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The Honorable Robert J. Wittman
Vice Chair, HASC
2055 Rayburn House Office Building
Washington, DC, 20515-4601

Subj: Limit F-35 Procurements Until Digital Engineering and Outcome-based Metrics are Certified

Dear Vice Chair Wittman:

Section 174 in the NDAA for FY 2025 limits f-35 procurements but is too limited in scope to meet your objectives. Please amend the provision and increase your oversight of Lockheed Martin's (LM) digital engineering (DE) improvements and use of outcome-based metrics.

Sec. 174, LIMITATION ON PROCUREMENT OF F–35 AIRCRAFT PENDING CERTIFICATION ON IMPROVEMENTS AND CORRECTION OF DEFICIENCIES, requires the Sec. Def. to certify that he has developed and will implement an acquisition strategy, with appropriate actions and milestones, to develop and field F–35 aircraft and mission systems digital twin models across the F–35 enterprise. However, Sec. 174 omits three, essential DE capability elements and is silent on outcome-based metrics.

To obtain the speed of relevance and respond to GAO findings, please obtain certification that *all* DE capability elements are integrated and that outcome-based metrics are finally being used to manage the program. There should be a digital thread between those metrics, the digital models, and the digital artifacts. GAO found that "botched metrics" are used on failing programs. Preclude botched metrics.

In April, you stated that LM should "use digital twin technology, digital design, and advanced methods to make sure that we develop systems at the speed of relevance…Those are things that have to happen." It ain't going to happen unless you increase your oversight.

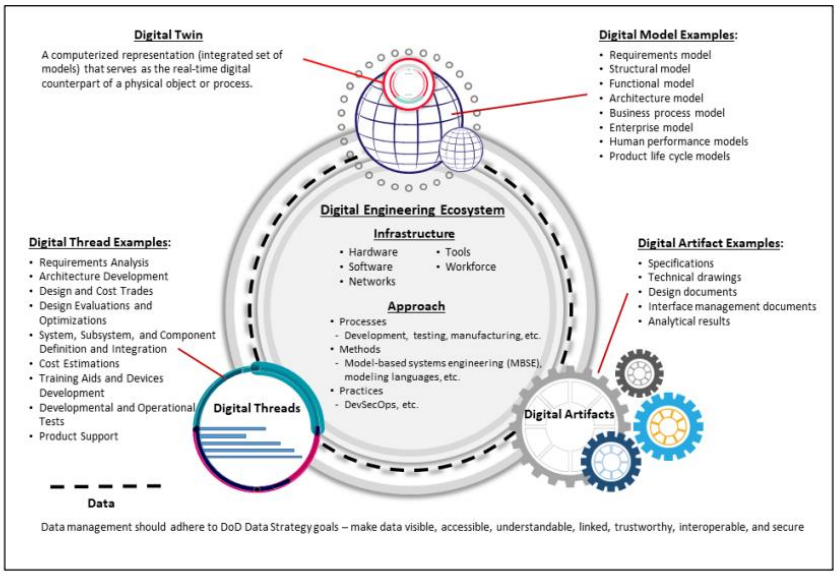
Excerpts from recent letters to you are in the Appendix. My letter to Rep. Norcross, dated August 11, 2023, cites an email to Sen. McCain, dated August 28, **2016,** regarding Block 3 functionality. I asked, "Does LM's (cost/schedule) reporting disclose the behind schedule condition to achieve Block 3i functionality requirements and the increasing cost overruns to Block 3i for the on-going rework?" Today's question is "Does the F-35 program use outcome-based metrics that are Authoritative Sources of Truth (ASOT) because they are generated by the DE ecosystem and are tied by a digital thread to the digital models?"

Please take corrective legislative or oversight actions to include all DE Capability Elements in the requirements for certification on improvements. The four DE Capability Elements are:

1. DE ecosystem.
2. Digital models (Including digital twins).
3. Digital threads.
4. Digital artifacts.

Figure 1 shows all the elements and a subset of the examples.

Figure 1. Digital Engineering Framework



Appendix D of the white paper, "*Integrating the Embedded Software Path, MBSE, MOSA, and DE with Program Management*," has excerpts from DODI 5000.97. The DE artifacts should be the ASOTs for cost, schedule, and technical performance to meet Congress's intent, to achieve NDIS objectives, to respond to GAO recommendations, and to preclude botched metrics. Output-based metrics are highlighted in the letters dated April 18 and May 16 and in the white paper entitled *Outcome-based Metrics Plus SE = Integrated Program Management,* Rev. 7 (*Rev. 7*).

Finally, do you remember the earned value Quality Gap? Per NDIA's EVMS, EIA-748, technical performance measures (TPM) are optional. Consequently, contractors do not link earned value to TPMs. Don't expect them to use digitally-threaded, outcome-based metrics without a DFARS requirement or incentives.

Better yet please consider repealing the DFARS EVMS clause that requires contractors to comply with EIA-748 guidelines. *Rev. 7* was revised to incorporate the *DoD Data, Analytics, and AI Adoption Strategy.* Sustainment of EIA-748 is counter to the Strategy's approach to product-centric development that prioritizes outcomes over processes and uses accurate data that correctly reflect proven, true values (as compared with earned value).

This in sharp contrast to EIA-748, which:

1. Covers the quantity of work and ignores the quality of the product.
2. Gives a green light to reporting earned value that reflects management's assessment of the % complete of the budgeted *work*.

The Appendix of the Strategy includes:

1. Accuracy: Data that correctly reflect *proven, true values* or the specified action, person, or entity.
    - How frequently do data values match *ground truth*?
2. Linked: - Are the *data linked* such that relationships and dependencies can be uncovered and maintained?
3. Trustworthy: -Do the data represent *a source of truth*?

Contractors may be compliant with EIA-748 guidelines and submit misleading status reports with values that do not match ground truth, are not linked to the DE ecosystem, and do not represent Authoritative Sources of Truth.

Per *EIA-748,* 3.8 Performance Measurement: "Earned value is a direct measurement of the *quantity* of work accomplished. The *quality and technical* content of work performed is controlled by other processes."

So, the proposed certification regarding digital twin models is a band aid, not a cure. Please go the whole nine yards and limit procurements until you get a DE ecosystem, outcome-based metrics, and effective incentives. Sen. McCain sent me the attached letter in **2015**. Please pick up his gauntlet. I invite the other recipients to join the acquisition reform Crusade.

My white papers contain detailed plans and justifications. This letter and cited documents may be downloaded from www.pb-ev.com at the Acquisition Reform and White Paper tabs.

Yours truly,

Paul Solomon

CC:
Hon. Andrew Hunter, AF Asst. Sec. for AT&L
Hon. Adam Smith, HASC
Hon. Carlos Del Toro, Secretary of the Navy
Nickolas Guertin (ASN RD&A)
Hon. David L. Norquist, NDIA
Anthony Capaccio, Bloomberg News
Shelby Oakley, GAO
Jon Ludwigson, GAO

Appendix: Excerpts from Letters to Vice Chair Wittman

12/12/23 Subj: **Today's hearing: Your Comments on F-35 DE and Lessons Learned**

You and Dr. LaPlante expressed concerns and objectives concerning good systems engineering, the future use of digital twin technology, and applying lessons learned going forward.

In previous letters to you and in cited letters to others, including Sen. McCain, I covered these topics. The lessons learned have not yet been applied to fix shortcomings in program management of the F-35 program and in our acquisition regulations and policies.

Remedies are in the previously cited article in *Defense Acquisition Magazine*, "Better Program Management Through Digital Engineering," May/June 2022. More recent and detailed recommendations are in my white paper, "Integrating the Embedded Software Path, Model-Based Systems Engineering, MOSA, and Digital Engineering with Program Management."

I would appreciate your oversight of DoD's implementation of those recommendations going forward.

4/8/24 Subj: **Systemic Shipbuilding Delays, Congressional Defense Modernization Caucus, and Earned Value**

Please lead in overseeing the Navy programs that are in trouble. Call in GAO to review a sample of the troubled programs.

Does surveillance ensure that the contactor's EVMS (cost/schedule reporting) accomplishes the preceding objectives? Do Navy program managers get timely and accurate EVMS status reports and schedules? Do contractors receive award or incentive fees that are based on inaccurate status? Do the HASC and SASC receive timely and accurate status reports, including EAC?

4/18/24 Subj: **F-35 TR-3 Delays Surprise; More Evidence of Pervasive Lack of Outcome-based Metrics**

Please markup the NDAA for FY 2025 to authorize GAO to perform the requested reviews in a sufficient sample of programs. Your action may also prod DoD to institutionalize timely, outcome-based metrics in the pending NDIS implementation plan. Otherwise, we are doomed to face recurring program surprises by traditional defense suppliers and with the new non-traditional suppliers and contract types.

5/16/24 Subj: **Second Request for NDAA Markup to Obtain Outcome-based Metrics**

Please markup the NDAA to include a provision that either DoD or GAO report on the extent to which outcome-based measures are defined, established, and utilized in the Block 4 subprogram. These measures should include technical performance measures and measures of progress in defining, validating, and verifying requirements. The measures should inform stakeholders of progress towards achieving the two key decision points cited in the report:

1. The first decision point initiates the advanced development of a capability and allows Lockheed Martin to develop capability through its preliminary design.
2. The second decision point confirms the specifics of the capability and takes place after preliminary design is complete.

The measurement planning and control process should also define and establish Minimum Viable Product and Minimum Viable Capability milestones.

5/16/24 (Letter to USD LaPlante, copy to you) Subj: **F-35 Block 4 Subprogram Should Put Its Metrics Where Its Mouth Is**

1. Determine if the Block 4 subprogram uses outcome-based metrics that are based on DE artifacts as ASOTs.
2. Today, GAO reported new delays (GAO-24-106909 F-35 Joint Strike Fighter). Was the latest delay a surprise or did the JPO have and share early warning from its use of outcome-based metrics?

My white paper, "Integrating the Embedded Software Path, MBSE, MOSA, and DE with Program Management," addresses a program manager's (PM) information needs for authoritative DE metrics of schedule, progress, quality, technical debt, and technical performance. The metrics are needed to inform the PM:

1. If the definitions of the technical baselines (functional, allocated, product), and if applicable Minimum Viable Products (MVP), and Minimum Viable Capability Releases (MVCR), will be completed on schedule.
2. If the needed capabilities, features, and functions will be delivered on schedule.
3. If the software engineering processes mitigate cost and schedule risks by identifying and removing software-related technical debt early in development (SE Guidebook).
4. If technical performance is being assessed at all levels: component, subsystem, integrated product, and external interfaces.
5. If the intermediate goals for tracking technical performance measures (TPM) are achieved on schedule.
6. If Modular Open Systems Approach (MOSA), defined interfaces between modules that are defined by widely supported standards are achieved on schedule.

The F-35 program has been touting its use of Agile methods and the benefits of its SE Transformation for several years. Has the Block 4 subprogram put its metrics where its mouth is? The Technical Baseline Review and/or the GAO should determine that.

The bottom line, ***"Use Outcome-based Metrics that Work to Build a Product that Works"*** (not a SOW).