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The Honorable Heidi Shyu
Office of the Under Secretary of Defense, Research and Engineering (USD(R&E))
The Pentagon, Washington, DC 20301

Subject: Modernize SE Processes to Leverage Digital Engineering and MBSE;
Reduce Risks to GBSD Program

Dear USD Shyu:

I watched your nomination hearing on May 25 and read your answers to the Advance
Policy Questions regarding digital engineering (DE) and model-based systems
engineering (MBSE). I have drafted acquisition reforms that address your objectives as
well as unfinished business from the 2009 *DOD EVM: Performance, Oversight &
Governance Report to Congress* (required by WSARA). My assessments and
recommendations address your following responses:

> Modernize systems engineering (SE) processes to leverage digital engineering (DE)
> and model-based systems engineering (MBSE).

> DoD still has work to do to align its test activities with the new Adaptive Acquisition
> Framework (AAF) and to ensure that test and evaluation (T&E) processes are properly
> structured to assess software-intensive systems

Details are in the white paper, *Integrating the Embedded Software Path, MBSE, and DE
with Program Management*. Excerpts from the white paper follow.

DoDD 5000.01, The Defense Acquisition System (DAS), includes policies to speed up delivery of
products that work as planned, e.g., products that meet the documented capability needs. However,
several DoD instructions and guides should be revised to better enable achievement of DAS
objectives. Revisions are needed to benefit programs with the following characteristics:
- Use the embedded software path to develop software embedded in weapon systems
- Employ DE metrics
- Employ MBSE

**Information Needs of Program Managers**

The current set of instructions and guides focuses on engineering, not program management, and is
insufficient to enable rapid corrective actions based on enhanced transparency and increased
efficiency in acquisition practices. The following documents should be revised to address a PM's
information needs for authoritative DE metrics of schedule, progress, and quality:
- DE Strategy (DE Strat)

- DoD Instruction 5000.87 Operation of the Software Acquisition Pathway (5000.87)
- DoD Instruction 5000.88 DoDI Engineering of Defense Systems (5000.88)
- DoD Instruction 5000.89 DoDI Test and Evaluation (5000.89)
- DoD SE Plan Outline (SEP)

The metrics are needed to inform the PM:
- If the definitions of the technical baselines (functional, allocated, product, and if applicable Minimum Viable Product (MVP) and Minimum Viable Capability Release (MVCR), will be completed on schedule.
- If the needed capabilities, features, and functions will be delivered on schedule.

**Recommendations**

Recommendations are provided herein that define the PM's information needs and the DE metrics that meet those needs. Recommended digital artifacts that should be considered as base measures of the DE metrics are also provided in Appendix B.

The pertinent overarching DAS policies and objectives are:
1. Deliver Performance at the Speed of Relevance using *data driven* analysis.
2. Employ Performance Based-Acquisition Strategies that are structured around *the results to be achieved as opposed to the manner by which the work is to be performed*.
3. Conduct Integrated Test and Evaluation (T&E), *integrated with modeling and simulation,* to assess *attainment of technical performance parameters* and to confirm *performance against documented capability needs.*

The documents cited above can be improved to better define the information needs of PMs for effective program technical planning and management, configuration and change management, and software engineering.

The PM needs accurate schedule status and situational awareness of program execution for proactive resolution of issues impacting cost, schedule, and technical achievement of program objectives. The technical achievement criteria are defined in the technical baselines. The PM also needs situational awareness of the degree of product quality as measured by functional completeness.

Finally, the exchange of schedule status information via model exchanges and automated transformations will eliminate or reduce the manual entry of estimated schedule performance such as the percent of work complete used with earned value management (EVM). The estimated percent of work complete, such as drawings or code, may fail to be an indicator of the true status of validating requirements, completing the preliminary design, meeting the weight targets, or delivering software and may fail to properly account for rework.

## Additional Rationale

Additional rationale for my recommendations is provided in my 2004 article in *Defense AT&L Magazine,* "Integrating SE with EVM." Despite the potential of DE to deliver performance faster using data-driven analysis, programs such as the Ground-Based Strategic Deterrent Program may encounter the same fate as programs which use EVM;

schedule slips, Over Target Baselines, and Nunn-McCurdy breaches. You can mitigate these risks if the right base measures of technical and schedule performance are employed with proper contractual direction and incentives. The article is still relevant even if EVM is not contractually-required. Excerpts follow:



This letter is posted on my website, www.pb-ev.com, at the "Acquisition Reform" tab along with the white paper. A link to the article is at the "Articles and Tutorial" tab.

Good luck,

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