Evolution of EVM and the Future

NSF Large Facilities Workshop
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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

$\begin{align*}
\text{Planned Expenditures} \\
\text{Actual Expenditures}
\end{align*}$

Is this program on time...under-running?

$\begin{align*}
\text{Time} \\
\text{Without Earned Value}
\end{align*}$
With Earned Value

- Planned Expenditures
- Actual Expenditures
- Earned Value
- Behind Schedule
- Over-run budget

Time

$
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”

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)
US Government EVM Policy

- **1967** – DoD Cost/Schedule Control Systems Criteria
- 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

**Earned Value Management Systems**
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)
• 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
  – 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 ≈ 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
  - EVM Council
# FAA EVM Assessment Summary
(Baseline 2005)

## Guidelines Overview

| Guideline | 1 | 2 | 3 | 5 | Sum | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 15 | Sum | 13 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Sum | 25 | 26 | 27 | Sum | 28 | 29 | 30 | 31 | 32 | Sum |
| Prog 1    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 2    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 3    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 4    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 5    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 6    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 7    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 8    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 9    |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 10   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 11   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 12   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 13   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 14   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 15   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 16   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 17   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 18   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 19   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 20   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 21   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 22   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 23   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 24   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 25   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Prog 26   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### FAA Average

*Program: Based on Unique Aspects of the Program this Guideline was Not Applicable*

*Program: 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*

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FAA EVM Assessment Summary
(October 2008)
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®

EVM and Project Management

Project Management Cycle

Initiate → Plan → Execute → Control → Closeout

Project Management Needs

- develop a realistic plan of the work scope, the budget, and the schedule
- authorize work
- control changes
- measure performance
- understand variances
- corrective actions
- forecast final cost and schedule

Earned Value Management
Integrated Program Performance Management – IPPM

IPPM - Enterprise Professional

practical experience and demonstrated ability are verified for Certification above Practitioner Level

IPPM-EP

IPPM-B
business track

IPPM-T
technical track

Practitioner IPPM

education, experience and re-certification apply above Foundation Level

Foundation - IPPM
Core Curriculum - General Knowledge and Concepts

Structures  Baselines  Measurement  Evaluation

Self-study

or

IPPM Authorized Training Provider Network (ATOs & ATIs)

or

CPM Conferences:
PEP Program & EVMW & IPMW

or

CPM Chapter & Education Events

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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

- Large unfavorable variances
- “Connect the dots”
- Front-loaded Baseline (or completion date is wrong)
- No work planned ’93 – ’96?

Effective teamwork avoids problems

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

• Contractor and PM EACs both imply no cost accrual for several years during key manufacturing/test phases
• Realistic EAC “off the chart”
A-12 Contract – Optimistic EACs

- Contractor estimates program will begin to underrun
- PM estimates all problems will be resolved – and no new problems will occur
- Realistic EAC variance “off the chart”
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

**CONTRACT PERFORMANCE**

- Cost-type contract
- Significant cost risk

- No variances
- Too good to be true?
- No scope change
- Effective planning
- Teams used EVM effectively
- Excellent performance

Hold contractors accountable for management
Super Hornet Variance Trends

COST/SCHEDULE VARIANCE TRENDS

MCDONNEL DOUGLAS
Airframe EMD N00019-02-C-0059 (CPAF/E/F)

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

- Substantial Management Reserve

Cost Variance: -30.6
Scheduled Variance: -2.3
Management Reserve: 34.5

Cost Var @ Completion:
- PM: 0.0
- CONTR: -41.5

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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
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!