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

Subj: More Reason to Limit F-35 Procurements – Digital Engineering and Outcome-based Metrics

Dear Vice Chair Wittman:

Yesterday, I wrote about the F-35 program which claims to use digital engineering (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.

What good are digital twins to support development and test without adequate metrics and management controls? The F-35 program will repeat its past failures unless you hold its program managers accountable to integrate DE with systems engineering (SE), program management, and outcome-based metrics.

I hope that you amend Sec. 174 of the NDAA for FY 2025 and increase your oversight of Lockheed Martin's (LM) DE improvements and use of outcome-based metrics. Sec. 174 omits three, essential DE capability elements and is silent on outcome-based metrics.

#### **Dec. 2021**

My letter to Dep. Sec. Hicks, Dec. 20, 2021, cited the NDAA for FY 2022, Sec. 1646. The provision required the Secretary of the Air Force to submit to congressional defense committees and the Comptroller General matrices related to the GBSD's EMD goals... Elements...include...technical maturity, design maturity, and software maturity (including key events and **metrics**).

#### **April 3, 2024**

The recurring need for metrics was stated in my letter to USD LaPlante, Subj: Outcome-based Metrics for LGM-35A Sentinel; Same Failures and Needs as F-35 TR-3/Block 4, dated April 3.

Excerpts of letter dated April 3:

This message mirrors my letter of January 29, subj: Outcome-based Metrics that Work to Build a Product that Works; F-35 Block 4. The program name has been changed to the Northrop Grumman (NG) LGM-35A Sentinel. Otherwise, the two programs are twins **regarding early hype about new**

**techniques, schedule slips, and cost overruns.** The F-35 letter includes a request to refine the scope of the Technical Baseline Review to include an assessment of the use, sufficiency, and effectiveness of outcome-based metrics. Then take corrective actions to improve F-35 program management and, more broadly, the defense industrial base (DIB) ecosystem. Please include the same scope and objectives in the Nunn-McCurdy breach review of the Sentinel program and add a review of **Sentinel's integration of DE with program management.**

The Sentinel program...has leveraged DE principles to model and authenticate virtual designs and significantly shorten development timelines. Please ensure that DE, and especially SE are integrated with program management (PM). Unfortunately, the Sentinel program's hype about DE mirrors the F-35's hype about Agile methods, as follows.

"DE...allowing us to go at a quick pace and focus on meeting milestones we have established."

- "We've made good progress on engineering the weapons systems," Manuel added. "DE is paying off quite well for us and expediting knowledge."
- DE brings the added advantage of being able to save time and lower costs by assessing and testing designs before "bending metal."
- DE is significantly reducing the time and cost of these efforts..."With DE, we can quickly proceed through the design, testing, and manufacturing phases, saving money and taking months or even years off of typical development timelines for large systems."
- As the Sentinel program proceeds, the scope has broadened to include optimizing scheduling, cost management, and resource deployment.

### Integration of DE with PM

Returning to yesterday's letter, the proposed certification of the F-35 digital twin models is a band aid, not a cure. Please limit procurements until you get a DE ecosystem and outcome-based metrics. From my letter to USD LaPlante, May 16,

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?**



Don't let the program managers off the hook and settle for digital twins. Get certification of a DE ecosystem with outcome-based metrics. I presented the following slide in 2001, minus Yogi, and added Yogi's quote at the Naval Postgraduate School in 2021. Unfortunately, it is still valid.

**"It's déjà vu all over again,"**  
**Yogi Berra**



**Integrating Systems  
Engineering, Risk and Earned  
Value Management**

CPM Spring Conference 2001  
San Diego, CA  
**24 May 2001**

Presented by:  
Paul Salomon  
Northrop Grumman Corp.

PAUL SALOMON - INTEGRATED  
PAUL SALOMON 1

Yours truly,

A handwritten signature in cursive script that reads "Paul J. Solomon". The signature is written in black ink on a light-colored background.

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