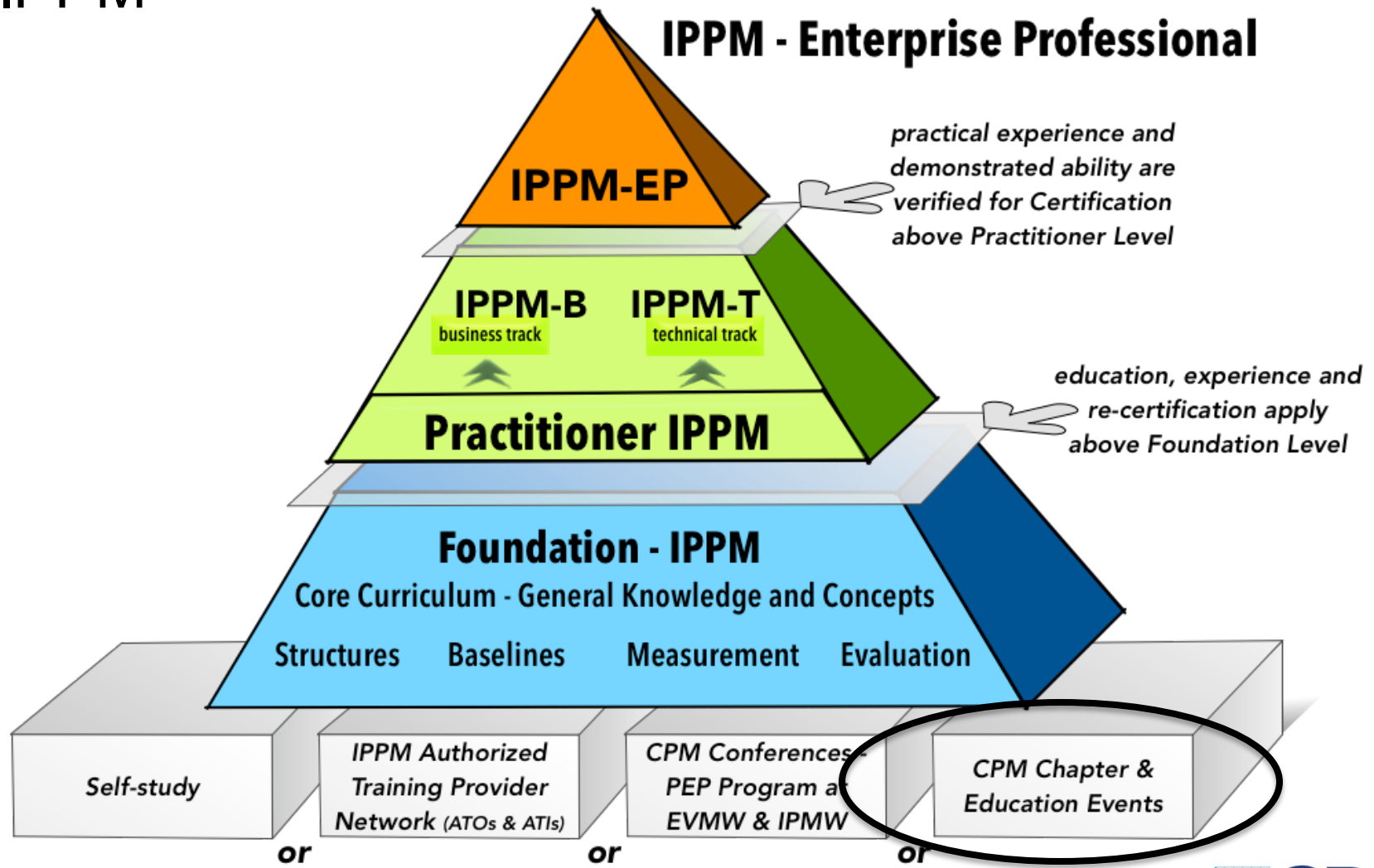
EVM and Project Management

Project Management Needs

Project Management Cycle



Integrated Program Performance Management – IPPM

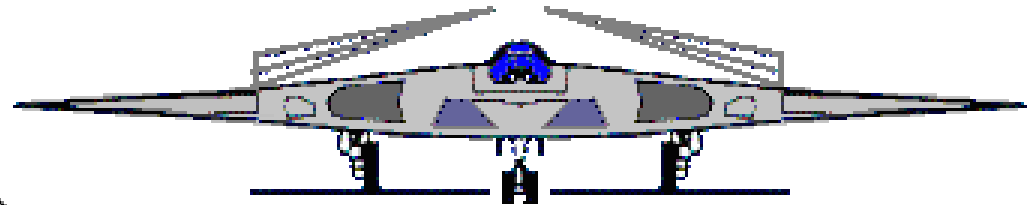
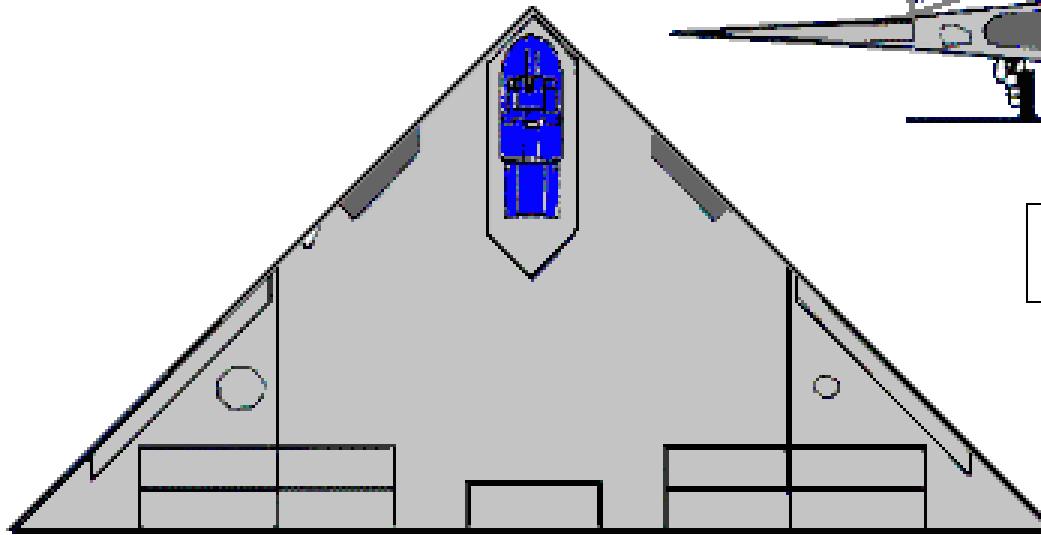


EVM and the International Organization for Standardization (ISO)

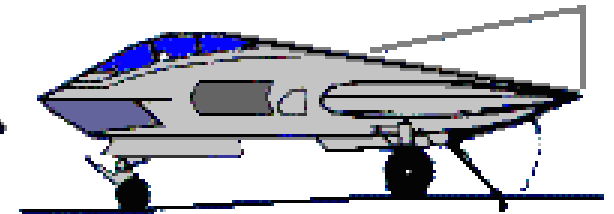
- Technical Committee 258
- 2 new Standards
 - Earned Value Management
 - Work Breakdown Structures
- CPM participating in 2 roles
 - Technical Liaison
 - US Technical Advisory Group (TAG)
- In addition, 2 CPM members on national teams --- Australia and Portugal

WAR STORY
A TALE OF TWO AIRCRAFT:
A-12 AVENGER II
F/A-18E/F SUPER HORNET

A-12 “Avenger” Concept



“The Flying Dorito”



Carrier-based Stealth Aircraft

A-12 Contract – Front Loaded

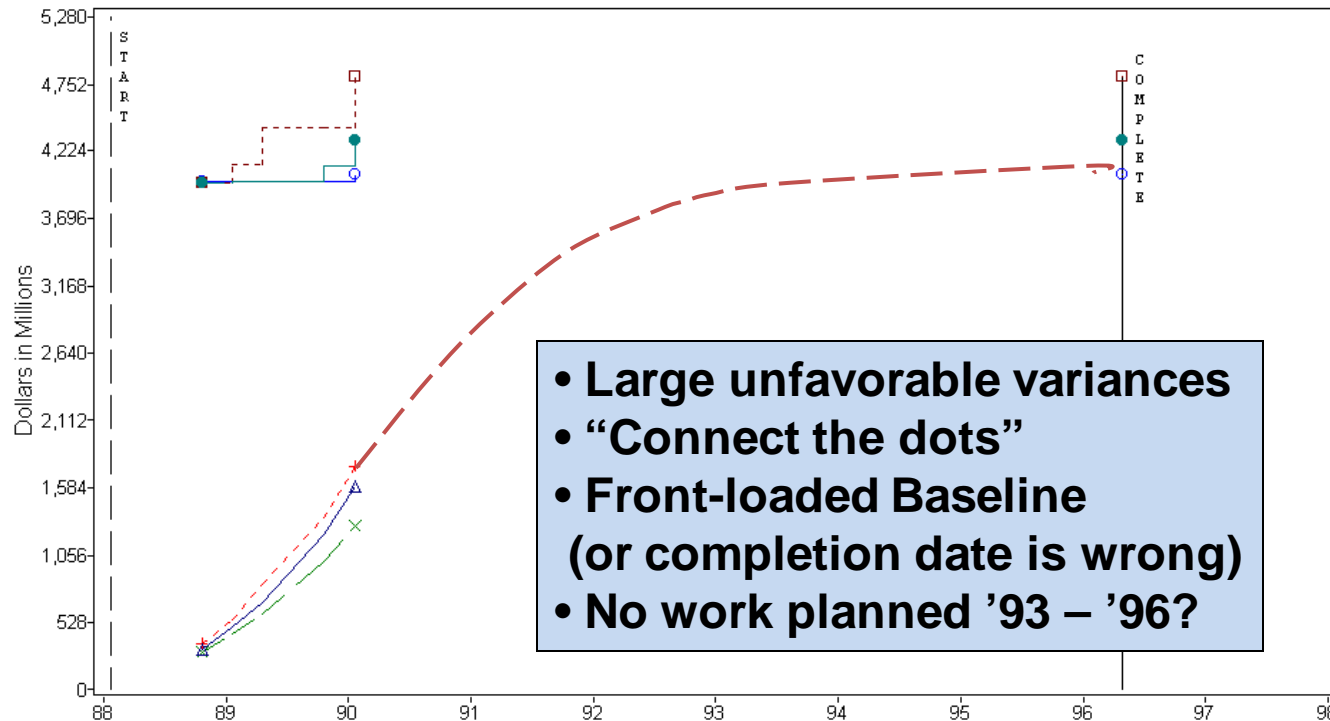
CONTRACT PERFORMANCE

GD/MCAIR

A-12 FSED N00019-88-C-0050 (FPI)

A-12 Adv Tac Acft(N)

As of 12/31/1989



| | | | | | |
|------|---------|---------|-----------------------|---------|---------|
| BCWS | ---+--- | 1,745.0 | Target | —○— | 4,042.3 |
| BCWP | ---x--- | 1,279.2 | Program Manager's Est | ---□--- | 4,808.7 |
| ACWP | —△— | 1,597.1 | Contractor's Est | ---●--- | 4,302.7 |

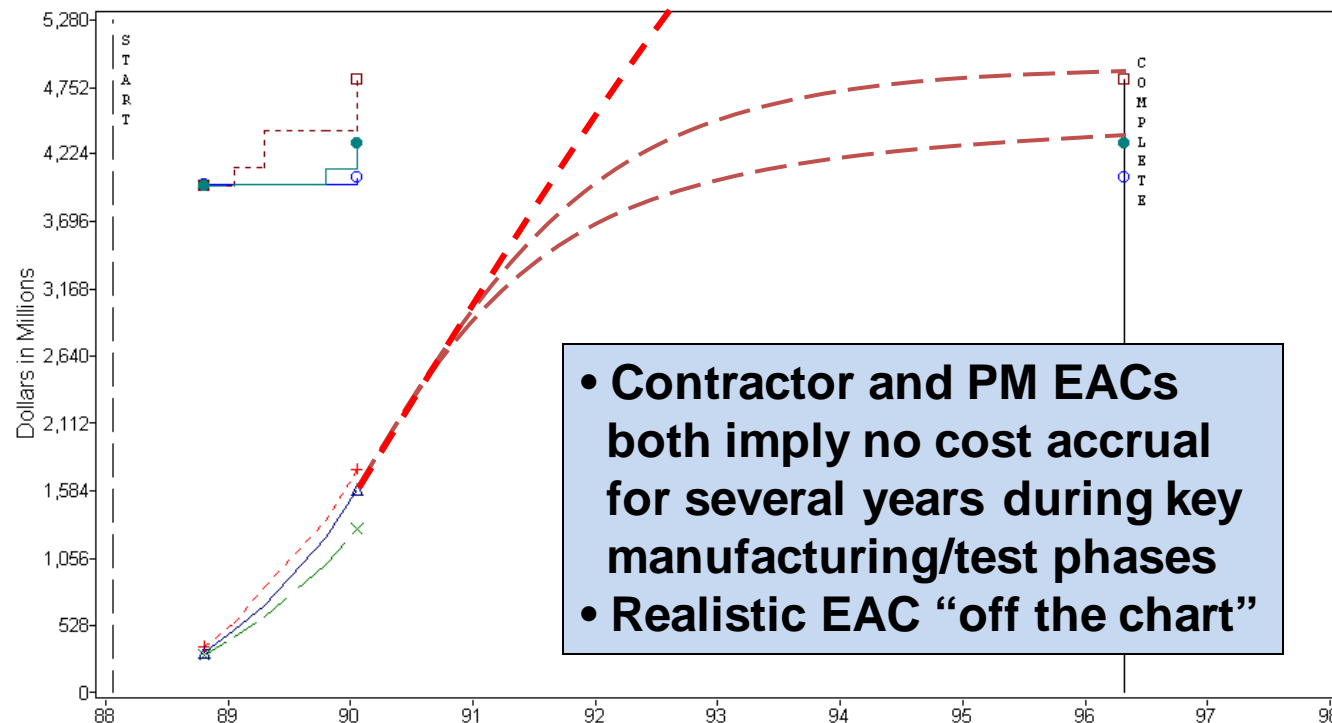
Effective teamwork avoids problems

A-12 Contract – Actual Cost vs. Est at Comp

GD/MCAIR
A-12 FSED N00019-88-C-0050 (FPI)

A-12 Adv Tac Act(N)
As of 12/31/1989

CONTRACT PERFORMANCE



| | | | | | |
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A-12 Contract – Optimistic EACs

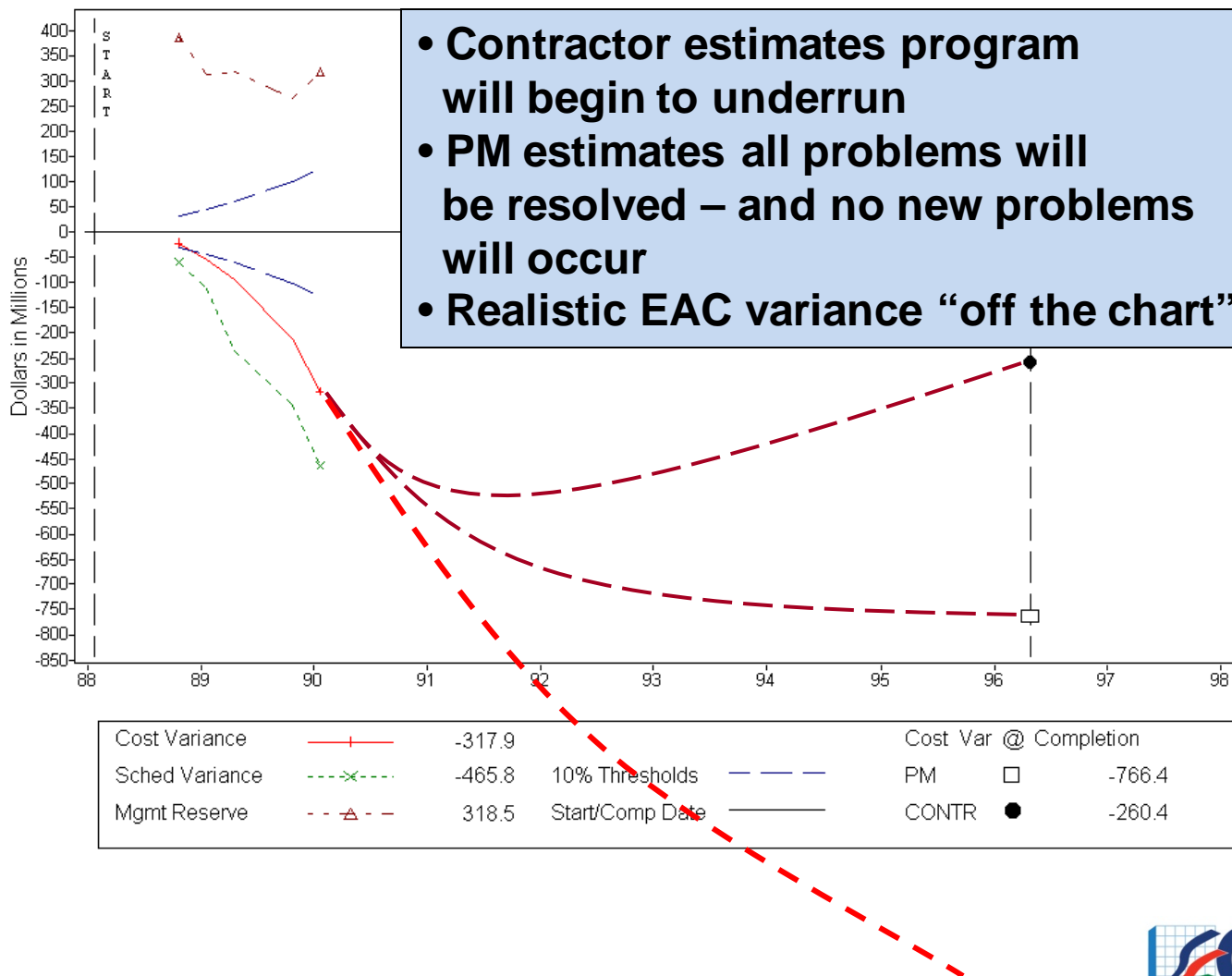
COST/SCHEDULE VARIANCE TRENDS

GD/MCAIR

A-12 FSED N00019-88-C-0050 (FPI)

A-12 Adv Tac Act(N)

As of 12/31/1989



Secretary of Defense on A-12

- In canceling the A-12 program in 1991, Mr. Cheney said:

"This program cannot be sustained unless I ask Congress for more money and bail the contractors out. But I have made the decision that I will not do that. No one can tell me exactly how much more it will cost to keep this program going. And I do not believe a bailout is in the national interest. If we cannot spend the taxpayers' money wisely, we will not spend it."

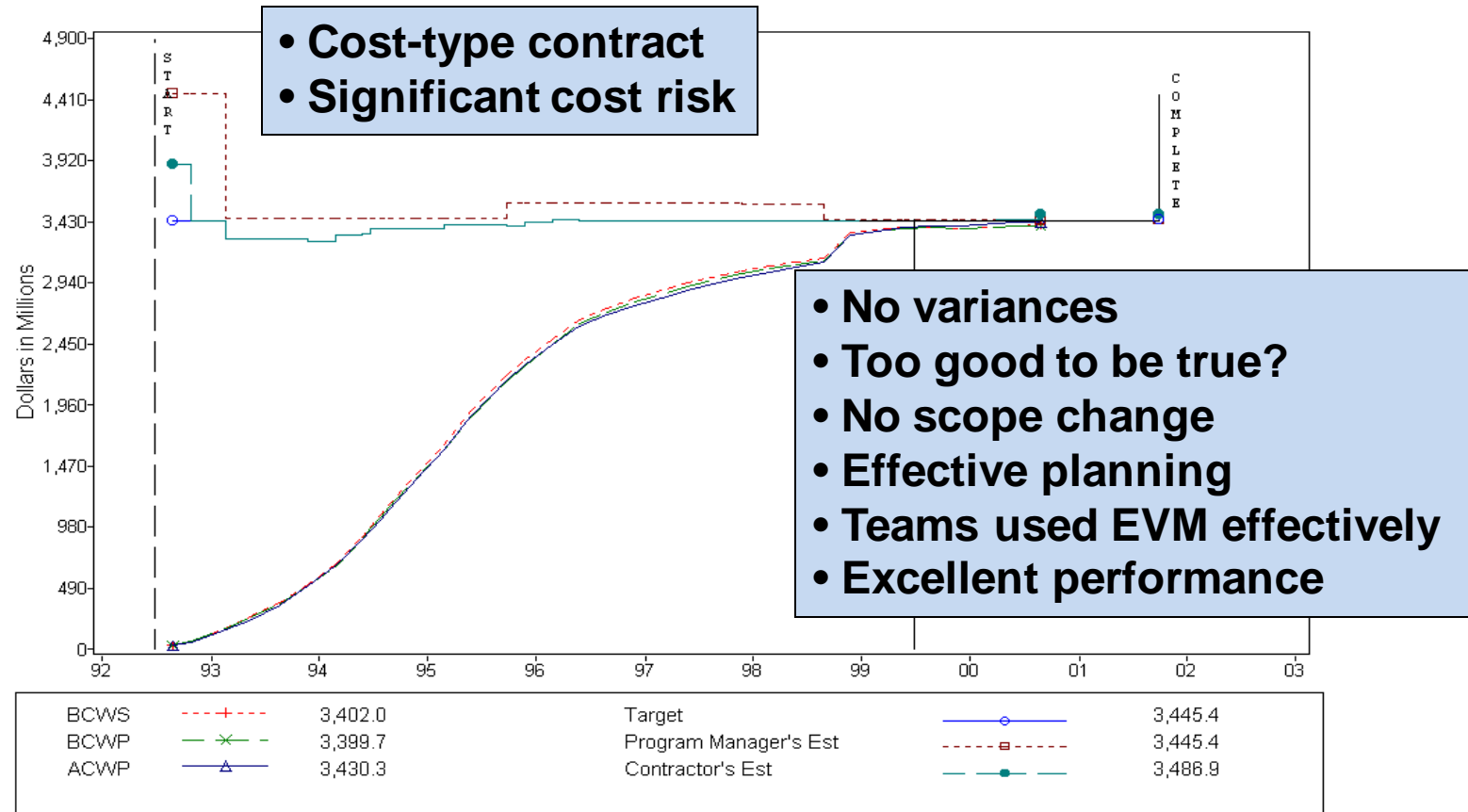
- ***Failure or crisis changes behavior in bureaucracies***
- ***Largest contract termination case in history***
- ***23 years in litigation – 5 trials***
- ***Supreme Court heard case in January 2011 – remanded***
- ***≈ \$2.7 Billion at stake***
- ***Resolved in 2014***
 - ***2 \$198M credits***



Super Hornet Cumulative Trends

MCDONNELL DOUGLAS
Airframe EMD N00019-92-C-0059 (CPAF/IF)

F/A-18 E/F
As of 7/31/2000



Hold contractors accountable for management

Super Hornet Variance Trends

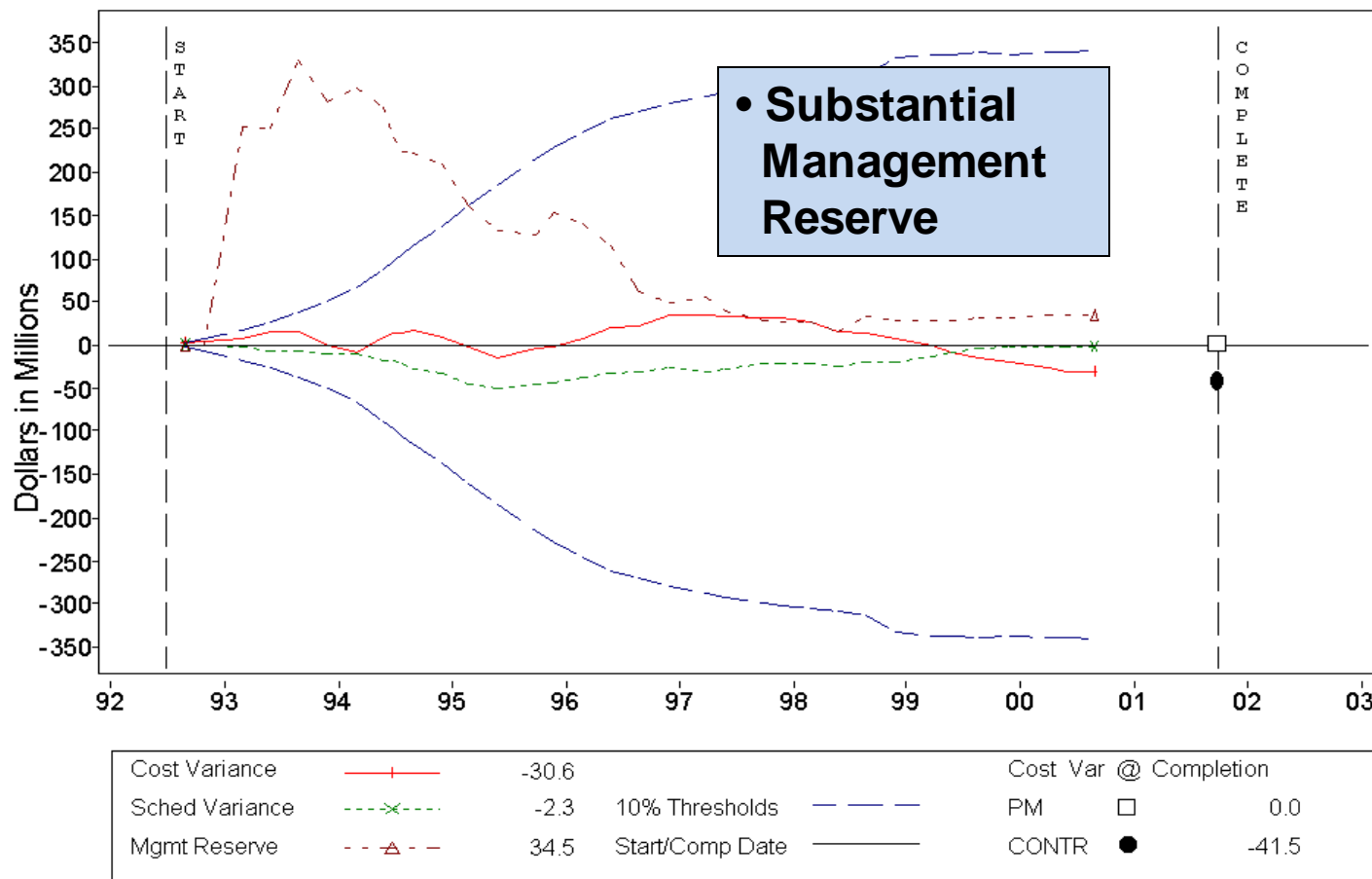
COST/SCHEDULE VARIANCE TRENDS

MCDONNELL DOUGLAS

Airframe EMD N00019-92-C-0059 (CPAF/IF)

F/A-18 E/F

As of 7/31/2000



Post Script: F/A-18E/F in the Fleet



*"I wake up every morning and I want to kiss the Super Hornet on the lips." **

Navy Admiral John B. Nathman, vice chief of naval operations, commenting on the smoothness of the Super Hornet fighter jet acquisition program. Explaining what makes the airplane so lovable, he said "It's an efficient, effective platform... under cost, on schedule."

** National Defense Magazine (March 2005)*

SUMMARY AND Q&A



<https://www.dau.mil/library/defense-atl/p/Current-Issue>

Click on Previous Issues (Upper Right)

Summary and Q&A

- After 50 years, EVM remains the tool of choice for integrated schedule, cost and technical performance management and oversight of complex programs
- EVM is the cornerstone of major US government management initiatives
 - Openness, transparency and accountability are essential
 - Synergistic executive and legislative branch interests
- EVM is growing internationally and CPM is enhancing Technical Benefits Realization and Scheduling integration as core disciplines of IPPM
- Demonstrated effective management → credibility → budget support. Better management = more science!

