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June 28, 2024

The Honorable Elizabeth Warren  
311 Hart Senate Office Building  
Washington, DC 20510-2604

Subj: Failures of Sentinel, F-35, and Digital Engineering

Dear Sen. Warren:

Your letter to Sec. Austin, dated June 24, concluded, “We look forward to hearing how your evaluation will provide essential oversight to this (Sentinel) program and, if it is not terminated, begin applying the necessary scrutiny to this project.” Preceding that statement, you cited Sentinel’s continuous delays and cost growth that reveals a persistent failure in program management.

I have a plan for USD LaPlante to implement and for Congress to oversee. The plan should be applied to the Sentinel program, if it is not terminated, and to other software-intensive weapon system acquisition programs, including the F-35 program.

You had cited the F-35 during an interview 2020 and discussed “our broken procurement system.” You stated, “We must ensure that the investments we make in our defense can actually **deliver as promised.**”

Both the Sentinel and F-35 programs use digital engineering (DE) and earned value management (EVM). However, their common outcomes of cost overruns and schedule delays, without early warnings, are evidence of a broken procurement system.

I covered both programs in my letter to Vice Chair Wittman, Subj: More Reason to Limit F-35 Procurements – DE and Outcome-based Metrics, dated June 17. Excerpts follow:

...the F-35 program...claims to use DE, is behind schedule, over cost, and still does not have sufficient outcome-based metrics. Today, GAO found similar shortcomings on the Sentinel program which reportedly uses DE but still lacks metrics. Please consider this new information when deciding whether to limit future F-35 procurements.

I have been reporting the Sentinel program management shortcomings since 2021 and was disappointed to learn that, like the F-35, there are still no effective, outcome-based metrics after all these years. Per GAO-24-106831 Weapon Systems Annual Assessment, Sentinel’s software development ...is progressing more slowly than anticipated and the program office lacks appropriate metrics to determine the overall status of the effort. The program office and contractor have yet to finalize software development metrics and are replanning the delivery schedule.

I have been assessing the F-35 failures to Congress (including you) and DOD since 2007. I added the Sentinel program in 2021. The acquisition problems are systemic and will not be resolved by simply applying over-hyped new remedies and transformations such as digital engineering (DE), Agile

methods, and the National Defense Industrial Strategy. To succeed, DoD must implement new policies and regulations that are unambiguous, impose contract terms with effective incentives, and monitor program performance with outcome-based metrics.

### **Problem Statement**

My plan addresses problems defined in acquisition reform letters since 2007. For example,

#### **Henry Waxman, March 10, 2008:**

Lockheed Martin (LM) has “managed data” in order to “make the number” on the F-35 program. LM’s practices were not in compliance with the EVM System standard EIA-748, required by FAR/DFARS. LM submitted monthly EVM reports ...misstated cost and schedule performance. Consequently, LM received unjustified award fees and...understated the final program costs, thereby avoiding Nunn-McCurdy scrutiny.

#### **Ike Skelton, March 28, 2010**

Subject: Panel on Defense Acquisition Reform Recommendation Regarding Earned Value

7. If you are measuring the wrong things or not measuring the right way, then EVM may be more costly to administer and provide less management value.
8. Industry has not corrected the flaws in EIA-748. Contractors prefer the status quo.
9. Commercial processes and best practices and systems engineering (SE) standards should be considered for EVM acquisition reform... Revise FAR and DFARS to require that earned value be integrated with technical performance and risk, using provisions in existing DoD and GAO guidance.

#### **McKeon, September 13, 2011:**

Sen. Collins said the following about EVM in the Weapon Systems Acquisition Reform Act (WSARA) conference report: “GAO observed that contractor reporting on EVM often lacks consistency, leading to inaccurate data and faulty application of the EVM metric. In other words, garbage in, garbage out.”

- DoD submitted a report to Congress in September 2009.
- "Utility of EVM has declined to a level where it does not serve its intended purpose."
- Contractors may circumvent proper EVM practices to keep EVM metrics favorable and problems hidden.
- Engineering community should establish technical performance measures (TPM) that enable objective confirmation that tasks are complete.
- Systems Engineering (SE) and EVM should be integrated, not stove-piped
- Neither the GAO nor any agency has ever validated that a contractor’s use of EVM integrates cost, schedule and quality/technical performance or ensures accurate status and Estimate at Completion (EAC).

#### **McCain letter, 10/25/11, Cost Controls on the F-35 and Need for Acquisition Reform of EVM**

- The EVMS guidelines (are) similar to GAAP. However, GAAP protects investors but EVMS often fails to protect taxpayers...has ambiguities and loopholes that should be removed.
- The two most important deficiencies are:
  1. Contractors are able to overstate progress and understate final costs by basing earned value on the quantity of work performed, not on technical performance or quality.
  2. Contractors routinely use “Management Reserve” (MR) as a slush fund for additional budget to compensate for poor planning, to reduce reported cost overruns, and to provide additional budget for tests and rework to designs that fail to meet technical performance or quality objectives.

**Trump-nominee, 11/13/16**

...loophole in the EVMS guidelines allows contractors to report progress in terms of percent complete that is based on flawed, misleading metrics. In construction terms, contractors may report cost and schedule performance based on the number of actual vs. planned architectural drawings, or floors built, even if the rising structure will not meet building codes, seismic risks etc. Contractors are not required by the EVMS guidelines to assess and report progress that is based on *achieved vs. planned technical performance or quality (Quality Gap)*.

**Robert Wittman, 12/23/23, Subj: More Lessons Learned: "Earned Value? We don't need no stinking Earned Value."**

previous letter concerned lessons learned from the F-35 program regarding TR-3 and Block 4 software. This letter expands the scope of my recommendations for acquisition reform to include all major acquisitions that have a DFARS requirement to use EV. ...Senate passed the NDAA for FY 2024. It includes a section that is pertains to your comment that “the things that we design the hardware around are only enabled if you have the software. We kind of have gotten things backwards.” That section is: SEC. 827. MODIFICATIONS TO EVMS REQUIREMENT

...DFARS be revised to exempt all contracts of the DoD from EVMS requirements. As stated in the attached letter to USD(A&S) La Plante, Subj: Software Acquisition Policy and Congressional Oversight Issues, dated August 1, 2023:

the Sec. 809 Panel reported that EVM does not measure product quality and concluded, “EVM has been required on most large software programs but has not prevented cost, schedule, or performance issues.” In 2009, DoD reported to the committee that “a program could perform ahead of schedule and under cost according to EVM metrics but deliver a capability that is unusable by the customer” and stated the program manager should ensure that the EVM process measures the quality and technical maturity of technical work products instead of just the quantity of work performed.” So, to paraphrase “Blazing Saddles” and “The Treasure of Sierra Madre”: “We don't need no stinking Earned Value.” Note: All references, including white papers and articles, are at [www.pb-ev.com](http://www.pb-ev.com).

**“THE PLAN”**

The Plan is in the following three letters, in articles in *Defense Acquisition Magazine*, and in my white papers.

**1. Letter to Gabe Camarillo, Subj: Army DE Directive vs. DoD Policy and GAO’s Call for Output-based Metrics, dated June 23. Excerpts:**

Army Directive 2024-03 DE is silent on two of four DoD DE Capability Elements and on outcome-based metrics. The integration of these elements is required by DODI 5000.97 DE. Per the GAO, “without the use of outcome-based metrics and continually assessing the value of what was delivered against user needs, a program using Agile software development might deliver capabilities and features that are not essential to the customer and that could contribute to schedule and cost overruns.”

...hold ...program managers accountable to integrate DE with systems engineering (SE), program management, and outcome-based metrics....hold...program managers and contractors accountable if they fail.

**2. Letter to Bill LaPlante, Subject: DE Acquisition Policy and Congressional Oversight Issues, 6/25/24. Excerpts:**

This letter about DE is a “twin” to my letter dated August 1, 2023, Subj: Software Acquisition Policy and Congressional Oversight Issues. The first letter cited your nomination hearing response to a question about EVMS. You replied, “I will work across the Department and with the industrial base— current and emerging—to validate, improve, or establish appropriate metrics across the acquisition pathways.”

The corresponding DE question and answer follow: 52. If confirmed, what steps would you take, if any, to require contractors that employ the DOD DE Strategy to maintain valid information in the digital authoritative data source that is sufficient for program managers to make informed and timely decisions to manage cost, schedule, performance, and risk?

Your reply included: “A combination of strong data, tool and modeling standards and environments, ...and proper contract ...guidance are foundational to enabling successful adoption of DE to feed the right cost, schedule, performance and risk data to our acquisition decision makers.”

**3. Attached Letter to Bill LaPlante, Subj: LGM-35A Sentinel Program Fails to Provide Early Warning, 6/25/24.**

**Conclusion**

The plan cannot “ensure that the investments we make in our defense can actually **deliver as promised.**” However, diligent implementation, incentives, and oversight will provide transparency, and early warning of potential failure. Use outcome-based metrics to monitor progress and to hold contractors and program managers accountable for failure.



Paul Solomon

Attachment

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June 25, 2024

The Honorable William LaPlante USD(A&S)  
1010 Defense Pentagon  
Washington, DC 20301-1010

Subj: LGM-35A Sentinel Program Fails to Provide Early Warning

Dear USD LaPlante:

On April 3, 2024, I asked you to review Northrop Grumman's (NG) use of outcome-based metrics on the LGM-35A Sentinel program and verify that NG's Earned Value Management (EVM) reports and Integrated Master Schedule provide early "joint situational awareness of program status and assess the cost, schedule, and technical performance for proactive course correction."

That won't be necessary. The House Committee on Defense Appropriations Report expressed the Committee's concern that "the issues driving the critical overruns were ***not identified sooner.***"

### **Over-Hyped Benefits of Digital Engineering (DE), Agile software, and EVM**

DoD and Industry are over-hyping the expected benefits of DE and related modernization transformations, such as Agile methods, just as they over-hype EVM. Botched metrics prevail instead of outcome-based metrics.

NG claimed in a press release, Sept. 21, 2022, "Sentinel is leveraging DE, agile software, and open systems architecture to model and authenticate virtual designs, lowering risk and reducing the time it takes to field the system and new technologies."

NG told *Business Insider*, February 10, 2022, "NG is helping to reduce costs, minimize the speed to field, and keep the US firmly ahead by applying the principles of DE to the weapons systems and equipment it builds for the armed services...As the Sentinel program proceeds, the scope has broadened to include ***optimizing scheduling, cost management,*** and resource deployment.

### **Prediction of Sentinel Failure, including Nunn-McCurdy breach, in 2021**

In 2021, I predicted today's failures, including the Nunn-McCurdy breach, in a letter to USD Shyu, Subject: Modernize Systems Engineering (SE) Processes to Leverage DE and MBSE; Reduce Risks to GBSD (Sentinel) Program, dated December 16.

Excerpt:

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 Sentinel 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.

## Outcome-based Metrics for LGM-35A Sentinel

Excerpts from my letter to you, Subj: Outcome-based Metrics for LGM-35A Sentinel; Same Failures and Needs as F-35 TR-3/Block 4, dated April 3, 2024: Excerpts:

- ...corrective actions to improve ...the defense industrial base (DIB) ecosystem.
- Please ensure that DE, and especially SE, are integrated with program management.

## DE Acquisition Policy and Congressional Oversight Issues

Finally, the removal, today, of the Sentinel Systems Director and the Committee report should be sufficient reasons for you to implement the recommendations in my earlier letter to you, Subj: DE Acquisition Policy and Congressional Oversight Issues. The earlier letter concluded:

### Whole hog, not half-assed attempts

Please establish policy, guidance, and oversight to “enable successful adoption of DE to feed the right cost, schedule, performance and risk data to our acquisition decision makers.” My white papers provide a template.

We need all four DoD DE Capability Elements and outcome-based metrics. DoD policies and contractual requirements should go the whole hog to buy a product that works (not a SOW).

YES



NO



NO



Half-assed efforts, such as omitting DE capability elements and outcome-based metrics, won't result in a DE ecosystem that include the processes, methods, and practices necessary to conduct DE, are the basis for accomplishing engineering activities and generating knowledge through digital threads and in the form of digital artifacts by extracting information from digital models.

Paul Solomon

CC:

Hon. USD (Army) Gabe Camarillo  
Hon. Donald Norcross, HASC  
Hon. Elizabeth Warren, SASC  
Hon. Nickolas Guertin (ASN RD&A)

Hon. Robert Wittman, HASC    Hon. Adam Smith, HASC  
Hon. Heidi Shyu, (USD(R&E))    Hon. SON Del Toro  
Hon. Andrew Hunter, AF Asst. Sec. for AT&L  
Anthony Capaccio, Bloomberg News