Acquisition Reform: Integrate Technical Performance with Earned Value Management

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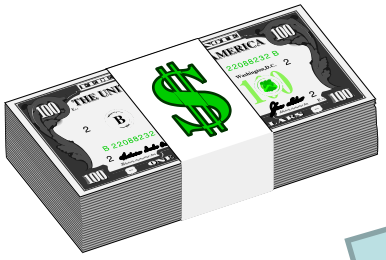
Agenda

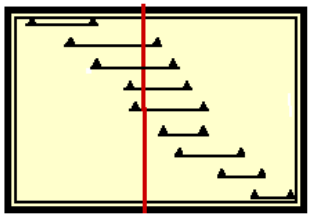
- Link EV to Technical Performance/Quality
- Government Needs and Acquisition Reform
- Standards, Models and DoD Guides
- Practical Application
- Proposed EVM Acquisition Reform

Does EVMS Really Integrate?

EVMS

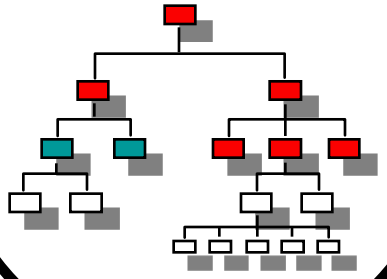


COST

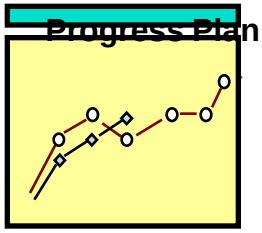


SCHEDULE

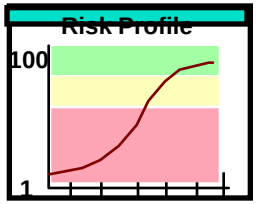
WBS



TECHNICAL PERFORMANCE



RISK



Value of Earned Value

"EVM data will be reliable and accurate only if:

- **The right base measures of technical performance are selected**

  and

- **Progress is objectively assessed" (a)**

(a) "Integrating Systems Engineering With Earned Value Management" in *Defense AT&L Magazine*, May 2004

Government Needs and Acquisition Reform

Office of Management and Budget (OMB)

- **OMB Circular No. A-11, Section 300**

  Planning, Budgeting, Acquisition and Management of Capital Assets

  - **Section 300-5**
    - ***Performance-based*** **acquisition management**
    - **Based on EVMS standard**
    - **Measure progress towards milestones**
      - **Cost**
      - ***Capability to meet specified requirements***
      - **Timeliness**
      - ***Quality***

DoD EVM Report to Congress

2009 Report: *DoD Earned Value Management: Performance, Oversight, and Governance* (1)

"Utility of EVM has declined to a level where it does not serve its intended purpose."

Findings and Recommendations:

- ***Inaccurate*** **EVM status data provided by vendors**
- **Use *Technical Performance Measures* (TPM)**
- **Integrate *Systems Engineering* (SE) with EVM**

(1) Required by Section 887 of the of the FY 2009 NDAA, "Weapon Systems Acquisition Reform Act of 2009" (WSARA), Sept. 2009

EVM Challenges in Report to Congress

Challenge: Technical Performance
• EVM can be an effective program management tool only if it is integrated with technical performance • The engineering community should establish technical performance measures (TPM) that enable objective confirmation that tasks are complete;

EVM Challenges in Report to Congress

Challenge: Technical Performance

• If good TPMs are not used, programs could report 100 percent of earned value (or credit for work performed), even though they are behind schedule in terms of:
  • validating requirements
  • completing the preliminary design
  • meeting weight targets
  • or delivering software releases that meet the requirements.

EVM Challenges in Report to Congress

Challenge: Technical Performance

• The earned value completion criteria
  • must be based on technical performance
  • the quality of work must be verified, and
  • criteria must be defined clearly and unambiguously.
• The PM should ensure that the EVM process measures the quality and technical maturity of technical work products instead of just the quantity of work performed.

EVM Challenges in Report to Congress

Challenge: SE/Technical Baseline
EVM can be an effective program management tool only if • **the EVM processes are augmented with a rigorous SE process** • **the SE products are costed and included in EVM tracking.** **If the SE life-cycle management method is integrated with the planning of the Performance Measurement Baseline (PMB), then EVM will accurately measure technical performance and progress.**

DoD Need: Integrated Testable Requirements

Memo: Test & Evaluation of DoD Programs (1)

1. **Improve relationship among testing, require-ments, and program management communities**
2. **Well defined, testable requirements**

- Requirements development must be informed by technical feasibility and ***rigorous trade-off analysis***.
- Define requirements in ways that are clear and ***testable***…should be achieved as early as possible.
- Define requirements in ways that provide *meaningful* ***increments of operational capability.***
- Define requirements in ways that enable efficient program execution.

(1) 6/3/2011, signed by USD for AT&L, Ashton Carter and Director OT&E, J. Michael Gilmore.

EVMS Quality Gap

Quality Gap

EVMS Standard shortfall (3.8):

- **"EV is..measurement of *quantity* of work"**
- ***"Quality* and *technical* content of work performed are *controlled by other means" !?***

EVMS Standard shortfall (Guideline 2.2b):

Identify physical products, milestones,

- **technical performance goals**

"*or*" other indicators that will be used to measure progress.

Quality Gap

"or"* not *"and;"* *technical performance is optional

Management Reserve (MR) Quality Gap

EVMS loopholes enable misuse of MR:

3.5.4 "MR is held for *unexpected growth* within the currently authorized *work scope*"

How is MR misused?

1. **Frequent causes of additional testing and rework:**
   - **Unrealistic baseline assumptions**
     - **Low estimates of rework %, software defects etc.**
   - **Failure of design to meet technical requirements**
2. **MR used to budget additional testing and rework, masked as "scope growth"**
3. **Results: Accurate progress and true cost overrun are not reported**

EVMS Quality Gap

EVMS Standard, Federal Acquisition Regulation (FAR) and Defense FAR Supplement (DFARS) are deficient:

No **guidance or requirement to link**

- **Reported EV**

  with

- **Progress toward meeting *Quality/technical performance requirements***

Guidance in Standards, Models, and DoD Guides

Requirements and Product Metrics

ISO/IEC 26702	EIA-632
6.8.1.5 Performance-based progress measurement	4.2.1 Req. 10: Progress against requirements
6.8.1.5 d) Assess • *Development maturity* • Product's ability to *satisfy requirements* 6.8.6 ***Product metrics at pre-established control points:*** • Evaluate system ***quality*** • ***Compare*** **to *planned goals and targets***	Assess ***progress*** … • Compare system definition ***against requirements*** a) Identify ***product metrics*** and ***expected values*** ▪ ***Quality*** of product ▪ Progress towards ***satisfying requirements*** d) ***Compare*** results against ***requirements***

Requirements-based Success Criteria

ISO/IEC 26702, (6.6): Success Criteria (CDR)

- **Design solution meets:**
  - ***Allocated performance requirements***
  - ***Functional performance requirements***
  - **Interface requirements**
  - **Workload limitations**
  - **Constraints**
  - **Use models and/or prototypes to determine success**

Technical Performance Measures (TPM)

ISO/IEC 26702: 6.8.1.5, Performance-based progress measurement	EIA-632: Glossary
TPMs are key to progressively assess technical progress	*Predict* future value of *key technical parameters* of the end system based on current assessments
Establish *dates* for – Checking progress – Meeting full conformance to requirements	*Planned value* profile is time-phased achievement projected • *Achievement to date* • *Technical milestone where TPM evaluation is reported*

Proposed Solution includes *SE Leading Indicators Gu*ide: Requirements Trends

Leading Indicator	Insight Provided	Base Measures
Requirements Validation Trends	Progress against plan in assuring that the customer requirements are valid and properly understood.	1. Requirements 2. Requirements Validated
Requirements Verification Trends	Progress against plan in verifying that the design meets the specified requirements.	1. Requirements 2. Requirements Verified

TPMs in INCOSE SE Handbook

4.3.1.4: The architectural design baseline ...includes:

- **TPM Needs – TPMs are measures tracked to influence the system design**
- **TPM Data – Data provided to measure TPMs**

5.1.2.2 Systems Engineering Plan (SEP)

- **TPMs are a tool used for project control**
- **The extent to which TPMs will be employed should be defined in the SEP.**

5.7.2.4 TPMs

- **Without TPMs, a project manager could fall into the trap of relying on cost and schedule status alone**
- **This can lead to a product developed on schedule and with cost that does *not meet* all *key requirements*.**
- **Values are established to provide limits that give early indications if a TPM is out of tolerance.**

Project Management Body of Knowledge Guide (PMBOK®)

5 Project Scope Management

In the project context, the term scope can refer to

- ***Product scope.*** **The *features* and *functions* that characterize a product, service, or result**
- **Project scope. The *work* that needs to be accomplished to deliver a product, service, or result with the specified features and functions.**

11.6.2.4 Technical Performance Measurement

- **TPM compares technical accomplishments during project execution to the … schedule of technical achievement.**
- **It requires definition of objective, quantifiable TPMs which can be used to compare actual results against targets.**

DoD Guides: Integrated Planning

DoDI 5000.02, Operation of the Defense Acquisition System (POL) 12/08
Defense Acquisition Guidebook (DAG)
Systems Engineering Plan (SEP) Preparation Guide 4/08
WBS Handbook, Mil-HDBK-881A (WBS) 7/30/05
Integrated Master Plan (IMP) & Integrated Master Schedule (IMS) Preparation & Use Guide 10/21/05
Guide for Integrating SE into DOD Acquisition Contracts (Integ SE) 12/06
Defense Acquisition Program Support Methodology (DAPS) V2.0 3/20/09

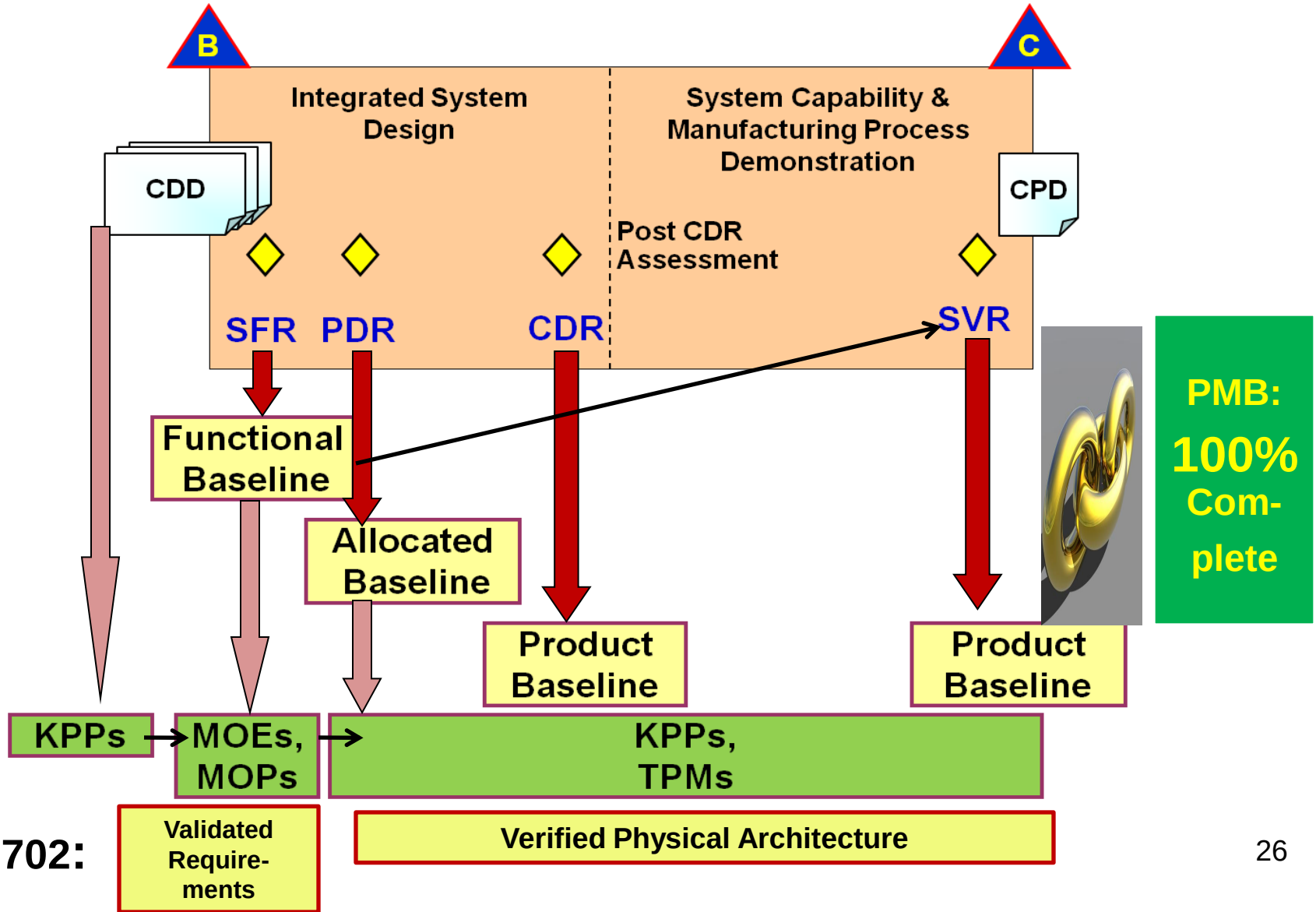
DoD: Technical Baselines And Reviews

DoD Policy or Guide	POL	DAG	SEP	WBS	IMP/ IMS	Integ SE	DAPS
Technical Baselines in IMP/IMS (Milestones): • Functional (SFR) • Allocated (PDR) • Product (CDR)		X				X	X
Technical Reviews:							
• Event-driven timing of technical reviews	X	X	X	X	X	X	X
• Success criteria of technical reviews	X	X	X	X	X	X	X
• Include entry and exit criteria for technical reviews in IMP and IMS		X	X			X	X
• Assess technical maturity in technical reviews		X	X	X		X	

DoD: Integrated Plans

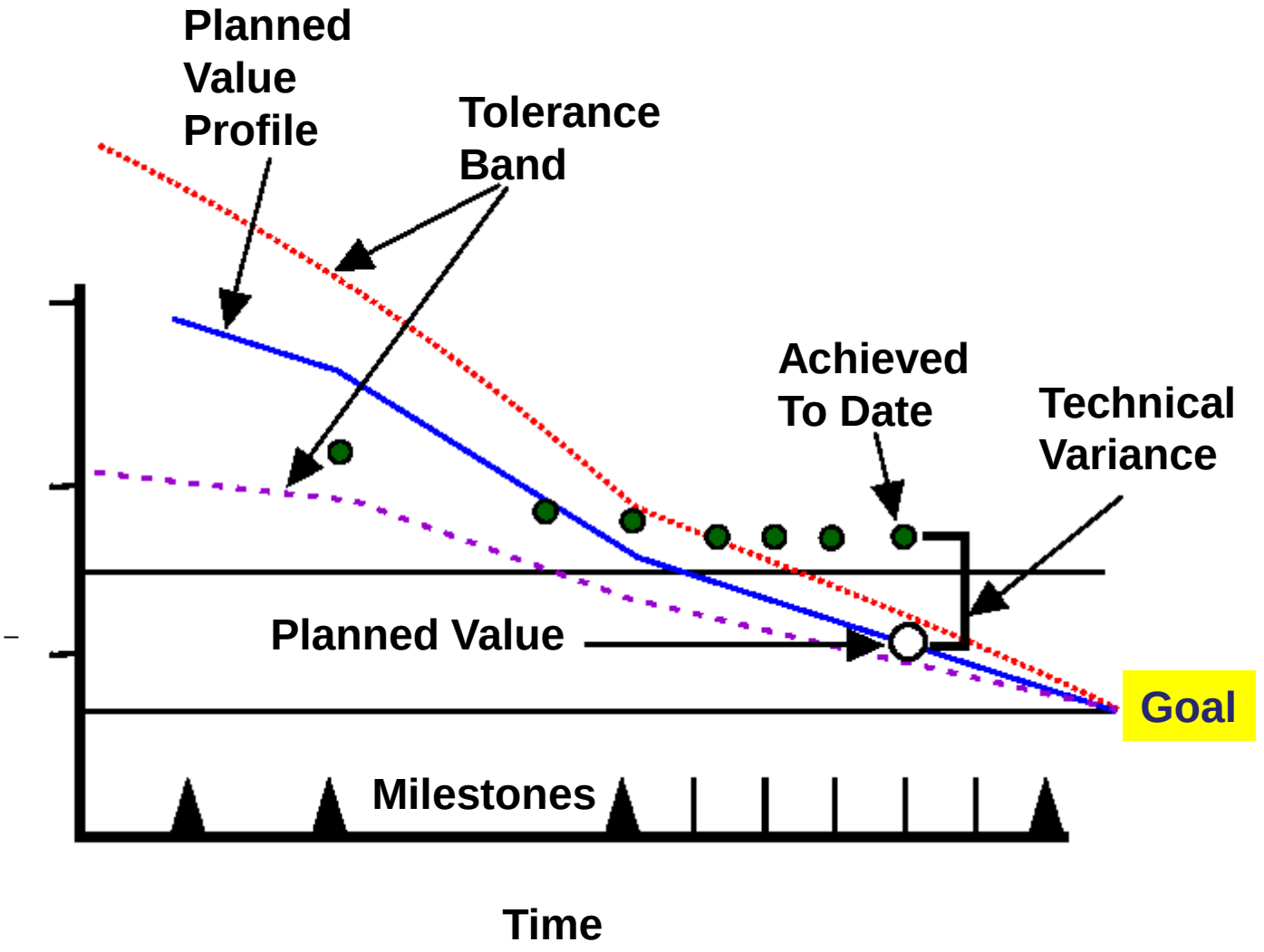
DoD Policy or Guide	POL	DAG	SEP	WBS	IMP/ IMS	Integ SE	DAPS
Integrate SEP with: • IMP/IMS • *TPMs* • EVM		X	X		X	X	X
Integrate WBS with • *Requirements specification* • Statement of work • IMP/IMS/EVMS		X		X	X	X	X
Link risk management (including risk mitigation plans), technical reviews, *TPMs*, EVM, WBS, IMS		X				X	X

Link PMB to Technical Baselines, Reviews, and Measures



Practical Application

TPM Performance vs. Baseline



Ex 1: EV Based on Drawings and TPMs (1 of 8)

- **SOW: Design a component, Enclosure, with 2 TPMs:**
  - **Maximum (Max) weight**
    - **Planned Value (PV): 6 lb. (May)**
  - **Max dimensions (length + width + height)**
    - **PV: 32 inches (when 80% drawings complete, April)**
- **Enabling work products: 50 drawings**
- **BAC: 2000 hours**
  - **Drawings: 40 hours/drawing @ 50 = 2000**
  - **If TPM PVs *not* met on schedule:**
    - **Develop recovery plan (RP)**
    - **Negative adjustment to EV based on RP**

Ex 1: EV Based on Drawings and TPMs (2 of 8)

Recovery Plan Adjustment to EV:

1. Develop RP to reduce weight from 7 to 6 lb.
2. Determine duration and completion date of RP
3. Move ETC *forward* to completion date of RP
4. Make negative adjustment to cum. BCWP =
   (duration of RP) x BCWS/period = (*backwards* adjustment)

Example:

- If RP = 1.5 months and
- BCWS = 400 / month
- Then RP *backwards* EV adjustment = - 600

Benefits:

1. Cum. EV reflects realistic schedule variance
2. Track RP with EV

Ex 1: EV Based on Drawings and TPMs (3 of 8)

Schedule	Total	Jan	Feb	Mar	Apr	May	Total
	Draw-ings						
Drawings/ period	50	8	10	12	10	10	50
Meet requirements:							
Weight	6 lb.						
Dimensions	32 in.						

Ex 1: EV Based on Drawings and TPMs (4 of 8)

Date	April 30	May 31
Drawings completed	41	49
Weight met	No	No
Dimensions met	Yes	Yes

Ex 1: EV Based on Drawings and TPMs (5 of 8)

Design (drawings)	Jan.	Feb.	Mar.	Apr.	May	Total
Planned drawings cur	8	10	12	10	10	50
Planned drawings cum	8	18	30	40	50	
BCWS cur	320	400	480	400	400	2000
BCWS cum	320	720	1200	1600	2000	2000
Actual drawings completed cur	9	10	10	12	8	
Actual drawings completed cum	9	19	29	41	49	
EV (drawings) cum	360	760	1160	1640	1960	
RP EV adjustment				0	-600	
Net EV cum	360	760	1160	1640	*1360*	*1360*

SV = -640

Ex 1: EV Based on Drawings and TPMs (6 of 8)

May schedule variance (drawings and requirements):

- **1 drawing behind schedule** **- 40**
- **Dimensions requirement met** **- 0**
- **Weight requirement *not* met and recovery plan will extend ETC**
  - **RP EV adjustment = 1.5 x (- 400/month) =** **- 600**

Schedule variance (SV) **- 640**

Ex 1: EV Based on Drawings and TPMs (7 of 8)

May comprehensive schedule variance analysis

- **Primary driver of SV is weight reduction (- 600)**
- **Recovery plan**
  - **Use magnesium alloy instead of aluminum; 1 lb. reduction**
  - **15 drawings to be reworked; dimensions and interfaces**
- **Recovery plan will take 6 weeks**
  - **Reflected in negative EV adjustment and IMS status**
- **Typical EAC and schedule impacts:**
  - **ETC extended 6 weeks until July 15**
  - **Non-recurring EAC: + $50K**
  - **Recurring material and fabrication costs: $800/unit**
  - **Schedule impact on CDR; slip 4 weeks**

Ex 1: EV Based on Drawings and TPMs (8 of 8)

Schedule	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	
Plan: Drawings/ period	50	8	10	12	10	10			
Weight	6 lb.								
Original EV cum		360	760	1160	1640	1960			
Rework Drawings							10	5	
Negative EV						-600			
Adjusted EV						1360			
IMS	Before After								

Proposed EVM Acquisition Reform

Revise Acquisition Policy, Regulations, SOW

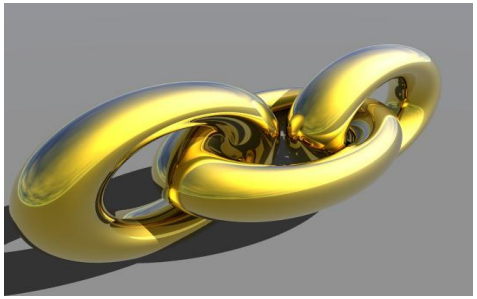
- Federal
  - OMB policy and FAR
- DoD
  - DFARS
  - DoDI 5000.02
  - DoD acquisition and SE guides
- Interim solution: Impose contract requirements per *CrossTalk* article, Jan. 2013:

  "Basing EV on Technical Performance"

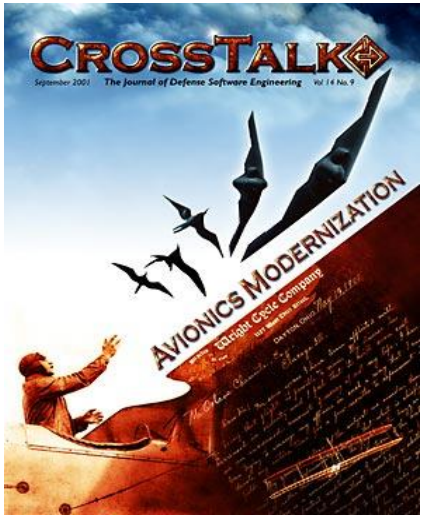
  http://www.pb-ev.com/Pages/AdvancedEV.aspx

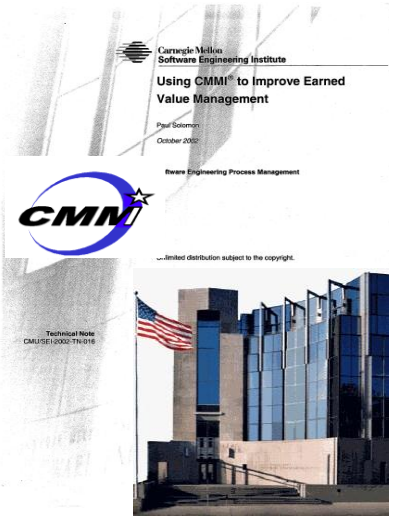
Program Management Tips

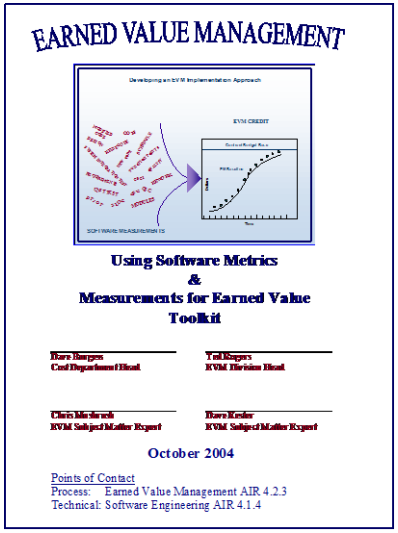
- **Make IMP a contractual requirement**
- **Require SE best practices and tailored EVMS clause in RFP and SOW**
- **Verify compliance in Integrated Baseline Review (IBR)**
- **Confirm achievement of success criteria in technical reviews**
- **Monitor consistency and validity of status reports, variance analyses, EAC**
- **Close the Quality Gap**



Resources Online







DOD **SEI** **NAVAIR** **DOD DAU**

ICFAI U. Press, India

CPM
College of Performance Management

College of Performance Management "Measurable News"

NEWS SoftwareTech

DACS
DoD Data & Analysis Center for Software

www.PB-EV.com

Acronyms/Contact

PMBOK Guide ® is registered by the Project Management Institute in the U.S. Patent and Trademark Office
CDR: Critical Design Review
EAC: Estimate at Completion
EVM: Earned Value Management
IBR: Integrated Baseline Review
IMP: Integrated Master Plan
IMS: Integrated Master Schedule
KPP: Key Performance Parameter
MOE: Measure of Effectiveness
MOP: Measure of Performance
OMB: Office of Management and Budget
PDR: Preliminary Design Review
PMB: Performance Measurement Baseline
SE: Systems Engineering
SFR: System Functional Review
TPM: Technical Performance Measure

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