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# INTEGRATING SYSTEMS ENGINEERING WITH EARNED VALUE MANAGEMENT, PART 2

By Paul Solomon, PMP

## ABSTRACT

In February 2004, a new U.S. DoD Policy for Systems Engineering (SE) called for SE to provide the integrating technical processes to define and balance system performance, cost, schedule, and risk. In May 2004, the DoD magazine, Defense AT&L, published my article as a best practice, “Integrating SE with Earned Value Management (EVM).” It stated that Program Managers (PM) should require contractors to adhere to industry standards for SE engineering processes and base EV on technical performance measures (TPM). This has not yet happened.

In 2010, DoD submitted a report to Congress which stated that EVM can be an effective PM management tool only if the EVM processes are augmented with a rigorous SE process and SE products (including TPMs) are costed and included in EVM tracking.

The National Defense Authorization Act for FY 2011 required the Secretary of Defense to review the acquisition guidance of the DoD, including DoD Instruction 5000.02, Operation of the Defense Acquisition System (DoDI 5000.02), to consider and report “whether measures of quality and technical performance should be included in any EVM system.” In 2015, DoDI 5000.02 was revised to require the PM to use TPMs to assess program progress. Per the Instruction, “Analysis of TPMs and metrics, in terms of progress against established plans, will provide insight into the technical progress and risk of a program.” However, DoDI 5000.02 is applicable only to DoD PMs and not to contractors.

Today, contractors are not integrating TPM with EVM and are not required to use processes that would enable a PM to adhere to DoD instructions and guidance regarding TPMs and SE. Why and what is the remedy?

Although the topics and recommendations herein address the needs of DoD, they are applicable to all high tech, high risk development projects, including government and commercial, and are relevant to the College of Performance Management’s (CPM) objective to lead EVM into the next generation – Integrated Program Performance Management (IPPM).

## KEY EXCERPTS FROM 2004 AT&L ARTICLE

This article is a sequel to the 2004 AT&L article (Part 1).

Key excerpts from Part 1:

- EVM data will be reliable and accurate only if the right base measures of technical performance are selected and if progress is objectively assessed.
- If you are measuring the wrong things or not measuring the right way, then EVM may be more costly to administer and may provide less management value.
- EVM can be more effective as a PM tool if it is integrated with technical performance and if the EVM processes are augmented with a rigorous SE process.
- A contractor may be compliant with EVMS but fail to truly integrate measurement of cost, schedule, and technical performance.
- A PM should ensure that integrated plans, schedules, and the earned value Performance Measurement Baseline (PMB) are linked with the contract requirements, TPMs, and unambiguous exit criteria.

## KEY EXCERPTS FROM DOD SE POLICY

In February 2004, the USD for AT&L, Michael Wynne, published the Policy for SE in DoD. It included the following key points.

- SE must be embedded in program planning and performed across the entire acquisition life cycle.
- Programs shall develop a SE Plan (SEP) that describes the program's overall technical approach, including processes, resources, metrics, and applicable performance incentives.
- It shall also detail the timing, conduct, and success criteria of technical reviews.

## KEY EXCERPT FROM DOD EVM REPORT

The DoD EVM Report, "DoD EVM: Performance, Oversight, and Governance," was required by the Weapon Systems Acquisition Reform Act of 2009 (WSARA). The DoD Report stated that 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.

## RECENT GOVERNMENT ASSESSMENT

In April 2016, Defense Contract Management Agency (DCMA) made a presentation to the National Defense Industrial Association (NDIA) Program Management Systems Committee. DCMA reported a common, EVM finding of a lack of objective measures to assess performance and stated "Measurement does not indicate technical accomplishment." The presentation provided supporting data that included the number of deficiencies found that were both compliant and non-compliant with individual EVM Guidelines.

## DOD INSTRUCTION, PRACTICE, AND GUIDES

DoD addresses the integration of SE and TPMs with EVM in many internal documents. However, the following documents are applicable only to the DoD PM and not to contractors:

- DoDI 5000.02
- Defense Acquisition Guidebook (DAG)
- Systems Engineering Plan (SEP)
- MIL-STD-881C DoD Standard Practice Work Breakdown Structures (WBS)
- Integrated Master Plan (IMP) and Integrated Master Schedule (IMS) Preparation and Use Guide (IMP/IMS Guide)
- Guide for Integrating SE into DoD Acquisition Contracts (Integ SE)
- DoD EVM System Interpretation Guide (EVMSIG), for EVMS compliance reviews by DCMA

Both the PM and DCMA are hindered from implementing the guidance and instruction because DoD has not developed any standard, contractual requirements for enabling, supplier processes and metrics.

Furthermore, DCMA is obstructed from issuing valid, EVMS non-compliance findings regarding TPMs because the use of TPMs is optional, not mandatory, in Guideline 2.2b (below).

## DAG

The DAG guidelines are summarized in a tutorial that was presented to the NDIA SE conference in 2012, "Integrating SE with TPM." The tutorial also provides practical examples. The tutorial and other articles discussed herein may be downloaded from [www.pb-ev.com](http://www.pb-ev.com) at the tabs, "Articles and Tutorial" and "Acquisition Reform."

## EVMSIG

EVMSIG provides the overarching DoD interpretation of the 32 EVMS Guidelines. Since September 2015, it serves as the authoritative source for EVMS interpretive guidance and is used as the basis for the DoD to assess EVMS compliance. Guidance for integrating TPM with EVM is in Guidelines 2.2.b and 2.2.e. Pertinent extracts follow.

**Guideline 2.2.b**

- Identify physical products, milestones, technical performance goals, or other indicators that will be used to measure progress.
- Purpose of Guideline: To ensure program schedule(s) establish and maintain a relationship between technical achievement and progress status and provide objective performance data that accurately reflects the progress of the work.
- Identifying objective criteria, linked to technical progress indicators, ensures performance assessments reflect the true technical performance of the program.
- Identifying and selecting appropriate objective completion criteria, that will align with how technical performance will be accomplished, for all discrete work and for each of the program’s key events, decision points, and milestones is essential for ensuring accurate schedule status and providing program management actionable information.

**Guideline 2.2.e**

- Determine discrete work and objective measures
- This provides PM accurate status and situational awareness of program execution for proactive resolution of issues impacting cost, schedule, and technical achievement of program objectives.
- Discrete work is defined as a specific product or service with distinct and measurable outputs that are relatable to the program’s technical objectives.
- Interim milestones representing measurable, technical accomplishment are required for performance measurement.

**COMMON ELEMENTS IN DOD DOCUMENTS**

The following table includes common elements in all DoD documents for integrating technical processes to define and balance system performance, cost, schedule, and risk.

DoD Document/ Guidance	DoDI 5000.02	DAG	SEP	WBS	IMP/ IMS	Integ SE	EVM-SIG
Event-driven timing of technical reviews	X	X	X	X	X	X	
Success criteria of technical reviews		X	X	X	X	X	X
Include entry and exit criteria for technical reviews in IMP and IMS			X			X	
Assess technical maturity in technical reviews		X	X	X			
Technical reviews include independent (of program) subject matter experts				X		X	
Use TPMs to compare actual vs. planned technical development and/or design maturity	X	X	X		X	X	X
Use TPMs to report degree to which system requirements are met in terms of performance, cost and schedule		X	X			X	
Integrate SEP with: <ul style="list-style-type: none"> <li>• IMP</li> <li>• IMS</li> <li>• TPMs</li> <li>• EVM</li> </ul>		X	X		X	X	
Integrate WBS with requirements specification, statement of work (SOW), IMP, IMS, and EVMS.				X	X	X	
Link risk management, technical reviews, TPMs, EVM, WBS, IMS						X	
Include risk mitigation plans in IMS						X	
Technical baselines (functional, allocated, and product baselines) are included in IMP/IMS						X	

DoD Document/ Guidance	DoDI 5000.02	DAG	SEP	WBS	IMP/ IMS	Integ SE	EVM-SIG
Establish milestones for technical reviews with explicit entry and exit criteria to monitor and control technical baseline maturity and risk mitigation						X	
Integrated program plans flowed down to teammates, subcontractors, vendors, lowest level suppliers and integrated across: <ul style="list-style-type: none"> <li>• SOW</li> <li>• SEP</li> <li>• IMP/IMS</li> <li>• Other plans and processes</li> <li>• to support critical path analysis, EVM, and risk management.</li> </ul>						X	
Proposal includes a matrix that correlates Government SEP with Offeror's integrated SEP, SOW, IMP/IMS, WBS.						X	

### INTEGRATING RISK MANAGEMENT

The June 1998 issue of Measurable News included my article, "Integrating Risk Management (RM) with EVM (RM Comes Out of the Closet)." Per the article, RM was overlooked by the authors of the EVM Systems guidelines. Thus there is no guidance on how to effectively implement RM with EVM and the benefits of doing this.

Some of the recommended best practices in the article follow.

1. Establish RM Milestones on the Baseline Schedule
2. Define Exit Criteria for RM Decision Points
3. Budget the RM Effort
4. Use TPMs as a Basis for RM and EV
5. Address RM in Performance Analysis and Exception Reports
6. Establish Management Reserve for Risk Reduction
7. Consider RM in EAC Development

These recommendations should be addressed in acquisition reform and in the IPPM initiative.

### INTEGRATING REQUIREMENTS

The June 2010 issue of Measurable News included my article, "Performance-based EV in Commercial IT Projects." It discusses how leading information technology companies in South Korea and India used techniques to link EV with technical performance and the product requirements.

The techniques illustrated in this article include:

- Defining the requirements baseline for each planned product release
- Tracing the requirements baseline to the schedule and work packages
- Tracking status of each requirement
- Monitoring technical performance with meaningful variance analysis
- Accounting for deferred functionality
- Planning and measuring rework
- Making negative adjustments to EV for accurate status

These techniques should be also addressed in acquisition reform and in the IPPM initiative.

### PROPOSED ACQUISITION REFORMS

I have proposed specific acquisition reforms to legislators and to DoD that include revisions to the Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS). Recommendations are in the articles, "Path to EVM Acquisition Reform," *Defense AT&L*, May 2011 and *CrossTalk, the Journal of Defense Software Engineering*, "Basing Earned Value on Technical Performance," January 2013.

## **CONCLUSION**

The DCMA status report provides recent evidence that there is a pervasive lack of integration of TPM with EVM. FAR and DFARS lacks contractual requirements to integrate SE with EVM. DoD has provided only instructions and guidance for the PM but has not published enabling, contractual requirements. We need acquisition reform to mandate that contractors embed SE and IPPM in program planning.

The guidance and recommendations herein, including those for integrating EVM with risk management and with the product requirements, should be also considered by CPM for inclusion in the next generation IPPM.

### **About the Author**

Solomon is retired from Northrop Grumman Corp. He is a Project Management Professional and co-author of ANSI-748 and the book "Performance-Based Earned Value," published in 2007. Solomon is a 1998 recipient of the Defense Department's David Packard Excellence in Acquisition Award. The author maintains a project management Website, [www.pb-ev.com](http://www.pb-ev.com), and welcomes comments and questions.

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