AV-8B Integrated Earned Value Management System

Presented to
College of Performance Measurement
15th Annual Conference
4 May 1999

Presented by
Debra L. Borden
Mark J. Zenthoefer
E-mail: debra.borden@chinalake.navy.mil
E-mail: zenthoefermj@navair.navy.mil
Brief Contents

- OSCAR Overview
- NAWC-WD/Boeing EVMS Overview
- Bringing it all together - The IBR
- Conclusions
AV-8B Operational Requirements

Mission Needs and Operational Requirements Will Continue to Evolve Capabilities

AV-8Bs Must Remain Operationally Capable Through 2015-2020+

- COMMON RAIL LAUNCHER
- DISPLAY COMPUTER UPGRADE
- MSI
- LINK 16
- IHAVS/AIM-9X
- DFC PHASE III SOFTWARE
- ALE-50
- AMRAAM PH II
- JSOW
- SCA PHASE II
- ALR-67(V)2
- ZRF SOLENOID
- IR SIGNATURE
- OC1.1 TRAINER MODS
- ALSO-A-SOB
- DCS-2000
- AMRAAM
- TARGETING POD/LASER TRACKER
- TAMMAC
- TAV-8B PERFORMANCE UPGRADE
- TAMPS
- HAVEQUICK/SINCgars
- FLIGHT INCIDENT RECORDER
- JDAM
- MIL-STD-1760B
- DIGITAL FLAP CONTROLLER
- VIDEO FATIGUE DATA RECORDER
- CMWS/ASTE/ALE-47
- OSCAR
- ARC-210
- GPS
- ATHS
- GPS
- GPS
- GPS
Legacy aircraft such as the Harrier are forced to remain operational well beyond their projected service life

Modernization of existing avionics
  Practical means of extending Harrier’s service life
  Leverage commercial technologies
Challenges of Avionics Modernization

- Existing avionics computational capabilities
  - Existing architectures are incompatible with available commercial technologies
  - Limited computation throughput
  - Input/output bandwidth limitations

- Commercial technology advancements
  - Military application of these technologies is hampered by acquisition process
  - Legacy systems have tightly coupled hardware, software and support equipment which make upgrades difficult
  - Commercial technology changes rapidly
    - Replacement of obsolete commercial parts may be a problem as they become obsolete much faster
Overall system engineering approach is key to using open architectures for legacy upgrades

- Plan to incrementally upgrade avionics suite as time and funding allow
- Engineer immediate upgrade requirements
- Design to allow for changes in the future
What is an Open System Approach?

- Product performance and life cycle support drive engineering decisions
- Modular system design isolates the effect of component upgrades
- Use of commercial, widely used interface standards
- Buy rather than develop system components
Open Systems Benefits

- State-of-the art systems
- Systems fielded faster
- Easier technology insertion
- Increased vendor competition
- Reduced life cycle costs
- Better performance
Open Systems Risks

- Government has less control over outcomes - Government is a consumer vice a designer.

- Open systems products may not provide the optimum design for modules, components, subsystems, and short-term solutions

- Building an open system takes time for:
  - Market Analysis
  - Prototyping
  - Standards selection

- Open systems Interface Standards extensions may cause problems later on in the system life cycle
Open System Core Avionics Requirement

- Replace the existing AYK-14 Mission Computer configuration with PMA-209’s Advanced Mission Computer
- Redesign and code the existing Mission Computer and Stores Management Computer functionality using:
  - Open Systems Architecture
  - Object-oriented Analysis and Design Methodology
  - C++ Programming Language
  - Commercial Software Development Tools
**System Engineering Support Contract**

- Cost Plus Award Fee Contract
- Contract specifies earned value and schedule data
  - CDRLs
    - Planning Data (Time phased budget data)
    - Status Data
    - VARs

**Common WBS and WBS Dictionary**

**BCR between organizations**
EVMS Process Overview

- PMA-257G
- IPT Leader
- OC1.1 Block Leader
- CAsMs
- CAMs
- Business Operations

Organization and Work Authorization (1.0)

Master Schedule
- SOPR
- PBB
- OBS
- WBS
- POD
- PUP

Detailed Planning & Budgeting (2.0)

Analysis & Performance Reporting (4.0)

Revisions & Access to Data (5.0)

ACWP

Accounting (3.0)

- BCWP
- SV
- CV
- BAC
- EAC
- VARs

- CAP
- PMB
- CAA
EVMS Integration Overview

C/SSR (BoIIS)

NIFMAS (NAWC-WD)

FSDB (NAWC-WD)

IMICS

C/SSR (EER/CTA)

COBRA (NAWC-WD)

MCS (Boeing-St. Louis)

OPP (NAWC-WD)

OPP Schedule Data

Combined NAWC-WD & Boeing
- CPR Format 1
- CPR Format 5
- Histograms
- S Curve

Integrated Schedule

Actual Cost Data

Actual Cost Data

EVM Data

EVM Status

Actual Cost Data

Actual Cost Data

Actual Cost Data

Actual Cost Data

Actual Cost Data

Actual Cost Data
Work Authorization Process

Establish Project Budget Baseline (PBB), Statement of Program Requirements (SOPR), and Master Schedule (1.1)

Approve and sign Program Office Directive (POD) (1.2)

Establish Performance Measurement Baseline (PMB) (1.3)

Approve and sign Control Account Agreement (CAA) (1.4)

- PMA-257G
- IPT Leader
- OC1.1 Block Leader
- CAsMs
- CAMs
Program Office Directive Contents

- Statement of Program Requirements (SOPR)
- Master Program Schedule
- Summary Program WBS Funding Plan
- Identification of Funding Sources
- Boeing Cost Plus Award Fee Contract Variance Analysis Threshold
  $100,000 or more and 10% of Sub-CLIN BAC
Detailed Planning & Budgeting

PMA-257G

IPT Leader

OC1.1 Block Leader

CAsMs

CAMs

Business Operations

Develop WBS & Dictionary; Establish target PMB budget for CAs

Assign Manager to each CA; Perform Control Account Planning

Resolve activity dependencies among Control Accounts

Ensure all CA WP/PPs start/stop dates support Master Schedule

Negotiate allocated CA PMB w/ CAP; sign CAA

Enter planning data into EVMS

Enter revised planning data into EVMS

Integrated CA Schedule

Allocated PMB/CA

PPR

RAM

B

I

R

Vers1 DLB/MJZ
Establish Project Budget Base

- **PMA-257G**
  - Provide ATP on Program Planning

- **IPT Leader**
  - Negotiate Project Budget Base
  - Prepare DRAFT WBS, WBS Dictionary, OBS, and Master Schedule. Identify MR, Distributed and Undistributed Budget.

- **OC1.1 Block Leader**
  - Identify Control Accounts in RAM w/ allocated budget.

- **CAsMs**

- **CAMs**

- **PPR**
  - Create Project Planning Request.
OMNI OC1.1 PBB Distribution

Program Budget Baseline (PBB)

Performance Measurement Baseline (PMB)

- NAWC-WD PMB Budget
  - Control Accounts
    - Work Packages
  - Undistributed Budget
    - Control Accounts
      - Planning Packages
  - PMB
    - MR
      - Award Fee

Management Reserve (MR)

Boeing-STL PBB Budget

- Control Accounts
Develop Control Accounts

PMA-257G

IPT Leader

OC1.1 Block Leader

Distribute Project Planning Request Form to all TTLs.

CAsMs

Identify all activities that will be accomplished to achieve scope of work identified in PPR.

Develop CA Statement of Work (SOW). Develop Basis of Estimate (BOE).

Group Activities into a time-phased logical sequence using Open Plan or MS Project.

CAMs

Identify milestones between CAPs to ensure that work and schedule are horizontally integrated across entire project. Reconcile distributed CA budget with CA BCWS.
Control Account Contents

- Statement of Work
- JON
- Schedule
- Authorized Budget
- Time Phased Budget
- Earned Value Measurement Techniques
- Work Packages/Planning Packages
- Activity Schedule
Project Performance Analysis

- PMA-257G
- IPT Leader
- OC1.1 Block Leader
- CAsMs
- CAMs
- Business Operations

**Status CA Earned Value every month.**

**Document and analyze variances.**

**Discuss impact of all variances as well as necessary corrective action.**

**Prepare Format 5 CPR for variances over threshold limits.**

**Prepare and deliver Sponsor Reports.**

**CPR Format 1 and Format 5**
# Document and Analyze Variances

<table>
<thead>
<tr>
<th>PMA-257G</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IPT Leader</td>
<td></td>
</tr>
<tr>
<td>OC1.1 Block Leader</td>
<td></td>
</tr>
<tr>
<td>CAsMs</td>
<td></td>
</tr>
<tr>
<td>CAMs</td>
<td></td>
</tr>
<tr>
<td>Business Operations</td>
<td></td>
</tr>
</tbody>
</table>

- Issue Variance Reports to CAMs.
- Analyze Control Account Variances.
- Determine cause of VAR, schedule impact, corrective action, and revised EAC.
- Violates Threshold?
- Prepare CPR Format 5.

CPR Format 5
PUP contents describe:

- Tools and methods program will use to accomplish Earned Value Management
- Deviations from the minimum requirements stated in the NAVAIR EVM System Description Document Version 1.1
- Aspects of a program’s EVMS that is not fully compliant with DOD 5000.2-R criteria
- Work Breakdown Structure coding instructions
- Reconciliation of accounting data (ACWP)
Bringing it all together

an

Integrated Baseline Review (IBR)

April 19-21, 1999
OMNI OC1.1 IBR Expectations

- Provide the IPT with sufficient insight to effectively evaluate
  - the contents of the integrated EVMS
    - technical
    - budget
    - schedule
  - EVMS products
  - EVMS architecture
  - EVMS tools
IBR Entrance Criteria

- EVMS used for 2-3 months
- EVMS has generated CPR for 2-3 months
- PUP approved and signed
- PBB established
- POD approved and signed
- CAM Notebooks created
IBR Entrance Criteria

- Approved SOPR
- Approved Master Program Schedule
- Integrated NAWC-WD/Boeing WBS
- Integrated NAWC-WD/Boeing WBS Dictionary
- IBR Brief
IBR Team

- Led by Program Office IPT Leader

- Team members included:
  - Program office technical specialists
  - NAVAIR EVM Specialists (supplemented by contractor support)
  - OSD - Mr. Van Kinny
  - DCMC - DPRO St. Louis

- IBR held at Boeing’s facility in St. Louis
  (NAWC-WD CAMs came to Boeing)
IBR Results

- IBR Team consisted of 14 Technical & EVM Analyst
- Interviewed 23 CAMs
  - 16 of 17 Boeing CAMs
  - 7 of 10 NAWC-WD CAMs
- Generated Concern Reports
- NAVAIR will track concerns to resolution
- Review was completed in a cooperative & productive environment
Strengths

- First time Integrated EVMS has been accomplished between Contractor & Government Facility
- NAWC-WD & Boeing have established a baseline for performance measurement
- System interfaces functioning well
- Good CAM knowledge and management of tasks
Strengths cont...

- Earned Value metrics for software development
- Management commitment to EVM
  - Boeing EVM experience has been beneficial
  - NAWC-WD has made significant progress
- Leadership - CAMs and support staff were open & candid
- “CAM bakes” demonstrate use of EV data
Concerns

- Aggressive software productivity assumptions
  (Issue resolved)

- Establish and manage a critical path schedule

- Create a process to transfer scope & budget between NAWC-WD & Boeing

- Amount of LOE in combined Control Accounts may distort performance measurement
IBR Summary

- IBR expectations achieved
- Performance measurement baseline captures cost, schedule and technical content of the project
- IBR review team identified pertinent issues that will improve the EVM system & data quality
- Project teams hard work, dedication, and commitment to the EVM implementation led to the success of the IBR
Conclusions
Journey towards establishing EVMS was valuable
- Discussions among Task Team Leaders
- Discussions between Boeing and NAWC-WD
- Recognized activity dependencies between all organizations
- EVMS provides baseline for budget, scope of work and schedule
- Tool to manage requirements changes

EVMS provided a means for a cultural change in engineering management at AV-8B
EVM Implementation
Conclusions Cont...

- Tools and Boeing interface has worked
- Provides process for meaningful dialogue between product team and program team
- EVMS requires a lot of education for all team members
- Need to assess workload for EVMS administration overhead
Conclusions

- EVM has provided significant improvement in visibility of budget and work scope
- The IBR is a critical part of preparing to execute a program
- Program office has a powerful tool to focus management attention